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EEC DATABASE PROJECT
ITALIAN NATIONAL SURVEY REPORT
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1. INTRODUCTION

This report gives the results obtained from a survey on Database users in Italy.

The survey was made in the period between October 1978 and February 1979 and is part of a more extensive project, partially financed by the European Economic Commission, in which Institutes from Germany (GMD), France (IRIA) and the United Kingdom (NCC) participated.

Two questionnaires and an interview guide were prepared while the survey was being conducted. These are described in detail in the chapter entitled "Survey Methodology".

120 one-page questionnaires were mailed together with an accompanying letter explaining the purposes of the survey.

The organisations receiving the questionnaire were either chosen on the basis of suggestions from within CNUCE and/or I.E.I. or from other DBMS users, or because they belonged to a particular user group.

The main criterion adopted when selecting the users was essentially to cover the entire range of the packages in use in Italy.

Table 1 gives the estimated number of users of the various packages.

DBMS	Estimated N. of users
DL/I	200
IDS	164
IMS	100
TOTAL	50
IMAGE 3000	20
ADABAS	15
S2000	10
IDMS	3
DBMS-11	1(test)

Table 1: DBMS's Users

30 replies were received. 29 of these were in favour of participating in the survey; only one reply was negative.

Out of these 29 organisations, 7 were rejected as not yet having sufficient experience in the Database approach.

All the interviewed organisations had already completed a very detailed questionnaire. This questionnaire had been sent to almost all those organisations which had replied that they were willing to participate in the survey but which had not been interviewed.

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The only questionnaire received has been included in the statistical analysis of the questionnaires.

Table 2 shows the hardware being used by the 23 organisations which completed the questionnaire.

```
=============================
   Hardware
=============================
   IBM 370/138        1
         /145         2
         /148         4
         /158        10
         /168         5
         3031         1
         3033         2
UNIVAC    1106         1
Honeywell 1 66/60      1
Honeywell 1 66/80      1
=============================
```
Table 2: Hardware

Note: For centers with more than one computer model, each model has been counted.

The following histogram shows the distribution of the organisations according to the year in which they adopted the DB approach.

```
|
|
|
|                                  XX
|                               XX XX
|                               XX XX
|                               XX XX XX      XX
|                            XX XX XX XX XX XX
|                            XX XX XX XX XX XX
|        YX         XX XX XX XX XX XX XX XX YX
|----------------------------------------------------->
|64|65|66|67|68|69|70|71|72|73|74|75|76|77|78|
```

Chapter 2 contains a brief description of the methodology adopted for conducting the survey.

Chapter 3 reports the findings which can be deduced from the analysis of the questionnaires and the interviews.

Chapter 4 gives a summary of the interviews and questionnaires.

In chapter 5, a number of guidelines for potential DBMS users are suggested.

In this article, a detailed description of the results of the questionnaire and interviews in Italy and the statistical analyses of these results have been omitted. The complete report, edited by CNUCE and IEI Institutes of CNR, is now being printed.

The global report, which will contain details of the results from all the Institutes collaborating in the project, will be published in four languages and can be requested from any of these Institutes.

2. SURVEY METHODOLOGY

2.1. Initial Survey

The initial contact with the potential participants in the survey was established through a one-page questionnaire which was accompanied by a letter which described the content and the intentions of the project (see Appendix 1 to the Contract).

The questionnaire which was adopted was that suggested by NCC.

The organisations to which the questionnaire was sent were chosen either on the basis of suggestions from within CNUCE or I.E.I. or from other DBMS users or because they belonged to a particular user group. The criterion adopted in selecting the users was essentially that of covering the entire range of the packages used in Italy.

Approximately 25% of the organisations replied to the preliminary questionnaire and, with only one exception, they were all in favour of participating.

The preliminary questionnaire was despatched in a series of mailings (between mid-July and the end of October). As the initial response seemed to be rather poor (maybe owing to the summer holidays), it was decided to combine the mailing of the questionnaire with direct telephone contacts.

This type of direct contact was found to be very useful both in resolving any eventual problems the participants might have with regard to the initiative and also in order to encourage response.

It is possible that initial problems and doubts could have been resolved by a better distribution of information on the project. These initial doubts were frequently the result of the fact that similar initiatives which had been made in the past by some Universities had not given the participants any final results which they felt justified their collaboration.

2.2. Full questionnaire

The full questionnaire was finally formulated after a number of tentative phases had been passed. The first version, drawn up by the NCC, was gradually improved and extended during discussions in meetings of the Working Group.

