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Differences in the identification process for new and emerging health technologies: Analysis of the EuroScan database

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Objectives: The aim of this study was to analyze the EuroScan Database and to describe and compare the characteristics of the included technologies and participating agencies.
Methods: Data of interest were exported from the EuroScan Database to Excel and to SPSS. A descriptive analysis depending on the agency, type of technology, stage of diffusion, and technology purpose was conducted. A frequency distribution analysis of the diffusion stage for different technology types and assigned purposes was made with the EpiCalc 2000 statistical calculator. A p value of less than .05 was considered to be statistically significant.
Results: Four agencies introduced the great majority of the technologies (81 percent), with drugs representing the 46.26 percent of the total, followed by devices (21.21 percent). The purpose of 24.45 percent of the identified technologies was not specified, and 34.58 percent of them were identified at the investigational or phase III stage. The frequency distribution of diffusion stage at identification was found to be similar for devices and diagnostics ($p = .543$), whereas drugs were identified earlier than devices ($p < .001$). Some agencies were found to focus their work on drugs, whereas others focused mainly on devices. Interagency differences were also observed with regard to the stage of diffusion at which technologies were identified.
Conclusions: This is the first analysis of one of the most important databases on new and emerging health technologies. Our study suggests that more active strategies should be designed to provide an earlier identification, mainly in the case of devices.

Keywords: Descriptive analysis, New and emerging health technologies, EuroScan

The term "emerging health technologies" (ET) refers to those techniques or procedures used in clinical practice that are just before being accepted or adopted into the healthcare system. This group includes those technologies that are currently in the applied research phase, in other words, those that have passed the clinical trial phase but whose use is not yet widespread, which means that they are currently being used in a limited number of centers (2). The introduction and diffusion of these technologies is influenced by several factors, including social and commercial demand and the enthusiasm of healthcare professionals for a recently developed technology. Occasionally, these factors, together with the lack of barriers to their implementation or the existence of technical problems when assessing them, have led to an *a posteriori* demonstration of their ineffectiveness and even their adverse effects. For this reason, there has been great interest in being able to assess these types of technologies at an early stage to identify their characteristics in terms of improved clinical practice, adverse effects, and ethical and economic aspects, which would allow the comparison between the advantages and disadvantages of these technologies with those currently in use (2;8).

We acknowledge and thank all EuroScan Members that provided data to the EuroScan Database.

The early assessment of emerging health technologies would involve the establishment of an information system that would aid in decision making. The availability of the most up-to-date information would prevent the undesired consequences resulting from the uncontrolled introduction of these technologies, and would promote the adoption of beneficial and cost-effective technologies.

There is an increasing international demand for the establishment of local networks, national systems, and collaboration frameworks for the identification and assessment of emerging health technologies. This led to the setting-up of the Working Group for the Identification of Emerging Health Technologies, which was established in Copenhagen in September 1997 by the Danish Centre for Health Technology Assessment (DACEHTA) and the Swedish Council on Technology Assessment in Health Care (SBU) (4;5). This group, in which Gezonheidsraad (Holland), NHSC (United Kingdom), and Osteba (Basque Country, Spain) also participated, led to the European collaboration network known as EuroScan. Other agencies as AETSA (Andalusia, Spain), AETS (Carlos III Health Institute, Spain), NOKC (Norway), CEDIT and HAS (France), MUMM (Finland), SFOPH (Switzerland), DMTP (Israel), ANZHSN (Australia and New Zealand), and CADTH (Canada) are also members of this network. Recently, DIMDI (Germany), IHQA (Ireland), the Italian Horizon Scanning Project (Verona, Italy), and LBI (Austria) have also become members of EuroScan.

The EuroScan collaborative network has the following objectives: (i) to assess and share information regarding new and emerging health technologies, (ii) to establish the information sources used to identify these technologies, (iii) to share the methods used for early assessment, and (iv) to disseminate the information regarding the identification and assessment of new and emerging health technologies (http://www.euroscan.org.uk). The EuroScan network has recently undertaken an analysis of its activity and reordered and reformulated its objectives as a result of a discussion panel and seminar held in Stockholm (9). One of the developments of the network is the database of new and emerging technologies identified and assessed over the past 8 years by member organizations, which is probably the international information source with the largest number of records concerning new and emerging technologies. The analysis of this database could provide information regarding the characteristics of the introduced health technologies, as well as the diffusion stage at which they are identified and their assigned purpose.

