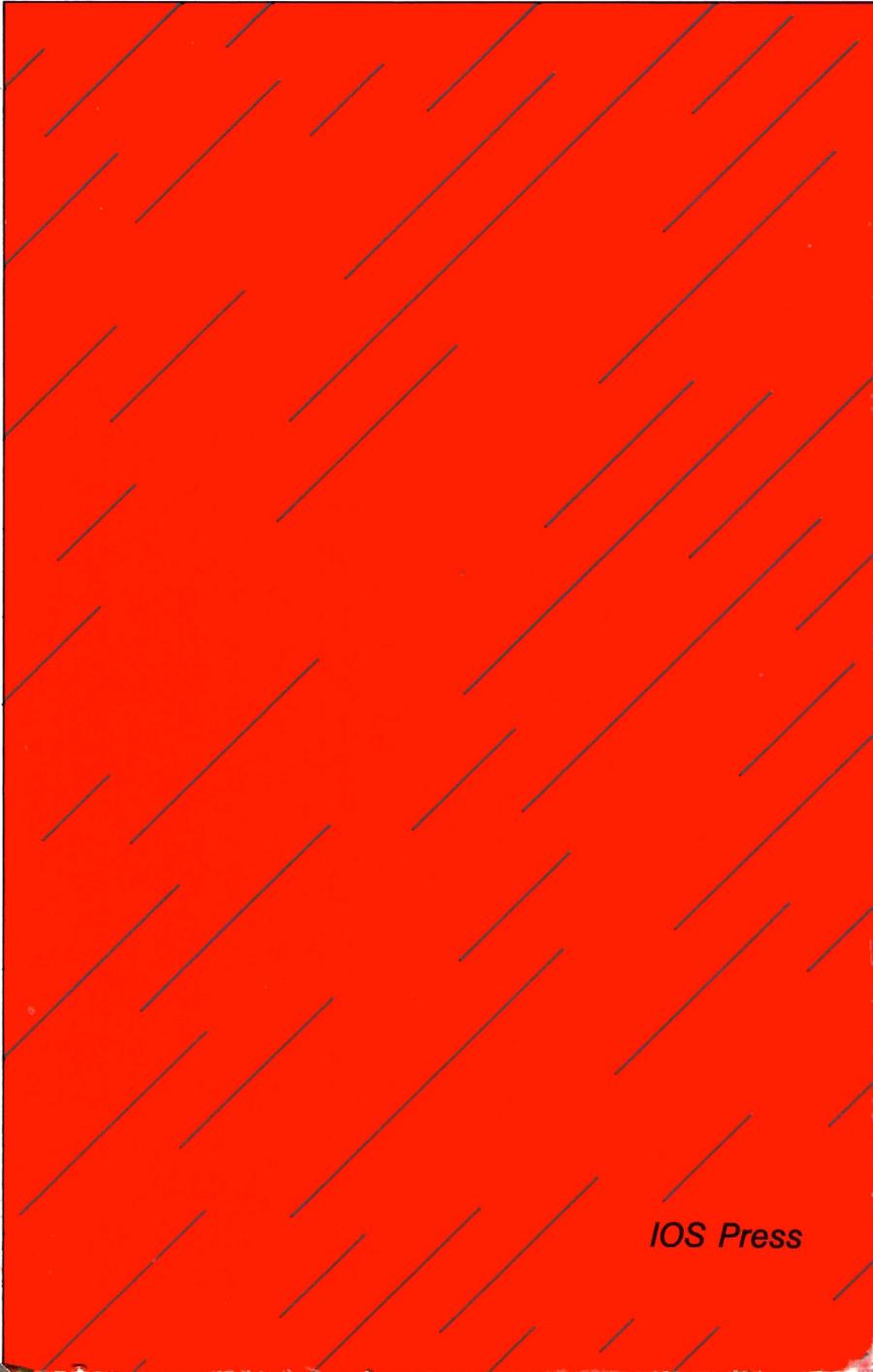


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Technology watch and competitive intelligence: a new challenge in Education for Information

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Abstract. Competition between nations and companies remains the key to success in the world. Since economic conflicts cannot be "solved" on a world-wide basis by international wars, the ground of competition is now mainly scientific, technical and economic. The recent fallout of the Soviet Union clearly supports this position.