The third version was adopted for a pilot interview. This trial showed that certain questions were not sufficiently clear and thus assisted in a better formulation of the final questionnaire.

As the reply to the initial questionnaire was not very high, the full questionnaire was mailed to those organisations which had stated that they were willing to participate. Exception was made for a few cases in which a DBMS had only been in use for less than six months.

Whether the questionnaire has been mailed previously to the interviewee or whether it was first presented at the interview, it was briefly discussed before the interview was carried out so that any doubtful points could be clarified. It was often difficult to have the questionnaires completed, and a telephone call was often necessary before it was possible to receive a reply.

Despite the various improvements which had been made to the initial draft of the questionnaire, a number of questions were still not very clear to the participants; only a very few organisations were capable of replying to certain other questions.

2.3. Interviews

Some of the organisations which had stated that they were willing to participate in the survey had to be rejected as they had not yet had sufficient experience with the DB approach.

In conducting the interviews, an "interview guide" was followed. This "interview guide" was drawn up following a procedure very similar to that adopted when formulating the full questionnaire.

The average interview lasted for 5-6 hours, with a division between the different interviewees within the organisation as shown below:

Manager	1.75	- 2	hours
DBA	2.5	- 3	hours
User	0.75	- 1	hour

the interviews were normally held with 2 or 3 people present.

A Tape recorder was used.

In general, we were able to interview the three different levels of interviewees separately. Some times this was

not possible. This happened most frequently when the DBA function was not well established and in these cases the Manager was present at the interview together with the DBA. It also happened in some other cases when the DBA was present at the interview with the user.

Some times the DBA was not able to reply to those questions which were further removed from his knowledge of the particular package; this depended on the level at which the DBA was kept within the organisation.

The existence of an interview guide proved to be of great assistance as it made it possible to conduct the interviews efficiently and homogeneously (i.e. in the same way for all the organisations visited). It also avoided wasting time and prevented the interviewee from adding irrelevant details even if he was never forced to follow too rigidly the order of the questions as laid down by the interview guide.

In some cases it was not possible to interview the end user. It should be noted that there was an improvement in quality in the later interviews as the interviewers gradually gained in experience.

4. General Comments

If an initiative of this sort is to have a good chance of success, a higher number of preliminary pilot interviews should be made together with an accurate evaluation of the first results so that all the doubtful or problematic questions can be revealed beforehand.

A better publication of the project could also help in lending greater credibility to the initiative and thus encouraging the participation of those organisations with a greater experience in the sector, which can provide a more significant contribution.

Despite the fairly limited sample, we gained the impression that the findings to the survey gave quite a faithful picture of the actual Italian users' experience.

3. FINDINGS

3.1. – End-user awareness

3.1.1. – Types of user

The users interviewed during the survey can be divided into two categories:

- programmer users;

- parametric users;

The casual user, as defined by the text--book, was not encountered.

As would be excepted, it was found that the use of non-procedural languages was very limited (3 out of 22), while the availabillity of an interactive query language was one of DBMS requirements which was given the lowest score.

Only one organisation felt the need to adopt, in the future, a non-procedural language, while in another case this type of language was rejected by the parametric users.

3.1.2. – Degree of awareness

In 40% of the organisations visited, the DB approach was completely transparent to the end-users (unaware). In the remaining 60% of cases the degree of awareness ranged from a vague realisation of a greater integration of the applications and of higher data quality and a more direct data access up to a full involvement in the development and operation of the applications.

In general, the attitude of the end--user was that of initial diffidence towards the new approach. This attitude

was gradually overcome as the user became more aware of the approach. In order to encourage acceptance of the DB approach, the EDP often divulged information to the end-user.

Only in one case was the approach not accepted.

3.1.3. - Involvement of end-users in project phases.

It was found that in 1/3 of the organisations the initiative for the development of new applications normally came from the user.

The degree of user involvement in the project phases varied in the organisations interviewed.

Basically three different categories could be identified:
- user completely un-involved;
- some user consultation;
- user representatives participated in at least some of the project phases e.g. Feasibility Study, System Study ans System test Stages.

3.2. - Database Administration

3.2.1. - What tasks are performed by DBA?

Even though many of the organisations (approx. 70%) stated that they had adopted the functions of the DBA, the general impression was that these functions were almost always closer to the technical support of the DBMS than to the conventional textbook DBA responsibilities.

Nevertheless, it was seen that all the organisations appreciated the importance of the DBA function and intended either to introduce it, if it did not already exist, or to better formalise or qualify it.

