

## TDF Customer- and product-oriented expertise

C. Schwartz

*Director of CCETT (until December 1996)*

*Director of DSM (from January 1997)*

D. Frossard

*Director of TDF-C2R (until April 1997)*

*Regional Director of TDF (from May 1997)*

*TDF – a privately-owned company belonging to the France Telecom group – is the main provider of radio and television transmission services in France. It also carries out R&D work in the broadcasting and telecommunications fields.*

*This article describes the current R&D facilities of TDF, and how they have been organized in the context of today's competitive business environment.*

### 1. Introduction

Four percent of the turnover of *Télédiffusion de France* (TDF) is devoted to research and development. This is the amount the company considers necessary in an international environment where all the major telecommunications and broadcasting businesses are investing heavily in new technology. However, the acquisition of new

technology is not an end in itself, but is a means of developing new services for existing and future markets. This explains our three main objectives in undertaking R&D:

- to increase the services we offer via conventional analogue radio and television channels;
- to develop future digital radio and television services and networks;
- to diversify our cable, mobile radio communication and data transmission activities.

Under the supervision of TDF's *Direction de la Recherche et de l'Innovation* (Research and Innovation Management), R&D is carried out at two centres:

- CCETT;
- TDF-C2R.

Original language: French  
Manuscript received 8/8/97.

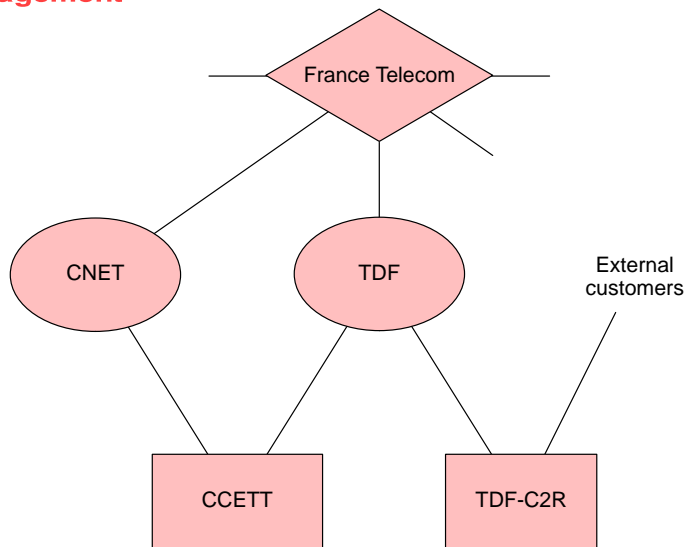


Figure 1  
Simplification of the relationship between CCETT, TDF-C2R and their parent bodies.

## ■ 2. CCETT

### ■ 2.1. Historical background

In 1972, the *Centre Commun d'Etudes de Télédiffusion et Télécommunications* (CCETT) was set up jointly by:

- *Direction Générale des Télécommunications*, part of the French Ministry of Posts and Telecommunications;
- *Office de Radiodiffusion et Télévision Françaises* (ORTF), a single state-run organization that was in charge of all radio and television broadcasting activities in France, from production to actual transmission.

The aim of its founding partners was to combine skills and cultures which seemed to have become separated by the development of broadcasting techniques on the one hand and telecommunications techniques on the other.

Many changes have occurred in the last 25 years. The direction in which CCETT's "parent institutions" have moved in that time is best appreciated by reference to the loss of their monopoly status, deregulation, the entry of many new players in the field, and the development of competition.

One of CCETT's founding partners – *Direction Générale des Télécommunications* – has been replaced by France Telecom, a national private-sector company, all of whose activities will be subject to competition from January 1998. The R&D arm of France Telecom is *Centre National d'Etudes des Télécommunications* (CNET).

The other founding partner – ORTF – has been replaced in this field by TDF, a private-sector company within the France Telecom group. Radio and television broadcasting services, now subject to competition, still account for the majority of TDF's business but it is steadily moving into other sectors such as mobile telephony, and into foreign markets.

A simplified organigram of France Telecom's research facilities is shown in Fig. 1.

### ■ 2.2. Present organization

CCETT is situated in Rennes. Three R&D sectors of CNET, jointly run by CNET and TDF, have laboratories there: DSM, DMR and DIH.

DSM's task is research and development in relation to broadcasting and on-line services. It has a total of around 300 employees, based at three centres:

- *Rennes* (services and uses, networks and audio-visual signals, terminals and multimedia applications, architecture, mediation and integration, multi-network broadcasting and on-line services);
- *Lannion* (directory, natural language and database management);
- *Paris* (access networks to on-line and multimedia services).