The general objective of this study was to describe the EuroScan database, and specifically (i) to study the characteristics of data introduction (number of technologies included by agency and year), (ii) to describe and analyze the main characteristics of identified technologies related to type, stage of diffusion and purpose of the technology, and (iii) to describe the differences found among member agencies.

METHODS

SPSS Database Creation

The EuroScan database can be downloaded at http://www.euroscan.bham.ac.uk/, and the majority of the information contained is opened to the public. To undertake the analysis of the data contained in this database, the data for each of the entries added up to May 2008 were downloaded in an Excel file, selecting those fields that were to be compared. The data contained in this file were exported to SPSS v15.0 for subsequent analysis.

Selected Fields. The selected fields for the analysis were the following: (i) the agency that introduced the data, (ii) the date of introduction, (iii) the name of the technology, (iv) indication, (v) the technology currently used for the defined indication, (vi) the type of technology that it is about, (vii) the diffusion stage at which the technology is identified, and (viii) the assigned purpose of the technology.

The EuroScan network defines the following categories for the Type of Technology variable: (i) device: nondiagnostic equipment, drug delivery systems, monitoring systems, therapeutic implants, prostheses, tissue-regeneration, and bioengineered products, nondiagnostic imaging, biomaterials; (ii) diagnostics: diagnostic imaging methods and equipment, diagnostic testing methods, diagnostic implants, interventional diagnostic procedures, gene-based diagnostics, genetic markers, tumor markers, screening tests (efficacy); (iii) drug: pharmaceuticals to include vaccines (efficacy) and blood products; (iv) procedure: therapeutic surgical and other interventional procedures, transplantation gene therapy; (v) program: population based-health promotion and public health activities, immunization and screening programs, and individual-rehabilitation, physiotherapy, psychotherapy, radiotherapy; and (vi) setting: settings of care, for example, oxygen treatment at home versus hospital, other changes to delivery of care, professional boundary changes, for example, nurses taking roles previously undertaken by doctors, and telemedicine.

For the Diffusion Stage at which the technology was identified, the network defined the following categories: (i) experimental-phase I; (ii) investigational-phase II; (iii) investigational-phase III; (iv) nearly established; (v) established; (vi) other, and (vii) information not available.

Finally, the Purpose of the Identified Technology was defined as follows: (i) additive or complementary, (ii) additive and substitutive, (iii) substitutive, (iv) other, or (v) unknown or uncertain.

Data Treatment. All variables were labeled, and the quality of data was assessed. Missing values were recoded and the Date of Introduction variable was recoded to Year of Introduction. Once this process was completed, the analysis was conducted.

Table 1. Number of Technologies Introduced per Year in EuroScan Database

Year	*n*	%	Cumulative %
2000	6	0.53	0.53
2001	103	9.12	9.65
2002	131	11.60	21.26
2003	166	14.70	35.96
2004	84	7.44	43.40
2005	165	14.61	58.02
2006	190	16.83	74.84
2007	234	20.73	95.57
May 2008	50	4.43	100.00
Total	1129	100	

Data Analysis

An initial analysis of the frequency distribution of the technologies in the database was performed according to (i) the year in which they were identified, (ii) the agency that introduced the data, (iii) the type of technology, (iv) the diffusion stage at which they were identified, and (v) the assigned purpose of the technology.

To determine whether the frequency distribution of the diffusion stage differs depending on the considered type of technology or the assigned purpose to it, goodness-of-fit tests were performed. To avoid expected frequencies lower than 5 percent, the categories Other and Information Not Available for the Diffusion Stage variable, as well as the investigational-phase I and phase II categories, had to be unify into single categories. In this case, a p value of less than 0.05 was considered as statistically significant.

The differences among agencies related to the type of technologies included and the moment at which they could identify them were also described.

The statistical software package SPSS v15.0 was used to perform the descriptive analysis. The statistical calculator Epicalc 2000 was used to perform the goodness-of-fit tests.