3.2.2. - Size

As shown by the Questionnaire Statistics, the average size of a DBA group is 2.6 members. This average figure, however, does not give a good picture of the actual situation as one organisation, in fact, had a very large DBA group (12 members). If this organisation was excluded a more realistic average of 2 members per group is obtained.

3.2.3. - Reporting level

The DBA reports at different levels in the different organisations but (with very rare exceptions) always within the EDP environment.

Three main levels can be noted:
- EDP Manager;
- Software Manager;
- Information Systems Manager.

3.3. - Approach

3.3.1. -Methods found

It was observed that only approximately 40% of the organisations interviewed justified the adoption of the DB approach on the basis of its intrinsic characteristics. In the rest of the case, the choice had been based on other considerations:
- more efficient access method (approx. 20%).
- suitable tool for the rationalisations of applications and the work of the organisation (approx. 16%)
- more efficient and reliable on-line processing (approx. 16%)
- keeping up with new developments (approx. 6%)

It should be noted that in most cases other reasons which could also have encouraged the adoption of the DB approach had not been considered throughly. This was probably due to the fact that the principal motive was almost always completely dominant and also

because it was felt that it would be difficult to evaluate in advance certain advantages (i.e. reduction of costs).

3.2.2. - Problems

In adopting the new approach, a large number of the interviewees (approx. 46%) had anticipated eventual organisational problems e.g. difficulties in user and trade union acceptance.

3.3.3. - Effects

In almost all cases (20 out of 22), the organisations confirmed that they were content with their choice, affirming that they had achieved their original objectives. This satisfaction depended mainly on the following factors:
- cautious approach (the first applications were quite simple):
- greater professional motivation in the EDP environment.

Nervertheless, it should be remembered that, since the statistical sample was not a true representation of the package distribution in Italy, eventual problems connected with the complexity of a specific package could be understimated.

3.3.4. - Impact

In general, no substantial modifications to the organisational structure of the firms had been made.

The new functions which were eventually introduced (Data Administration, User Representative, etc.) in most cases had not yet been formalised.

Apart from a few rare exceptions, the interviewed organisations found it difficult to give precise indications on the effect of the DB approach on the staffing situation. Nevertheless, the impression gained was that the organisations were able to achieve a great-er amount of work with the same number of staff.

It was found that an improvement in the professional level of the end-user was obtained as the greater availability of information (on-line access) permitted a greater assumption of responsibility and meant that the individual end-user was able to function at a more qualified level. (Job enlargement and redefinition).

In the EDP environment, there was a considerable improvement in quality with the introduction of applications analysts, system designers, and a number of functions connected with the Data Base administration.

3.3.5. - Costs

Approximately 60% of the organisations interviewed affirmed that they were unable to assess the costs of the Data Base approach. The remaining organisations were unable (with only a few exceptions) to give a sufficiently precise estimate of their costs.

3.4. - Selection of the DBMS

3.4.1. - Corporate initiative and end- -user involvement.

Management involvement was almost always (17 out of 22 cases) very low (either complete un-involvement or simply authorisation of expenditure). Only in 3 cases was there a full participation.

The end-user participation was practically non-existent (no involvement at all in 82% of the organisations).

3.4.2. - Type of evaluation

Generally, the evaluation was useful in demostrating that the package chosen on the basis of other considerations was, in fact, suitable to respond to the actual requirements of the organisation. In this sense, it can be noted

that rather than a selection process between different products, a verification process was evidenced. The various forms that this evaluation process took are summarised and given in the statistical analysis of the interview.

3.4.3. - Criteria

In two thirds of the organisations interviewed, the package had not really been chosen as a result of a careful evaluation but on the basis of other considerations:
- political choice
- hard selling tatics
- compatibility with the hardware and software already in use.

Where an evaluation had been made (72%), apart from a few exceptions, it had only been made superficially. This was probably due to a lack of specific competence within the organisation and because of the high costs involved, both financially and in man-hours, in an accurate evaluation.

3.4.4. - Constraints

Certain organisations had to reduce the package selection times because of urgent immediate requirements.

In retrospect, it can be thought preferible to delay the immediate satisfaction of requirements (even if these are urgent) in order to be able to make a more thorough DBMS evaluation and choice.

3.5. - Advantages and disadvantages of Database.

A great variety of replies were received when the organisations were requested to state the advantages of the DB approach. Mainly, the advantages quoted were those reported in the literature.

For two thirds of the organisations, the advantages claimed were substantially linked to a better organisation of the data (integration, non redundancy, consistency, etc.).

The only advantages in costs savings reported were relative to possible reductions in programming and maintenance times.