It is evident that Intelligence will follow the same trend, and that the objectives and the methods will change with this new orientation. Technology Watch and Competitive Intelligence is one of the key factors. This means that information in scientific and technical areas will be subjected to new treatments, validations and presentations to match this new trend. How to move from classical documentation, to this new field, and what will be the place of the teaching institutions?

The present paper will try to emphasize several aspects of these problems in close relationship with several years' experience of research and education.

1. The technologies turn over

Years ago the scenery of science and technology was quite stable. Large and even small companies knew exactly their market place. The changes in technology were not very fast, and in some cases the same know-how could last for decades! Then came the Japanese: the western world had the Nobel Prizes, but Japan made the money! How to explain it? And if possible how to teach it to students, researchers and decision-makers? Let us examine several key points of the problem:

- Years ago, decision-makers and executive boards of companies were mainly concerned with the financial aspects of their business.
- Then came marketing and organizations developed special services for this purpose, these services being closely related to top management,
- But without a competitive labour force it was impossible to progress; this brought to the forefront the Directorates of Human Resources, also closely related to top management.

These three aspects of management were for many years considered as the only ones worthwhile to achieve. But, in the last decade, large companies collapsed because they did not appreciate the menace from other competitors, especially in the realm of technological breakthrough.

This consideration prompted the more innovative companies to add a new chapter in the decision-making system of their organization: Technology Management, and subsequently Technology Watch and Competitive Intelligence. Technology turn over should be one aspect to emphasize to students, because during their academic courses they do not appreciate that technology and science are fast moving ahead. Worse, very often they have a strong feeling that knowledge is very stable and they have no idea of how fast changes in science and technology have to be appreciated by industry.

2. The flux of information

De Solla Price pointed out in 1950 [1] that in the next fifty years the weight of information would be overwhelming. At a rate of several hundred items of information put out every 10 seconds, to cope with quality information is a challenge that most organizations have to face every day. It is commonplace to say that tomorrow will be the information age, but for the people engaged in this field, tomorrow is already today.

2.1. The informations classes

According to Hunt [2] there are four information classes:

- *text information*: computer-readable files, home made or external to the company, such as online databases (patents are one of the focal points of this information class).
- *firm information*: this is the information obtained from visits to patrons, or suppliers, ... or competitors. This type of information is often in part related to marketing.
- *expertise information*: all organizations assemble during their life people who have expertise in various fields. This is wealth for the company; such information has to be preserved and transmitted.
- *exhibition information*: in all businesses there are some contact points where patrons, producers, scientists, suppliers, etc., meet. These events are very important as unique information sources and the participation of the company in such meetings should be carefully planned.

The difficulty in Technology Watch and furthermore in Competitive Intelligence will be to bubble up the key information from all sources according to the Critical Success

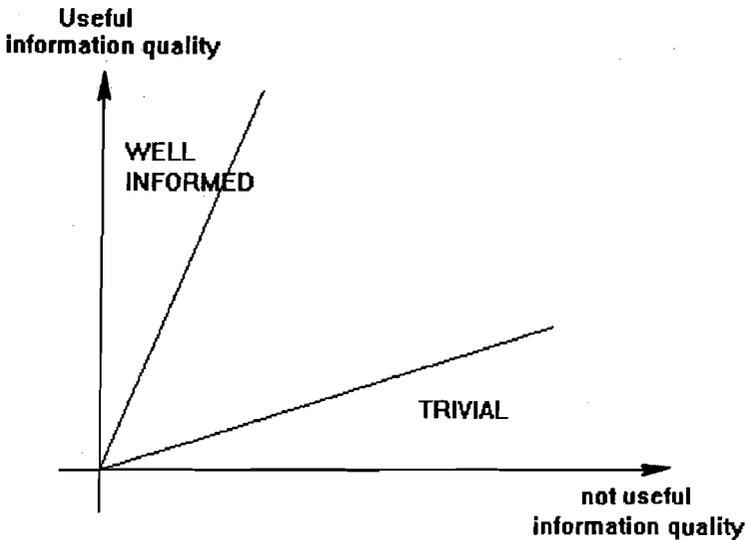


Fig. 1. Information ratio.

Factors of the company. To detect by a validated approach this critical information is very important. This is the goal of what is called in France “*Veille Technologique*”.