RESULTS

Characteristics of Data Introduction

The number of technologies introduced into the EuroScan database per year is shown in Table 1. It can clearly be seen that not all member agencies have identified the same number of technologies. In fact, four agencies introduced the 81 percent of total entries: Agency 1 introduced 32.68 percent of the total, whereas Agency 2 introduced 24.18 percent. Agencies 3 and 4 introduced 14.44 percent and 9.3 percent of total technologies, respectively.

However, the fact that not all agencies started to introduce data at the same time must be taken into account: Agency 1, for example, started in 2000, whereas Agency 3 did not start introducing data until 2005.

Characteristics of the Included Technologies

Drugs are in the first place (46.28 percent of the total), followed by devices (21.21 percent), procedures (12.30 percent) and diagnostic tests (9.64 percent) (Table 2). Examples of included technologies are drugs such as mitoxantrone, devices such as alternative site glucose testers, technologies such as thermal radiofrequency ablation of small breast tumors, or programs such as "A standardized approach to, and nationwide dissemination of, clinical practice guidelines regarding hepatitis C virus (HCV) screening in infants born to women who are HCV positive."

If we consider the moment at which technologies were identified, 34.58 percent of these technologies were at investigational-phase III stage, 25.96 percent were already established and 21.65 percent nearly established (Table 2).

The high number of missing values (24.45 percent) regarding the purpose assigned to the new or emerging technology should be noted. Moreover, for those technologies whose purpose was defined, 36.58 percent were additive or complementary and 31.66 percent were substitutive (Table 2).

A comparison of the frequency distribution of the diffusion stage according to the type of technology involved showed that the distribution for devices and diagnostic tests is similar, whereas those for drugs, procedures, and programs differs (Figure 1a; Table 3).

Furthermore, a comparison of the frequency distribution of the diffusion stage according to the technology purpose showed that substitutive technologies are identified later than the additive and substitutive or additive and complementary technologies (Figure 1b), although the difference between these distributions is not statistically significant (Table 3). It should also be noted that more than 60 percent of technologies whose purpose is unknown, are identified at an investigational or phase III stage (Figure 1b).

Characteristics of the Identification Process by Agency

The profile of each agency according to the type of new or emerging technology it identifies shows that some agencies mainly identify drugs, whereas others are more directed to identify medical devices, and yet others where the identification of medical procedures is the main concern (Table 4).

With regard to the stage of diffusion at which the agencies identify these technologies, it can be seen that the majority of member agencies identify them when they are already established or close to being so, whereas only a few agencies identify them when they are still in phase III trials (Table 5).

DISCUSSION

The identification, prioritization, and assessment of new and/or emerging health technologies, often known as "horizon scanning" or "early warning systems," has become a

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Table 2. Number of Technologies According to Type of Technology, Diffusion Stage, and Assigned Purpose

Variable of interest		*n*	%	Valid %
Type of technology	Device	231	20.46	21.21
	Diagnostics	105	9.30	9.64
	Drug	504	44.64	46.28
	Procedure	134	11.87	12.30
	Program	28	2.48	2.57
	Setting	1	0.09	0.09
	Combination	50	4.43	4.59
	Other	36	3.19	3.31
	Total	1089	96.46	100
	Missing	40	3.54	
	Total	1129	100	
Stage of diffusion	Investigational-phase I	1	0.09	0.09
	Experimental-phase II	73	6.47	6.84
	Investigational-phase III	369	32.68	34.58
	Nearly established	231	20.46	21.65
	Established	277	24.53	25.96
	Other	107	9.48	10.03
	Information not available	9	0.80	0.84
	Total	1067	94.51	100.00
	Missing	62	5.49	
	Total	1129	100	
Purpose	Additive and substitutive	199	17.63	23.33
	Additive or complementary	312	27.64	36.58
	Substitution technology	270	23.91	31.66
	Other	39	3.45	4.58
	Unknown/uncertain	33	2.93	3.87
	Total	853	75.56	100
	Missing	276	24.45	
	Total	1129	100	