The headquarters and management of DSM are in Rennes.

DMR is responsible for research and development in the field of mobile telephony and radio networks or systems. Its work on modulation and coding for cable, satellite, MMDS and LMDS channels is all carried out in Rennes.

DIH is entrusted with studying the interaction between consumers and services, particularly voice dialogue, text messages and basic languages for France Telecom and TDF services. In Rennes, it has teams specializing in image processing, image quality, ergonomics and pilot-scale trials of new services.

There are 410 staff at CCETT, employed either by CNET or TDF.

### ■ 2.3. Aims

Generally speaking, the aim of the R&D carried out at CCETT in Rennes is to enable the parent institutions – TDF and CNET – to introduce "innovations" but one may well ask: *what sort of innovation is really necessary, and why?*

Originally, the main criterion for selecting research projects was their potential for technical innovation, the final purpose being to enable the operator to improve services, for example in terms of effectiveness, quality or performance.

This resulted in basic or technical studies in areas such as optical systems or imaging systems. There were close links with industry, since R&D was regarded as a way of encouraging manufacturers to incorporate new developments into the equipment they supplied to the operators.

This approach was adequate so long as the operators did not have to defend their field of activity, which was protected by the regulatory framework in force at the time.

Changes in the competitive and regulatory environment have resulted in new objectives. The operators now need to improve their position in the fields in which they are active, move into new areas of activity, offer new services and reduce their costs – including spending on R&D.

#### ■ 2.4. Customers for R&D services

Now that CCETT's activities are conducted in a totally competitive environment, the role of R&D is to meet the needs of the customers of France Telecom and TDF, and to develop the range of services offered to them. This has been achieved by setting up new structures which offer a high degree of interactivity and ongoing relations with the marketing and sales teams.

In recent years, France Telecom and TDF have adopted a structure based on *product divisions*, each responsible for its product lines, turnover and operating budget. At the same time, CCETT has appointed *product correspondents* in each of its R&D teams, who are responsible for co-ordinating the relations between R&D and the product divisions. *Product lines* are such things as digital televisions, multimedia broadcasting, and electronic programme guides.

The research and development programmes, prepared jointly by product line managers and their correspondents, are the subject of contracts between R&D and the sales divisions. This "customer-supplier" type of contractual approach is sometimes difficult, as the sales manager tends to worry about his operating budget while the researcher may be reluctant to dispense with some of the proposed functional features of a product.

This obviously raises the question of how to achieve a balance between short- and long-term

objectives in R&D. For this reason, not all of the research studies are conducted on a contractual basis.

R&D activities have been subdivided into three categories:

- *Research which is subject to a contract with the sales divisions and charged to their operating budget.* It is intended that between 50 and 60% of R&D activity be conducted on this basis.
- *Research which is "sponsored" by the sales divisions.* These are medium-term projects, which are not immediately adopted by a product marketing manager. The sales division must, however, approve them and will eventually pay part of the cost from its operating budget. Between 15 and 25% of R&D activity is to be conducted on this basis.
- *"Basic" studies which lay a foundation for future research.* Accounting for between 15 and 25% of R&D activity, studies of this type

Figure 2  
Aerial view of  
CCETT, Rennes.





are not subject to a contract with the sales divisions.

R&D activities are co-ordinated by TDF's *Research and Innovation* unit and CNET's *Research and Programming* unit.

The establishment of closer relations with the sales divisions has also made it possible to introduce more frequent evaluations and to experiment more with services. Products and services developed in the laboratory need the earliest possible exposure to the consumer – at the pilot or pre-experimental stage – so that the end-user's observations can be taken into account and in order to minimize the time required to bring a new product or commercial service to market. These preliminary phases also generate useful feedback as regards operational methods and supervision.

Under this system, the product correspondent has a special role to play in relation to the R&D teams. As a co-ordinator, he/she may be called upon to manage the budgets for projects undertaken on a contractual basis with his/her customers, and to manage teams spanning several research departments. The product correspondent effectively subcontracts work to the R&D teams, the work being performed within a project structure.

### ■ 2.5. A process of transformation

The increasing proportion of projects that are subject to contract with the sales divisions is changing the way in which the R&D teams work. The research staff may regret the resulting loss of autonomy and freedom but they often respond positively to the challenge of a team project that is geared to bringing a new product into service as rapidly as possible, or to carrying out trials on it.

Figure 3  
CCETT's dielectric measurement arch at Rennes.