The main stream of information reaches us every day. From this main stream about 10% is useful and of this 10% only a portion (let us say 10 to 20%) is *critical*. The process to go from the main stream of information to the critical information is the key. This induces towards information an attitude very different from the one generally taught in information science or library schools. *Conservation* is not the focal point, *information retrieval* only concerns part of the system and *informal information* is important, as well as the time span for its validity. If the information has at the outset the same value, it should quickly be submitted to expert analysis for validation and then only a small portion of it will be considered as critical.

Then, this will therefore require from the people engaged in documentation centres (at least for part of them) a change in attitude: they will need to become aggressive if they want to participate in the process of moving from Information to Intelligence.

2.2. A change in attitude

Figure 1 represents the quality of information that a person may receive. If the ratio of general information versus useful information is small, the person is well-informed. If this ratio is large this means that gossip and common places will be the core of his/her information. But the system is more complicated, because another factor of primary importance appears: this is the relation of the person to the infor-

mation. This point is very important, and is rooted in the educational background. This is why we believe that in the field of Technology Watch and Competitive Intelligence, the people involved must have a double or triple competency:

- * First, a competency in science and technology acquired in a relevant university degree programme.
- * Second, a background in the methodology of Competitive Intelligence and Science and Technology observation. This also includes good knowledge of information sources as well as documentation techniques and information retrieval.
- * Third, a good knowledge of computer science and new information technologies. This is why in our opinion such programmes can only be offered at the postgraduate level, as done in Marseille in the Diplome d'Etude Supérieure Spécialisée, Gestion de l'Information Scientifique et Technique (DESS), Diplome d'Etude Approfondie, Information Stratégique et Veille Technologique (DEA) and PhD.

3. A brief insight into the methodology in Technology Watch and Competitive Intelligence

(a) Technology Watch and Competitive Intelligence must benefit from a commitment by top management to make the process successful. This is not the only condition, of course, but it is of primary importance.

(b) When this is done, the organization must determine its Critical Success Factor. It must be considered as the areas (carefully identified) to which the Technology Watch and Competitive Intelligence will be applied. The determination of such Critical Factors is sometimes difficult and examples and methods should be given to the students [3–6].

(c) When consensus on such factors is reached (the number of factors is not very important) it is generally wise at the very beginning to accumulate on each factor any types of information available. This information will come from the four different sources described above. This is the starting point. If this step is well-implemented, this means that all the useful information or at least most of it will be considered. The work will be done by the so-called observers. Some are professionals such as specialists in patents; others are occasionals (people visiting patrons or laboratories, etc.).

(d) The next step is to select various experts coming from different areas of the organization: research, development, marketing, production. These experts will react to the above information, and will select the critical parts which will be used to build up the strategic information files. These files will be commented upon and the results put into the strategic information report for the top executives of the company.

(e) This is a cyclic process: the turn-over of the process has to be established in accordance with the quantity and pace of research carried out in the considered field.

These steps can be more complicated, because various sources of information must

be consulted, various people are involved and the gathering of all information will not occur simultaneously. The experts' reviews may also be subject to various time intervals according to the people involved. To solve this problem some softwares like Microsoft Project 3 or PSN IV may be useful.

4. The people involved in the process

4.1. Executives and experts

Technology Watch and Competitive Intelligence is not, like Total Quality, a matter of concern for all the employees of the company. For a large company, two to three people should be in charge of several Critical Success Factors. They will have to determine the forces in information gathering for the different factors, and have in charge part of the documentation centre and the occasional observers. They will also be in charge of the transmission of the information to the expert groups, and they will have to take care of their feedback.

The expert groups do not involve a large number of people. For the most important factors 10 people are generally sufficient. Do not forget that the backbone of the Technology Watch and Competitive Intelligence Process must remain very light, even for a large company.

In smaller companies, the number of people will depend on the type of technologies involved and the amount of money that the company can spend on the process. But, beyond the consideration of cost, it is the state of mind of the executives and decision-makers induced by this process which will be the most important. How to integrate critical information in the decision-making process is the key problem and on its solution depends success.

1.2. Observers

There are two kinds of observers:

(1) People from the documentation centre of the company: not all people will be involved, but a core of specialists in scientific, technical and economical databases will be necessary as well as one or several persons specialized in patents (for a large company). These persons have of course a documentation knowledge, but they must also have an important scientific and technical background in the areas of the company's interest. They should also be able to use all types of computer facilities to analyse large sets of data (downloaded data for instance) and to understand the limitations of the mathematical treatments used for their analysis. Other capabilities in organization, planning, etc., will be necessary.