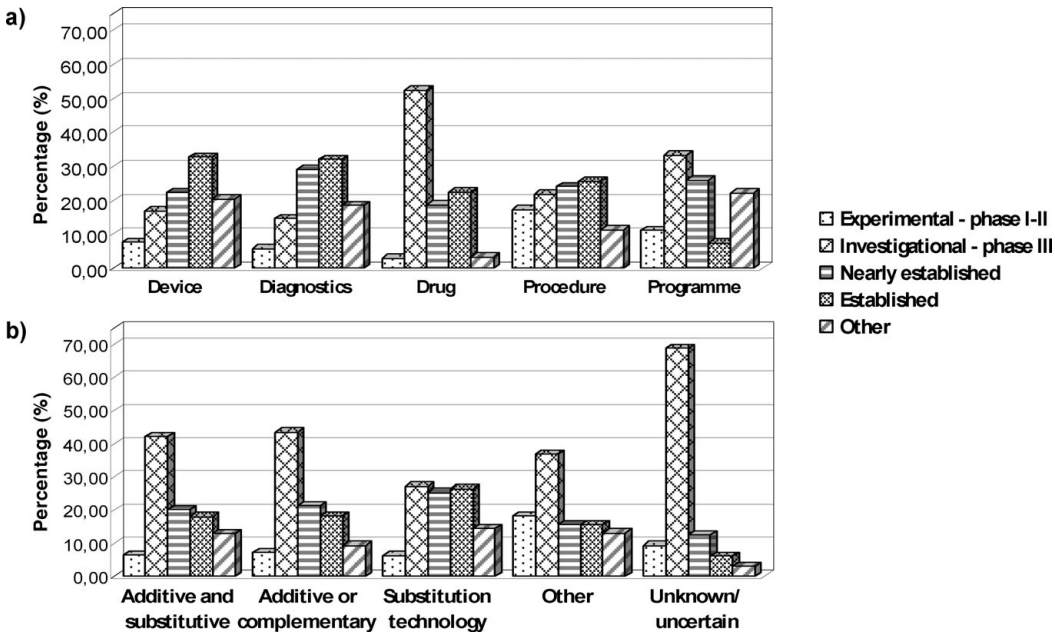

Figure 1. Diffusion stage profile for (a) different type of technologies and (b) different assigned purposes.

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Table 3. Goodness-of-Fit Test for the Frequency Distribution of the Diffusion Stage According to the Technology Type and Its Purpose

	Comparison	X^2	DF	*p*
Type of technology	Devices versus Diagnostics	3.09	4	0.543
	Devices versus Drugs	96.44	4	<0.001
	Devices versus Procedures	19.12	4	<0.001
	Devices versus Programme	38.03	4	<0.001
Purpose	Additive and substitutive versus Additive and complementary	2.75	4	0.599
	Additive and substitutive versus Substitutive	8.00	4	0.091

DF, degrees of freedom.

Table 4. Profile of the Agencies Depending on the Identified Technologies

	Type of technology							
	Device *n* (%)	*Diagnostics* *n* (%)	*Drug* *n* (%)	*Procedure* *n* (%)	*Program* *n* (%)	*Setting* *n* (%)	*Other* *n* (%)	*Total* *n* (%)
Agency 1	34 (9.3%)	28 (7.6%)	284 (77.4%)	11 (3%)	1 (0.3%)	—	9 (2.45%)	367 (100%)
Agency 2	58 (22.5%)	18 (7%)	137 (53.1%)	24 (9.3%)	—	—	21 (8.14%)	258 (100%)
Agency 3	73 (44.8%)	34 (20.9%)	1 (0.6%)	23 (14.1%)	10 (5.5%)	1 (0.61%)	22 (13.50%)	163 (100%)
Agency 4	15 (14.3%)	7 (6.7%)	24 (22.9%)	34 (32.4%)	14 (13.3%)	—	11 (10.48%)	105 (100%)
Agency 5	5 (9.3%)	3 (5.6%)	38 (70.4%)	3 (5.6%)	—	—	5 (9.26%)	54 (100%)
Agency 6	12 (60%)	3 (5.6%)	1 (5%)	4 (20%)	—	—	—	20 (100%)
Agency 7	17 (50%)	2 (5.9%)	—	7 (20.6%)	—	—	8 (23.53%)	34 (100%)
Agency 8	2 (10%)	5 (25%)	5 (25%)	6 (30%)	—	—	2 (10%)	20 (100%)
Agency 9	3 (15.8%)	1 (5.3%)	6 (31.6%)	7 (36.8%)	1 (5.3%)	—	1 (5.26%)	19 (100%)
Agency 10	7 (46.7%)	1 (5.3%)	—	7 (46.7%)	—	—	—	15 (100%)
Agency 11	2 (15.4%)	1 (6.7%)	6 (46.2%)	1 (7.7%)	—	—	3 (23.08%)	13 (100%)
Agency 12	1 (9.1%)	—	2 (18.2%)	5 (45.5%)	2 (18.2%)	—	1 (0.91%)	11 (100%)
Agency 13	2 (25%)	2 (25%)	—	—	1 (12.5%)	—	3 (37.5%)	8 (100%)
Agency 14	—	—	—	2 (100%)	—	—	—	2 (100%)