The rapid introduction of new products also creates a need for higher quality standards. Initiatives are under way to develop quality in each aspect of the work: software, documentation, validation methods and technical management.

Because of the need to keep control of costs and deadlines, it has become expedient to compare different ways of obtaining the desired product or service: making it in-house, having it made outside, or buying components "off-the-shelf". There needs to be a more open attitude to the use of external components. Old technology is becoming increasingly important in fields where technical progress and the launch of new products is very rapid. Furthermore, there needs to be ongoing training in new techniques and new software development tools.

The drive to reduce R&D costs has led to a search for new methods of cost-sharing:

- co-operating in European projects (ACTS, Eureka, etc.);
- forming industrial partnerships;
- exploiting patents and intellectual property rights;
- offering services and expertise;
- developing industrial products (metrology, professional equipment, etc.).

CCETT has been involved in activities of this kind for several years. As well as making a financial contribution, they offer excellent opportunities for the R&D teams to benchmark themselves against others working in the same field.

It is therefore evident that, for several years, R&D at CCETT has been in a process of transformation. This began earlier than in other research centres, as the kind of services being developed at CCETT were already very much open to competition.

Despite all these changes, the original vision of 1972 has proved to be correct: the convergence of telecommunications, information technology and television is going ahead more strongly than ever.

The 410 CNET and TDF staff who work at CCETT are making a valuable contribution to this converging environment, by developing appropriate new services to meet its needs.

### ■ 3. TDF-C2R

TDF's other research centre is TDF-C2R, based in Metz. It was established more recently (1993) than CCETT and is smaller (with 120 employees).

TDF-C2R is mainly concerned with network aspects, and with broadcasting and radio communications sites.

### ■ 3.1. Customer-oriented research

In common with more and more research laboratories, TDF-C2R is performing a large part of its work on a contractual basis. Some of its customers are internal, i.e. within TDF, while others are external to the parent organization. In 1997, research contracts accounted for 85% of TDF-C2R's business: 65% on behalf of TDF and 20% for external customers.

### ■ 3.2. Internal customers

In 1994, TDF adopted a product-oriented approach. It set up six *product divisions*, each corresponding to one of its traditional markets: TV, radio, radio communications, international services, etc. In promoting the growth of its market, each division seeks support from TDF's research centres. For example, The Radio Product Division is supported by both CCETT and TDF-C2R in the planning of DAB services and networks. These product divisions are TDF-C2R's main internal customers. In addition, regardless of the products or services it is concerned with, TDF has to ensure the development of its own production tools (information systems, network planning tools, etc.). One TDF department (DPM) is responsible for this area of development and contracts the work out to appropriate research organizations. Because of its skills and the fields of activity it covers, TDF-C2R is a major supplier to DPM.

### ■ 3.3. External customers

To a certain extent, TDF research is expected to be self-financing, earning 20% of its budget by marketing its services. We see this objective as a way of sharpening our skills in the competitive research-services market.

Income derives from two main sources. The first is European research programmes, to which TDF-C2R devotes 25% of its efforts. The European Commission is the customer for these services (subsidising and monitoring the projects), even though it is not directly interested in the results. Of course, the European projects are also conducted on behalf of an internal customer, which validates the strategic interest of the enterprise in this subject, particularly the sharing of results within a consortium. In 1996, European subsidies represented 50% of TDF-C2R's income.

The second source of income is commercial. It consists of the sale of (i) our services and (ii) licences to use our know-how. In 1996, 40% of our income from commercial activity was derived from services, 10% from licences.

Finally, TDF-C2R is about to launch into a further lucrative area of business: *products*. The idea is to take things a step further and market some of the equipment we have developed for TDF. The internal structure was defined and set up in 1996, and several products are under development. The aim is to generate a third of TDF-C2R's income by this means in the medium term, in collaboration with such industrial and/or commercial partners as we may need.

### ■ 3.4. Non-contractual research?

Our non-contractual activity could be seen as free of all constraints: TDF-C2R's "secret garden". This is definitely not the case. The 15% of non-contractual activity subdivides in three ways:

- so-called "long-term" research into future products not yet within the strategic field of a particular product division (e.g. cellular TV);
- pure technological research which is not yet of direct interest to a division (e.g. propagation at 60 GHz);
- support for research where the only customer is TDF-C2R itself (e.g. installing a new echo-free chamber).

Even if these activities are not of interest to buyers of research services, they are of interest to the research facility itself and, as such, are performed under contract with TDF's Director of Research and Innovation.

Figure 4  
General view of  
TDF-C2R, Metz.