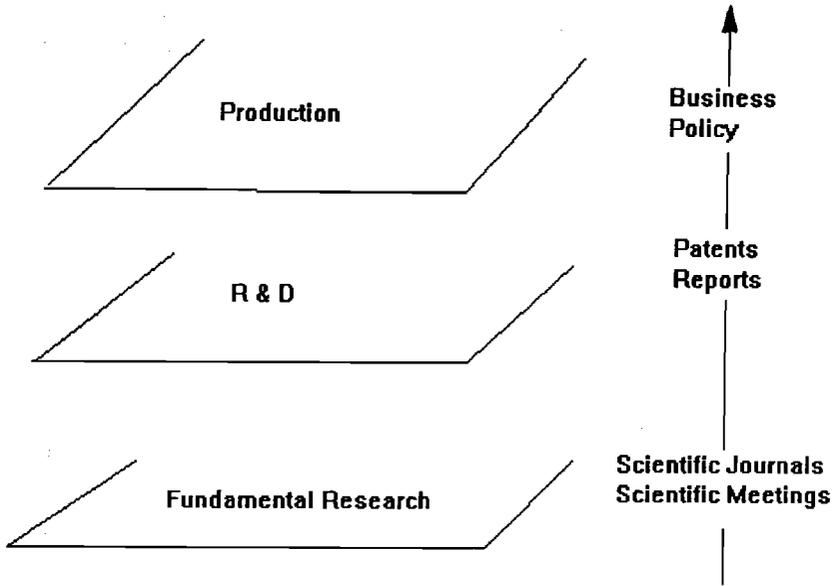


Fig. 2. Information types versus activities.

(2) Occasional observers: these people are those who are employed by the company and who go outside to visit patrons, or to attend meetings, etc. These people are able to observe many things, but their mission should be carefully prepared according to the critical information needed to master one or several Critical Success Factors. To prepare these missions (with briefing and debriefing) requires skill and practice.

5. Research and innovation process

In Technology Watch and Competitive Intelligence understanding the process from research to production is very important. Recent work has shown that this process is not as simple as we thought a few years ago [7, 8].

Research, Research and Development and Production can be considered as three different “worlds” living in distinct universes. Each of them has its own set of rules, information networks and sources. The passage from one universe to the other is not straightforward, and strong incentives may be necessary to go from one to the other.

One of the goals of Technology Watch and Competitive Intelligence is to identify in the different universes the nodes where something significant has occurred. This is because in each universe a network of competency and expertise is developed between the various actors in science and technology.

In order to identify the key nodes (according to the goal of the company) it is necessary to use various tools (data analysis, networks of experts, fuzzy information com-

Table 1
Computer facilities

Computer room adjacent to the teaching room. Both as well as the research rooms from the CRRM are located as a separate unit into the library of the university.

One computer PC Compatible (class 286 with arithmetical coprocessor) for two students. The computers are available all year round on this base.

Four computer PC Compatible (class 386 with arithmetical coprocessor or 486), with 8 Mo RAM, VGA +, for bibliometric applications and for Data Base Management.

One MacIntosh for file transfer (PC Mc – Mc PC)

Local network

One host Videotex, (5 doors)

Several Minitel

Laser, fast and slow printers.

Modems [from 300 bauds to 2400 bauds and FAX (9600 bauds)], various kinds to show different configuration to the students.

CD Rom (Phillips)

Scanner (black and white)

Access to the IBM 30/90 of the university, networking to the main research networks.

Audiovisual facilities: TV, videotapes, overhead, computer overhead device, etc.

ing from occasional observers, etc.). This is a crucial step in Technology Watch and Competitive Intelligence. The identification must be made according to location, institutions, subjects, people, cross collaborations, etc.

Of course, to spot the key areas in each domain, all types of information will be needed. Figure 2 indicates the domains involved, the networks and type of information generally used.