The many disadvantages cited can be classified into three main categories: higher costs (30%), difficult impact on the organisation (20%) and technological problems (50%).

The rise in costs was due to the greater complexity of a DBMS, a greater request for resources (hardware, software and personnel) and the necessity for higher qualified staff.

The problems arising from the impact on the organisation were essentially a result of the enforced change in mentality, the loss in independence owing to the necessity of thinking in terms of an integrated information system and the growth in responsibility of the EDP whose role becomes particularly critical in the functioning of the organisation.

The third category includes all the problems described in detail in the literature (recovery, restructuring, DB design, reorganisation) and which are especially felt at the actual state of technological development.

3.5.1. - DBMS requirements

In the evaluation of a package, two of the requirements which received the highest score regarded vendor and package stability rather than technical aspects.

Considerations concerning package costs and technical support, however, were given relatively little importance.

In spite of the importance normally attached to security and integrity controls, and to recovery/restart facili-

ties, one third of the organisations interviewed held that the recovery/restart features of their DBMS were inadequate, and another third considered the integrity and security to be unaffected.

These results probably depend on the fact that two thirds of the organisations had chosen their DBMS on the basis of considerations which were not the result of a careful evaluation.

3.5.2. - DBMS Usage

The impression was gained that in many organisations the full potentiality of the DBMS was not exploited.

This could depend on a number of factors:
- the User did not have the experience or the technical competence to be able to fully exploit all the facilities offered by the package;
- certain facilities supplied by the packages are difficult to use either because they need expensive extras in terms of hardware and/or software or because they degrade performance.

3.5.3. -DBMS objectives: achievement

The three fundamental objectives of a DBMS: data independence, data availability, and data quality were only to a limited extent achieved by the organisations.

This depend on the fact that the packages in use only partly permit the achievement of these objectives and the state of development and competence of the User was not always sufficiently mature.

3.6. - Application Design

In general (17 cases out of 22) the application design had been made on an intuitive basis. In the rare cases where a formal methodology had been followed, a manual process was involved.

The use of computer aided techniques was practically non-existent (only one case).

External consulting firms had been employed (usually the vendor) by 50% of the organisations in the development of the first applications or for the more complex ones.

3.7. - DDS Usage

45% of the organisations used a DDS, and 60% of these had adopted a DBMS complex. 70% of the organisations considered DDS a useful tool in the development and maintenance of the applications. It is likely that, in the near future, the use of the DDS will become increasingly widespread.

3.8. - Corporate Data Bases

None of the organisations interviewed has realised a corporate Data Base. Indeed, in quite a few cases, certain traditional applications were transferred under the DBMS, without any substantial modifications.

After the realisation of the first applications, (usually kept quite simple) no tendency towards the realisation of an integrated system was manifested; the development of sectorial Data Bases for specific applicative areas continued. In only one case did an organisation (with several years experience in the field) show an interest in realising a corporate Data Base. On the other hand, another organisation has chosen to move towards total decentralisation, adopting the distributed computing approach.
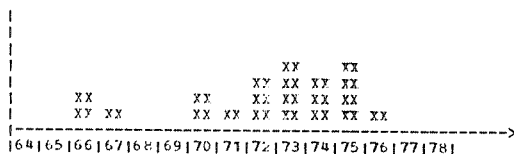
3.9. - Applications planning and control

The introduction of the DB approach has favoured a greater rationalisation in the development of applications and greater participation by end-user.

3.10. – Correlation between CPU size and DBMS used

The average CPU sizes of the installations which were investigated are as follows:

DBMS	Average CPU (Mb)	No. of installations	Actual values (Mb)
IMS	3	8	3,3,3,3,5,2,3,2
DL/1	1.6	4	2,2,1,1.5
TOTAL	1.9	5	4,2,0.5,2,1
S2k	1.5	1	1.5
ADABAS	3.5	2	3,4
IDS/1	1.25	2	2,0.5
DMS	1.5	1	1.5

3.11. – Correlation between DBA group size and DBMS used

The average DBA group sizes of the installations which were investigated are as follows:

DBMS	Average DBA group size	No. of installations	Actual values
IMS	3.6	6	3,12,1,2,2,2
DL/1	2	2	1,3
TOTAL	2	3	4,1,1
S2k	2	1	2
ADABAS	2.5	2	3,2
IDS/1	–	1	no response
DMS	–	–	–

4. SECTION SUMMARY

4.1. Background to the Database ·Approach

15 of the 22 organisations interviewed (68%) had a centralised management philosophy 18% had a decentralised philosophy and 14% were in a transition stage.

The replies received from the interview were referred in each case to the organisation's management philosophy.