Table 5. Profile of the Agencies Depending on the Stage of Diffusion at which They Do the Identification

	Stage of diffusion					
	Experimental-phase I-II *n* (%)	Investigational-phase III *n* (%)	Nearly established *n* (%)	Established *n* (%)	Other *n* (%)	Total *n* (%)
Agency 1	11 (3.0%)	255 (69.7%)	51 (13.9%)	16 (4.4%)	33 (9%)	366 (100%)
Agency 2	1 (0.4%)	16 (6,6%)	78 (32.2%)	142 (58.7%)	5 (2.1%)	242 (100%)
Agency 3	25 (15.3%)	26 (15.9%)	28 (17.9%)	22 (13.5%)	62 (38%)	163 (100%)
Agency 4	18 (17.1%)	33 (31.4%)	31 (29.5%)	17 (16.2%)	6 (5.7%)	105 (100%)
Agency 5	6 (11.1%)	9 (16.7%)	4 (7.4%)	30 (55.6%)	5 (9.3%)	54 (100%)
Agency 6	—	2 (11.8%)	7 (41.2%)	8 (47.1%)	—	17 (100%)
Agency 7	2 (5.9%)	7 (20.6%)	7 (20.6%)	18 (52.9%)	—	34 (100%)
Agency 8	2 (10%)	2 (10%)	2 (10%)	14 (70%)	—	20 (100%)
Agency 9	4 (21.0%)	8 (42.1%)	6 (31.6%)	1 (5.3%)	—	19 (100%)
Agency 10	2 (13.3%)	—	10 (66.7%)	2 (13.3%)	1 (6.7%)	15 (100%)
Agency 11	1 (8.3%)	3 (25%)	3 (25%)	2 (16.7%)	3 (25%)	12 (100%)
Agency 12	—	2 (20%)	2 (20%)	5 (50%)	1 (10%)	10 (100%)
Agency 13	2 (25%)	6 (75%)	—	—	—	8 (100%)
Agency 14	—	—	2 (100%)	—	—	2 (100%)

key activity within the health technology assessment (HTA) processes used to aid decision making in all areas of health care (1). Many different national, regional, and even private organizations are currently involved, either fully or in part, in horizon scanning activities. For this reason, and in light of the possible benefits of collaboration, in the mid-1990s it was decided to create a network to bring together all the public efforts in this field, which was named EuroScan. In 2006, this network decided to organize a workshop with the aim of assessing the collaboration's progress and discuss the next

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steps that could be taken as a group and as a service to the wider HTA community. This workshop was conceived as an open forum that would consider the opinions of the different international HTA collaborations and would listen to the different interest groups who receive information upon which to base their decisions (9). The workshop clearly showed the importance of collaborations and drew up the next priority action plans: (i) to promote the importance of collaborating in the various HTA forums, (ii) to disseminate the results of these collaborations within the HTA community, and (iii) to create a discussion and methodological and structural support platform for other groups for which EuroScan should be a reference. In this sense, EuroScan has collaborated with various HTA organizations, for example in the EUnetHTA project, to meet the needs of HTA interest groups.

In this study, we analyze one of the products of the EuroScan collaboration, the new and emerging health technologies database, which includes all the technologies identified by members, with the final objective of producing a series of conclusions that could improve the information retrieval and analysis processes for early decision making.

Representative Technologies Introduced into the Database

The first aspect that should be considered is the possibility of generalizing the results obtained for the database and if introduced technologies are representative, together with the degree of completion of the different variables included in this study.