6. An integrated information system

To be successful, an organization must build an integrated information system which should be able to bring to the focal points (one of these focal points is the Technology Watch and Competitive Intelligence Unit) all kinds of information. This means that this *information system is global* and must be concerned with the four types of above-mentioned information. The documentation centre will be part of the system, but many other sources of information will be necessary, and networks of people, laboratories, etc., will be sometimes invaluable. At the same time the organization of the collection of fuzzy information obtained during visits, meetings, etc., will be of primary importance. Economic information will be also added and the overall result

Table 2
Software facilities

MS/DOS 5.0

Interface: Windows 3.1

Word processor: Word V and WRITE or WINWORD 2

Spread sheet: EXCELL, LOTUS 1 2 3

Windows utilities

Communication: several softwares including XTALK XVI

Programming: Quick Basic 4.5, Professional Basic BC7, Visual Basic, Palcal 6.0

Database Management Software: Dbase IV, Info Bank (I + K, Germany), TEXTO. Full information on other DBMS such as AS (available on the Campus), ORACLE, TOPICS, DORIS.

Reformatting software: Infotrans (I + K Germany) plus several packages developed at the CRRM in the frame of the bibliometry workstation

Data Analysis: STAT ITCF (French), Clustan (Clustan Ltd UK), PATSTAT (Derwent). If necessary the students can use the relational analysis facilities at the CEMAP (Centre de Mathématiques Appliquées, IBM France)

Project Management: Microsoft Project 3, PSN IV

File Transfer: LAN, PC Link

Utilities: PC Tools, Norton Commander

Bibliometry: all facilities, since the CRRM commercializes via the Company Madicia a bibliometric workstation.

Leximap (CSI), Patstat.

Other packages are often in demo at the CRRM.

Practice: interactive educational softwares: ORBIT, BRS, Telesytemes, DIALOG, ESA.

will be given to the experts and after validation and analysis transmitted to the top management.

One of the keys to success of the global information system will be that it retrieves and analyses all four types of information in the same process. Computers will be very useful, but prior analysis of the language, thesauri, etc., will be of a considerable value because this will constitute a common platform to the company. To have the same global expression of various problems will be a considerable advantage. To complete this process no barriers should exist between various services of the company such as marketing, patents and scientific information retrieval services.

Data Management Systems and Data Analysis will also be very helpful to understand the textual information and to build reports. Some of these tools are very

Table 3
Hosts and Database facilities

a – *Hosts:*

Access to Telesystemes Questel and CEDOCAR (French Hosts)

Access to BRS

Access to ORBIT. With a special mention because the facilities offered by this host in online analysis of data (GET Commands) are very powerful, and are included in the process of our bibliometric workstation (DATAGET, Dynamic comparison of Gets).

Access to ECHO (EEC Database)

These are the main hosts used in the CRRM.

Other hosts such as ESA, DATASTAR or STN and DIALOG are shown to students during brief sessions organized by the French representatives.

b – *Databases:*

Online:

Cuadra, Chemical Abstracts, Chemquest, Inspec, Compendex, SCI (Scisearch), Rapra, Weld, FSTA, WPI(L), USP, Claims, Japio, Fiesta, BMT, FPAT, Quest (French parliament questions), Noriane (French standards), IALINE, Pascal

Offline:

CD ROM: Encyclopaedia, books catalogs, dictionnaires, NATO, Pascal, Fisrt (EEC patents)

In House: Chemistry in Marseille from 1981 to date

Physic in Marseille from 1981 to date.

Set of references given by various laboratories.

powerful but are unfortunately beyond the scope of this paper. They involve a good knowledge of database management (online and in-house), and are strongly related to Bibliometry and Intelligence.

Table 1 shows the main hardware of the education program offered in this field at the University of Marseille. The DEA of Strategic Information and Technological Watch of the University of Marseille (CRRM) is the only one of this kind in France. Table 2 lists some of the software. Table 3 lists some of the most useful hosts and databases used during the educational process. Table 4 indicates some other information sources that students should have at least seen once. Further information is available upon request [13].

7. Conclusion

To promote an Education Program in Technology Watch and Competitive Intelligence, it is necessary to work at the postgraduate level (in some cases during the last

Table 4
Fuzzy information

(The list is not selective and is reprinted from *La Veille Technologique* pp. 40–41, Henri Dou, Hélène Desvals, Dunod Editor, Paris 1992).