Figure 5  
TDF-C2R's anechoic  
chamber at Metz.

### ■ 3.5. How research programmes are drawn up

Each year, the Director of Research and Innovation signs a contract with each of our customers. These contracts are all included in the *Schéma directeur des études et recherche* (master plan of studies and research), abbreviated to SDER, which draws together the activities of the two centres for the coming year.

This synthesis is the end product of a long process beginning in the summer, when proposals for studies for the coming year are drafted, whether they are a continuation of existing work or new projects. From September to November, negoti-

ations take place between the centre and its customers, who also have new projects to propose. During this period, the negotiations are also concerned with resources (man-hours of work and costs), deadlines and results.

The total sum to carry out the proposed studies greatly exceeds the centre's resources, so the final stage of the process involves arbitration. This is effected over a long day of collective negotiations, which ends in a theoretical balance between resources and the annual programme. A proportion of resources is also kept in reserve to allow a degree of flexibility in accommodating the customers' changing requirements.

### ■ 3.6. A customer-oriented structure

TDF-C2R is organized on a matrix basis, with one axis of the company focusing on products, the other on technology.

The technology axis consists of four departments which together contain all the research staff. This arrangement ensures that TDF-C2R has international expertise in four fields:

- *Radio frequencies*: radio spectrum, propagation, transmission, antennae and HF electronics;
- *Signal processing*: sound, image and channel coding, modulation techniques and digital electronics;
- *Networks and IT*: telecommunications networks and protocols, data protection, network architectures and supervision, software engineering and advanced information technology;
- *Testing and Quality*: audio, video and telecommunications equipment testing, electromagnetic compatibility, subjective testing and Quality of Service.

The task of the product side is to define and monitor the research programmes. It consists of a team of six engineers – the *programme managers* – who act as an interface with TDF customers. Each is responsible for a programme corresponding to one or more customers, depending on the level of demand from the customer(s) concerned. It is the manager's job to negotiate the programme with his customer(s) and with the technical departments, in accordance with the process described earlier, and to orchestrate the final programme as incorporated in the SDER.

To complete the organizational structure, TDF-C2R also has two support departments. The first, *Valorisation et Propriété Intellectuelle* (economic development and intellectual property

rights), is particularly concerned with external customers. It has a commercial manager, responsible for services and the granting of licences, and a manager responsible for project funding – in particular, funding from the European Commission. The second department is responsible for the day-to-day running of the centre in respect of human resources and finance.

The TDF-C2R Management Committee – which consists of the Director and the department heads (technical departments, support departments and programmes group) – takes major decisions on behalf of the centre.

### ■ 3.7. Quality: a constant concern

Each year, TDF-C2R publishes its annual objectives. These are drawn up on the basis of dialogue within the centre and with our customers. The first objective is always to improve the quality of our research studies, in terms of performance, deadlines and costs.

To be able to quantify customer satisfaction, we created a “satisfaction form” in 1995 which takes into account the various aspects of the quality of a research study (performance, deadlines, communication in the course of the work, quality of the final document, use of the results). This form is sent to each customer (internal or external) at the end of each study period, or during the year in the

case of longer studies. Results to date have been very encouraging as the overall index of satisfaction was 63% in 1995 and 70% in 1996. Our target for 1997 is 75%.

Since 1993, we have been developing an original approach to project management. This has been a long process, to enable us to manage the quality of our services in terms of deadlines and costs. In 1993, we defined the method; in 1994, the centre was trained in its use and, gradually, in 1995 and 1996, all the centre’s studies were brought into line with this method. In parallel with these developments, a software tool was specified in 1994 and developed in 1995 and 1996. A new software tool is being developed for 1997.

This method has been derived from conventional approaches to project management and adapted to meet our special requirements. What happens is that each research study is divided into four phases, each ending with a document which records the decision whether or not to proceed to the following phase. This decision is taken by the Management Committee. The stages are as follows:

1. *Gestation.* This phase is concerned with defining the customer’s needs in terms of performance, cost and deadlines. It is generally conducted by the programme manager concerned, who makes a rough estimate of the resources required and nominates a research manager to

*Ms Christiane Schwartz qualified as an engineer from the Ecole Supérieure d’Electricité. She began her career at CNET in 1969, working in the Bagneux laboratory, where she produced a postgraduate thesis in quantum physics. In 1973, she followed CCETT to Rennes where, as deputy head of the department specializing in videotext, teletext and facsimile, she contributed to the initial work on Antiope and Télétel, and to their standardization.*