The histogram below shows the time distribution of the decision to adopt the Database approach.

```
|
|
|
|                      XX      XX
|                   XY XX XY  XX
|       XX          XX  XX XX  XX
|       XY XX       XX XX XY XX XX XX XX
|----------------------------------------------->
|64|65|66|67|68|69|70|71|72|73|74|75|76|77|78|
```

This histogram shows that, after a first stage in which a limited number of organisations adopted the DB approach, there was a static period and only since 1970 had the DB approach become increasingly popular.

In more than half of the organisations, the initial interest came from the EDP sector, only rarely was the initiative taken by the Management.

In a few cases, pressure by the vendor proved a determining factor. In 50% of the multinationals, the initiative came from the Overseas Head Office. In one case, the initial decision was taken outside the organisation, in the Holding to which this organisation belonged.

The main reasons for the adoption of the DB approach have been described in detail in the "Findings" and in the interview statistics. In this section, we should like to deal with certain aspects which we feel deserve particular attention.

In three of the organisations, one of the reasons which encouraged the adoption of the DB approach was the advantage of being able to introduce a unifying element. These three cases were:

– a multinational environment
– a group of firms
– a merger between two organisations

In a few cases, the fundamental decision taken by the management was the adoption of the TP; the DB technology was then chosen within the EDP environ-

ment as the most suitable for the reali-
zation of on-line applications, and, in
particular, because of the recov-
ery/restart facilities which this ap-
proach offers.

In general, there was a certain cor-
respondence between the main reasons
quoted and the DBMS requirements which
received the highest scores.

The other reasons, quoted as secondary
in the interview, had, in fact, a sec-
ondary weight in the choice of the ap-
proach. This is shown by the fact that
it was necessary to repeat them one by
one to the interviewees, and 45% stated
that these reasons had not even been
considered.

In adopting the DB approach, the organi-
sations generally expected organisat-
ional rather than technical problems
(23% anticipated no problems). This may
depend on the fact that a particularly
simple package had been adopted or be-
cause of an underestimation of the pos-
sible problems.

4.2. Application Design

The replies to the questions in this
section were generally unsatisfactory.
This was probably partly due to the
fact that many of the interviewees did
not had very clear ideas concerning
some aspects of the problem. Most of
the interviewees (18 out of 22) claimed
that they had made a data analysis,
even though this varied considerably as
far as level and accuracy was concerned
from organisation to organisation. A
functional analysis had been made less
frequently (8 out of 22 cases), and
very often as a verification of the
design. In four cases, a Data Analysis
had not been made as the traditional
applications had been transferred to
the DBMS without substantial modifica-
tions. The organisations were equally

divided between those which first
considered the local view and those
which first gave importance to the glo-
bal view (9 local, 9 global, 4
no-distinction).

It should be noted that in certain
cases we gained the impression that
there was not a clear vision concerning
the context in which a distinction
should be made between the local and
global view (programs, applications, or
others).

A clear result was the tendency to
develop and maintain the specific com-
petences necessary for the realisation
of the applications within the organisa-
tion itself. Only for the first applica-
tions was the assistance of external
consulting firms considered necessary
(usually the vendor). This was mainly
due to lack of experience and a limited
acquaintance with the package being
used.

The tendency to not employ external
consultants was probably also favoured
by the fact that in a number of cases
the support offered by the vendor in
this area was inadequate.

Basically, the design was intuitive (17
out of 22), and in 6 cases no dis-
tinction was made between the logical
and physical design.

The logical design was influenced by
the facilities of the DBMS (14 out of
22 cases) and partly by the previous
files. The physical design was very
often (13/22) dominated by particular
applications. In particular, there was
the tendency to privilege the on-line
applications.

In the majority of cases (17 out of 22
organisations), the design was condi-
tioned by middle-term planning.

However, we gained the impression that

the influence of this thinking was very limited both because the system designers mainly relied on system flexibility for data structuring, and also because it would be difficult and expensive to take eventual DB evolutions fully into consideration.

In one case, it was stated explicitly that it had been uselless to consider this middle-term planning, and in another two organisations the difficulty for the DBA to make accurate forecasts for the future was stressed.

4.3. Evaluation

Management involvement was almost always (17 out of 22 cases) very low (either complete un-involvement or simply authorisation of expenditure). Only in 3 cases was there a full participation.

The end-user participation was practically non-existent (no involvement at all in 82% of the organnisations).

In two cases, the evaluation was made outside of the organisation.