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- Tech Tendances, CPE, 1 rue Descartes, 75005 Paris.
- MMR Mitchell Market Reports, PO Box 23, Monmouth, Gwent NP5 4YG, GB.
- MIRC Market Intelligence Research Corporation, 55 rue Vandenhoven, 1200 Bruxelles, Belgique.
- Technology Impact Reports, Frost and Sullivan, Sullivan House, 4 Grosvenor Gardens, London SW1W 0DH, GB.
- VJP News Letter, 13 rue de Montreuil, BP 155, 95305 Vincennes cedex.
- Technologie et Stratégie, OTS, Ministère de l'Industrie et de l'Aménagement du Territoire, 30–32 rue Guersant, 75833 Paris cedex 17.
- OTAN Actualités, OTAN, Division des Affaires Scientifiques, BP-1110 Bruxelles, Belgique.
- Japon Panorama, INIST Cellule Japon, CNRS, BP 132, 75960 Paris cedex 20.
- Innovation, A Jour, 11 rue du Marché-St-Honoré, 75001 Paris.
- La Lettre de l'Intelligence Artificielle, EC2, 269 rue de la Garenne, 92024 Nanterre cedex.
- Informatique et communication, Institut Méditerranéen de Technologie (IMT), 13451 Marseille cedex 13.
- RHT Infos, Association Route des Hautes Technologies, CMCI, 2 rue Henri-Barbusse, 13001 Marseille.
- Forum Technologique, Innotec, 20 rue des Frères-Lumière, 31520 Ramonville-St-Agne.
- Cités technologiques, 20 rue des Frères-Lumière, 31520 Ramonville-St-Agne.
- Recherche Technologie, MRT, 1 rue Descartes, 75005 Paris.
- FTS French Technology Survey, 1 rue Descartes, 75005 Paris.
- Courrier de l'ANVAR, 43 rue de Caumartin, 75436 Paris cedex 09.
- Signal, DGA, CEDOCAR, 26 boulevard Victor, 75000 Paris Armées.
- Jane's Defense Weekly, disponible au CEDOCAR, 26 boulevard Victor, 75000 Paris Armées.
- LOGON, UMI Data Courier, 620 South Third Street, Louisville KY 40202-2475, USA.
- Gale Research International, PO Box 699, North Way, Andover, Hants SP10 5YE, GB.
- Monitor, Learned Information, Hinksey Hill, Oxford OX1 5AU, GB.
- Normatique, AFNOR, Tour Europe, 92049 Paris la Défense cedex 7.
- Hotline, Royal Society of Chemistry, Thomas Graham House, Science Park, Milton Road, Cambridge CB4 4WF, GB.
- Bases, 27 rue de la Vistule, 75013 Paris.
- Science Watch, ISI, 3501 Market Street, Philadelphia PA 19104, USA.
- Arthur D. Little Decision Resources, DR Reports, 17 New England Executive Park, Burlington MA 01803, USA.
- Technical Insights Inc., PO Box 1304, Fort Lee NJ 07024-9967, USA.
- Material Information, Translations Service, The Institute of Metals, 1 Carlton House Terrace, London SW1 Y5DB, GB.
- Technology Strategy, Baumackerstrasse 46, 8050 Zurich, Suisse.
- High-Tech Material Alert, Technical Insight, 32 North Dean Street, Englewood NJ 07631-2807, USA.
- Eurostatus on diskettes, EEC, Jean Monnet Building, Eurostat A3, L-2920 Luxembourg.
- Information Market IM, EEC, DGXIII, PO Box 2373, L-1023 Luxembourg.
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university year). The students must have a scientific and technological background.

The goal of the education program is to equip the students with the methodology and the tools necessary to understand or to develop a small unit of Technology Watch and Competitive Intelligence.

They must understand that information is costly and represents the work of many people. But they must also understand that they are not there to only transmit the information to the right people, they must be engaged deeply in the process of Technology Watch and Competitive Intelligence. It means that the whereabouts of the information selected must appear clearly to them. If the knowledge of documentation techniques is necessary, this is not the goal of the teaching, the scope is beyond this point and really what we must aim at is to give to the students a Social Intelligence frame of mind necessary to understand all the rules of the game in which their organization is involved on a world-wide basis.

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- 12 H. Dou, P. Hassanaly, A. La Tela, L. Quoniam, H. Rostaing. A travel among the ghosts. *Pscientometric* 60 (1992) 9–14.
- 13 More information on this subject can be obtained from CRRM, Faculté des Sciences de St Jérôme, 13397 Marseille cedex 13, to the attention of Professeur Henri Dou. Programs of DESS and DEA are available as well as details on the PhD program of the DEA.

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