*In 1979, again at Rennes, Christiane Schwartz took charge of a group tasked with the external development of remote-control products and services. She played an active part in the early work on multimedia and in the AFNOR – later ISO – standards initiative. This led to the creation of the ISO’s MHEG group. At the end of 1991 she became Deputy Director of CCETT and, from 1995 to 1997, she had sole responsibility for running the research centre.*

*Since January 1997, Ms Schwartz has been head of the Direction de Recherche des services de Diffusion et Multimédia (DSM), part of France Telecom’s new R&D organization.*



*Mr Didier Frossard – an ENSI-trained engineer, – joined TDF in 1983 as manager of the CERIM reception laboratory (TDF’s Paris research centre). He made a notable contribution to the work of the EBU in the fields of frequency planning and digital signal reception.*

*In 1989, Mr Frossard became head of TDF’s RDS/radio paging project, tasked with developing RDS applications in France and several other countries. He contributed to the work of the EBU’s RDS Working Party, which later became the RDS Forum. In 1992, he served as Mr Daniel Sauvet-Goichon’s deputy in launching TDF-C2R, a research centre combining TDF’s Metz and Paris laboratories, which specializes in broadcasting networks and radio communications. He took over the running of this centre in 1995, when its activities were all moved to Metz.*

*Since May 1997, Didier Frossard has been south-east regional director of TDF, based in Marseilles.*

take responsibility for the project. This phase may be of longer or shorter duration, depending on the size and difficulty of the study.

2. *Preparation.* This involves detailed planning, breaking the project down into specific activities and tasks, and appointing people to be responsible for each activity, all in consultation with the customer and the technical departments.
3. *Development.* This is the stage of actual execution, and will go much more smoothly if the preceding phases have been carried out properly. The person who is responsible for the project manages the resources and deadlines, and carries the responsibility for the final result. It is also his/her duty to give warning if difficulties arise during the work or if modifications (always a possibility) are requested by the customer.
4. *Evaluation.* At the end, the project is evaluated and a satisfaction form is sent to the customer.

As well as improving the monitoring of deadlines and costs, this method of project management ensures that each person involved in the project takes responsibility for his/her part.

### ■ 3.8. *Towards ISO 9001*

At the end of 1996, we decided that TDR-C2R needed to obtain a quality standard. Our aim is to achieve ISO 9001 certification by the year 2001. This decision was based on an analysis of our environment carried out during 1996. We are not yet under strong pressure from our customers (including the European Commission), but our analysis shows that this pressure will increase over the next five years. TDF, itself, has ISO 9001 certification for FM broadcasting (1996) and is currently extending this approach to other services. TDF-C2R will not be starting from scratch as all our operational procedures are already recorded in writing. Furthermore, in January 1997, we were granted COFRAC accreditation for our performance in matters relating to EMC.

### ■ 3.9. *Managing research staff*

120 people work at TDF-C2R, almost 90 of them on research projects. The average age is low (34) and the level of qualification is high (75 are quali-

fied engineers). These characteristics are essential if we are to remain competitive in the long term, but they mean that we are unable to guarantee our young researchers a long career at the research centre. We make this quite clear when they are recruited: there is a 70% likelihood of them leaving TDF-C2R within five to seven years. This has two consequences.

Firstly, when employing someone, we tend to look for an "engineer" rather than a "pure researcher". This means that our staff are more likely to find another post in the operational departments of TDF. Of course, we do engage some "pure researchers" to whom we can offer career development opportunities within the centre, for instance in specialist roles.

The second consequence is that we are geared for mobility. A "research staff careers advice committee" has been set up by the two research centres and TDF's human resources department to prepare staff for the possibility of moving. TDF-C2R managed to achieve mobility levels of 6% in 1995, and 10% in 1996. This is sufficient to maintain the average age of staff at below 40, which is our objective.

## ■ 4. *Research: a major asset for TDF*

The R&D facility of TDF is a major asset. Not only must the company invest in technically-promising fields, it must also work closely with the company's other departments – marketing, sales, operations, etc. – to ensure that research projects are rapidly transformed into new services.

The essential point which emerges from the different, yet closely-related, experiences of CCETT and TDR-C2R is the way in which the "customer" has become the driving force in every initiative and, therefore, of the organization and the daily conduct of our activities. The proportion of "R" in R&D has diminished in favour of more "D". It is however important to maintain continuity and retain sufficient "R" to ensure that we are not "caught napping" by sudden changes in technology. It is also necessary to check, on a regular basis, that the projects we are working on still meet the needs of our customers.