In the evaluation stage, 50% of the organisations had had contacts with other organisations (of the same and/or of different types) which had already matured a significant experience in DBMS usage. These contacts were in the form of discussions and practical demonstrations, however they had generally only been held on the superficial level and were thus of very little real value. In two cases, it was noted explicitly that only rarely during these contacts did the actual difficulties appear which would later be encountered by the organisations when implementing the DB. Often, these contacts were instigated by the vendor. In two cases, it was decided to visit organisations in the U.S.

Generally, the evaluation was useful in demonstrating that the package chosen

on the basis of other considerations was, in fact, suitable to respond to the actual requirements of the organisation. In this sense, it can be noted that rather than a selection process between different products, a verification process was evidenced. The various forms that this evaluation process took are summarised and reported in the statistical analysis of the interview.

The organisations were all well aware of the importance of the choice of the DBMS which would be most suitable for their requirements and therefore, felt the necessity of having tools available to assist them in making a thorough evaluation.

It must be noticed, however, that a superficial evaluation was partly a result of management pressure for the first applications to be implemented as soon as possible.

As has already been stressed in the "Findings", in the selection process considerations which were not strictly of a technical nature were important. These included, in particular, compatibility with specific hardware, firm policy, pressure from the vendor.

One reason why certain products were rejected was the dissatisfaction of certain users who had already had experience with these products. When a comparison was made between a number of products, one of the decisive motives for the final choice was the speed with which the applications could be implemented.

In any case, almost all of the organisations found that they had only a limited possibility of choice. This was because only a small number of packages were available on the market and also some of those available did not have sufficient guarantee of reliability (i.e. DL/I), others either did not ex-

ist in Italy or were unavailable commercially (e.g. SYSTEM 2000, ADABAS), for other systems the vendor's support was inadequate owing to insufficient experience.

It should be observed that certain products which were quite well-known abroad were only just beginning to become known on the home market (i.e. IDS/II, IDMS).

Practically only the IMS users complained of difficulties in the installation of the DBMS software. It was found that in many cases the DBMS verification stage often coincided with that of evaluation (pilot applications) or with the development of the first applications.

Only a small number of organisations made a sufficiently thorough DBMS verification.

4.4. Using the Database

The impression gained was that the adoption of the DB approach favoured an improved planning and control of the development of applications. In 10 out of 22 cases, a formal procedure for the development of an application already existed, most of the other organisations intended to introduce such a procedure in the future.

It was found that in 1/3 of the organisations the initiative for the development of new applications normally came from the user, in another third from the EDP environment, and in the remaining cases as a result of managerial decisions.

The phasing of this and the corresponding typical team is reported in the interview statistics.

These statistics show that there is a tendency to coinvolve the User during the Feasibility Study, the System Study and the System Test stages. In two cases, a User was given the function of "Project Leader". The User participates in the development of applications through his representatives who act as interface with the EDP and the User Department. In some organisations, this function has actually been formalised.

In moving from the traditional approach to the DB approach, 15 out of 22 organisations have preferred to totally rewrite the application programs. In another 5 cases, the programs were only modified. There are a few cases in which traditional procedures are still in existence together with the DB procedures, through interface programs.

It was difficult to obtain a precise estimation of the training necessary for the different functions. The type of training adopted was, typically, short courses both internal and external to the firm (these courses were very often run by the vendor).

The functions which needed the greatest training time were the DBA and the system designers.

It was also noticed that the training time depended heavily on the package complexity.

It was found that the problem of data privacy was not considered to be particularly important. Half of the interviewees explicitly declared that they had no problems in this respect. The others almost always resolved any problems without using any very sophisticated techniques. The most common techniques adopted were: the use of passwords, the enabling of a terminal to perform a particular transaction, control transferred to the application level.

Only in a few rare cases were special methods used, e.g. terminals with locks, magnetic badges, accurate use of certain package features (i.e. control of the logical path). Security problems were usually faced by using the features supplied by the packages.

It should be noted that these features were held to be inadequate by 40% of the interviewees for the batch and by 32% for on-line. In these cases, the package features had been integrated by self-developed software. The impression was gained that dissatisfaction was greatest in those organisations which had paid particular attention to this problem.

The time in which an organisation can afford to be "off the air" depended largely on the type of organisation and the particular moment in time. In broad terms, the organisations can be divided into 4 categories according to the following ranges: (0-1/2h), (1h-1d), (1d-1w), (1w-2w).

The organisations belonging to the first categories normally use 2 CPUs.