As EuroScan's members are a heterogeneous group with different areas of interest, it could be considered that this would lead to certain trends in the inclusion of technologies. However, this heterogeneity and the members' geographical distribution, together with the fact that the assessment was performed over a relatively long period of time (8 years), which meant that the number of technologies included was over a thousand, and the individualized analysis of the different technology groups (drugs, procedures, diagnostic tests, and so on), have, in our opinion, helped to eliminate these possible trends.

Similarly, the fact that the analysis was performed for a long period of time has allowed technological subgroups that are worse represented in the range of new and/or emerging technologies, such as public healthcare interventions.

Analysis of the EuroScan Database

As shown in Table 1, the introduction of data into the EuroScan database has been continuous and steadily increasing. The need to get used to a new tool and the incorporation of an unfamiliar activity into the daily routine both explain the low initial activity. Similarly, it should be remembered that, although the network has its own organizational structure, the members themselves are responsible for the voluntary introduction of these data. Likewise, the number of members belonging to the collaboration has slowly increased with time, which would explain the greater activity over the past few years.

As for the type of technologies introduced, our analysis shows that drugs predominate over other technologies. This could be due to the fact that the organizations of the EuroScan network that identify the largest number of technologies are focused on this group. However, many members of the network do not identify drugs, and some organizations with significant capacity in this sector also identify a large number of other technologies, for example medical devices (Table 2). Another possible explanation for this dominance could be the difficulty in identifying technologies that are not subject to the same degree of regulation as drugs until they are launched on the market. Similarly, there are many information sources that focus their activity on drugs and that are widely used by health technology identification agencies (6).

If we now consider the technology's diffusion stage, technologies are predominantly identified at the investigational-phase III stage, followed by established technologies (Table 2). This factor can also be explained by considering the characteristics of the database itself and the technologies introduced in it. Indeed, as discussed above, the majority of the introduced technologies were drugs for which the information of interest for decision making was available from the clinical trial stages. Medical devices are not subject to the same stringent regulatory procedures, and as a consequence, they are identified at a later stage (Figure 1a). Two questions arise from this observation, namely whether horizon scanning systems are achieving their mission and/or whether they should provide information at an earlier stage, particularly for nonpharmaceutical health technologies.

It is clear that early warning systems are providing information for the various interest groups, as discussed by Simpson et al. (9). However, it is equally clear that in the case of devices or procedures, this information only becomes available to decision makers at the premarketing or marketing stage. This leads to two conclusions: the need to establish mechanisms whereby manufacturers of devices or diagnostic tests must comply with a series of requirements to provide information at earlier diffusion stages and the need to change the rigid procedures of those organizations dedicated to assessing health technologies by encouraging them to play a more proactive role, as suggested in the conclusions of the Inno-HTA project (http://www.inno-hta.eu/) (3). Various HTA members (DIMDI [Germany], Osteba [Basque Country, Spain]) are currently focusing their efforts in this sense, as other organizations dedicated to the promotion of research, such as TrusTech (www.trustech.org.uk) and CELS (www.celsatlife.com) in the United Kingdom. These different approaches to solve the problem of the rational introduction of new health technologies to meet the needs of health systems' users could lead to a large degree of equality,

or at least cooperation, between manufacturers, regulatory systems, informational systems, and decision makers at all levels.

Finally, our analysis of the characteristics of the new and emerging technologies included in the database with regard to those already existing is not less important. Thus, although a large percentage of these technologies are additive or complementary, there are still a significant number of technologies that can be considered to substitute pre-existing ones (31.66 percent, Table 2). Furthermore, the difference found between the different stages of diffusion is correlated with the amount of information available regarding the technology. Thus, the substitutive technologies are identified at a later stage as it is only then that enough information is available to ensure their correct classification (Figure 1b). This suggests the need to establish structured technological disinvestment mechanisms that would help to recover funds that can be reinvested in other technologies and thus help the maintenance of healthcare systems (7).

In our opinion, this work could aid our understanding of the identification-assessment process for new and/or emerging health technologies and could lead to the identification of the gaps that currently exist in some phases. Similarly, this work falls within the strategy developed by the EuroScan network since its meeting in Stockholm in 2006, together with the new developments, such as a twice-yearly newsletter and a methodology document, which should help already existing systems and anyone intending to establish a new horizon-scanning system.

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