The use of tools for monitoring and tuning is not greatly extended and almost one third of those interviewed had not used such tools. In general, tools for tuning were not available, when available they were usually supplied by the vendor. Basically, the tools supplied together with the package were those used; less than a quarter of the organisations had integrated these with other self-developed tools or with tools produced by the software houses. With respect to the various packages, it was found that the tools supplied by IMS were generally satisfactory while those supplied by TOTAL were mainly inadequate.

However, the use of these tools was usually limited to particularly critical situations, and certain specific cases e.g. a change in Hardware or the introduction of new applications of some importance.

Among the tools used most frequently were: DB/DC Monitor, DB Analyzer, DL/1 Test Program, Problem Program Evaluator, SMF Analysis.

Despite the fact that 45% of the organisations possessed a DDS, the impression was obtained that its use was quite limited and confined to documentation purposes.

One organisation had developed its own DDS but so far this has not been adopted because of lack of confidence in its usefulness.

4.5. Effects of the Database Approach

As shown by the interview statistics, and as discussed in the Findings, almost all the organisations (20 out of 22) claimed that they had reached their original objectives and that they were satisfied by the DB approach.

The reply to the next question, however, appeared, in part, contradictory as it tended to demonstrate certain eventual changes in the original objectives.

In fact, only 14 organisations confirmed that they had not changed their original objectives. In 6 of the remaining organisations, modifications were a result of specific package limitations, and in two other cases the cause was to be attributed to external factors:

- economic crisis with the consequent redimensioning of investments and hiring;
- radical change in the organisation's management philosophy (from centralised to decentralised).

The replies obtained must be referred to the specific package being used rather than the DB approach in general.

File integration was, in most cases, limited; a greater degree of integration was found at the applications level. The limited file integration was probably due to a deliberate policy of data redundancy and duplication in order to avoid degrading on the DBMS performance and also because of a desire to simplify the problems of privacy, concurrent access, and security.

In 13 out of the 22 organisations, data security and integrity had been enhanced; in no cases did a lowering in standards occur. These results can be attributed both to the packet supplied features and also to the greater attention which is being paid to the problem of data protection within an organisation.

The results which refer to the impact of the DB approach are reported in the interview statistics.

It is worth mentioning that the DBA function was kept within the EDP environment and was frequently very close to the DBMS technical support. In certain cases, there was quite strong resistance against attempts to establish this function at a higher level. Such efforts were consequently unsuccessful.

Although the adoption of the DB approach did not cause a revolution in the EDP departmental structures, it did introduce some new functions (DBA, Systems analysts, Data Administrator) of a certain importance.

Only in 4 cases, and with a particularly complex products – the IMS – were technical problems reported by the analysts and the programmers; in two cases, problems were related to the change in mentality imposed by the new technology.

In most of the organisations, the types of standards introduced were relative to documentation and programming. These standards were often introduced at the same time as the DB approach not as a direct consequence of it, but purely because it was a convenient moment.

The end-user usually felt that the introction of the Database approach was justified and had not found any substantial changes in his department or in his way of working. The information flow was unchanged, but more direct, with some intermediary passages being eliminated.

Almost all the end-users had noticed an improvement in the quality of the information and in the times. A number of end-users, however, complained of slow response times.

The participation of the end-user in the development and the operation of the applications had been increased. This also contributed to an improvement in his efficiency and to the assumption of greater responsibility.

There was not a great interest in data-sharing, only 9 of the 22 organisations permitted it and none of them had encountered any problems.

This result can be explained by the fact that most of the organisations either did not allow updating operations on shared data, or had resolved the data sharing problem at the application design level.

Only rarely had a costs benefits analysis been made since implementation.

In these cases, the result had been positive, and even in one case, where the costs were found to be greater than the original estimates, the decision to use the DBMS was judged to have been correct.

4.6. General Review and Future Plans

Only three interviewees declared that the DBMS did not live up to expectations.

The principal reasons for the dissatisfaction of these IMS users were related to the hardware requirements and to complex management.

Other users, especially TOTAL, although they were satisfied for the moment, felt that their package would not be able to meet the ever-increasing requirements of their organisation.

In general, the vendor's support was considered adequate. Among the various aspects that this support can assume (technical, DB design, installation, tuning) it was felt that the least satisfactory was the DB design.

Vendor support, however, had improved only recently. In a number of cases, the initial support was inadequate partly because the vendor, himself, was lacking in experience.

Successive Package Releases were mainly (11 out of 15) considered positively and had had practically no consequences on the applications already in operation as these Realeases normally ensured upward compatibility.

Only the IMS users reported significant problems (i.e. greater installation difficulties).

In 14 out of 22 cases, a restructuring of an operational Database was unnecessary. When such a restructuring was proved to be necessary, the main reason (4 out of 8) was new applications requirements.

Only 3 CICS users (with DL/I, ADABAS and Self-developed) had encountered problems in interfacing between the TP Monitor and the DBMS.

Only a few of the organisations visited allowed a concurrent update. Therefore, problems in concurrency handling methods were not greatly felt. However, on a theoretical level, many interviewees recognised that this was an essential feature. 7 organisations asserted that their package did not deal adequately with this problem.

Two thirds of the organisations interviewed would readopt the same DBMS if they were to restart the DB approach afresh. The impression was gained, however, that this attitude was conditioned by an inadequate acquaintance with the other packages available on the market. In some cases, the need to have more information available was explicitly expressed.

One third of the organisations would, if starting again, adopt a different DBMS. It should, however, be stressed that the reason for this change was motivated by dissatisfaction with the package actually in use only for a part of these cases (40%, especially IMS users); in the other cases the reason was either that the DBMS being used was no longer capable of responding to the requirements of the organisation (especially TOTAL users) or that there was a necessity to pass from a self-developed package to a commercial package in order to keep up with technological developments.

All the interviewees strongly rejected the possibility of writing their own DBMS and all declared themselves in favour of the introduction of the DB approach.

With reference to the planning of future extensions to the DB to meet the needs of other users or applications, 7 out of 22 organisations did not expect future developments as they had reached

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a consolidation stage. In the other cases, there was interest in the introduction of new Databases to serve sectorial applications.

The most frequently mentioned application enhancement was the possibility to represent more complex logical relations. The following enhancements were also cited:

- Query Languages;
- Concurrent update (record level);
- Reenterant code;
- More efficient sequential access;
- Schema/subschema facility.

When asked about their opinions concerning the future, and how they expect the DBMS to develop, the users most frequently mentioned the following developments: Relational Data Bases and Distributed Data Bases.

Also quoted:

- Decreasing costs;
- More integrated DB/TP;
- Automatic recovery;
- User oriented languages.

The most welcome DBMS developments are:

- Distributed Data Bases;
- Codasyl systems;
- Relational systems;
- Special purpose systems;
- System functions implemented in firmaware;
- Flexible user interface.

Even if the great majority of the interviewees expressed themselves in favour of standardisation and portability, in reality, we had the sensation that these problems were not greatly felt and the replies were determined more by theoretical motives than by actual requirements.

5. GUIDELINES

1. Before deciding to adopt the DB approach, the specific needs of each organisation must be verified carefully in order to be sure that this approach is the most suitable to satisfy these needs.

2. The initial approach should always be very cautious, and the first applications should be kept reasonably simple.

3. Unless your needs are unique (which is very unlikely) do not write an in-house DBMS.

4. Package evaluation is a very important stage in the selection process and must be made extremely carefully, taking strictly into account the specific needs of the organisation.

5. A formal methology (possibly computer-aided) for the Database design and a Data Dictionary System are decisive tools in the efficient development and use of a DB.

6. The establishment of the DBA function at a sufficiently high level within the organisation, on an official and a practical basis, is an obligatory step towards the achievement of effective management control within the organisation.

7. The definition of a formal procedure for the planning and control of the applications and the direct involvement of the end-user in the most important stages (Feasibility study, System study, System design, System testing) in the development of an application enables a better rationalisation of this development, makes the end-user more fully aware, arouses his interest and thus helps him to use the DB more efficiently.

8. It should not be imagined that the DB approach is in some way magic, capable of solving any problem. It is only a technology which, if used efficiently, can considerably help managerial decision making on a more objective basis, help the organisation to improve the efficiency of any services offered, and in general, assist in an improved utilisation of the organisation's data.

9. The DB approach necessitates a change in mentality both by the end-user and by the EDP environment as all thinking must be done within the context of an integrated information system. This change in mentality must be encouraged by means of a diffusion of information concerning the new approach within the organisation.

10. A costs and benefits estimate of the DB approach is important so that the DBMS can be used to render the DB approach cost-effective for the organisation.

11. The rationalising effect of the DB approach is only felt when it is inserted into an organisation which is already efficient and prepared to handle the new technology.

12. In order to encourage a greater diffusion of DDSs an improved divulgation of information at the potential user level is necessary together with an enhancement of the products currently available on the market.

13. The DB approach leads to a centralisation of the organisation's data. Although this should result in a more efficient management of the data, it also makes the organisation more vulnerable to a computer crash which could be caused by a number of possible factors (including external factors). In this light, the new tendency towards distributed data bases should be regarded with attention.