Information Society Technologies (IST)

Report of a

Programme Integration and Management Study

Conducted following evaluation of the first Call for Proposals

Edition :
September 1999

Editorial Note

The PIM Study was undertaken during two weeks 19 July – 01 August 1999 in conjunction with the technical evaluation of proposals resulting from the first Call. The study covered 641 proposals that received high scores in the evaluation, and which were ranked as candidates for negotiation or for the reserve list. The draft PIM report was distributed to the Directors and Heads of Unit of DGXIII on 2nd August, and has generally been warmly received.

This revised edition of the PIM report has been prepared for much wider circulation. It has been reduced in scope, to cover only the 486 proposals now included in the implementation plans drafted by the Commission. (For the moment, these exclude IST Support Measures. For RTD proposals reserve lists were shortened, with some of the lowest ranking proposals being dropped). The main report and conclusions of the PIM study are unaffected by this editorial change. However all references to proposals not included in the RTD Implementation plans have been removed from the annexes of this edition of the report. In order to protect the integrity and independence of the PIM study, the analysis originally conducted by the experts (Eg. the statistical distribution of proposals) has not been modified in any way. Neither has the database (PIMBASE) described in Annex 3 been changed.

Readers may therefore be confident that on the one hand, they will not lose time by considering specific proposals that are not currently "in the frame" and on that the other hand, the report still genuinely reflects only the views of the independent experts.

N P Heenan
PIM Study Co-ordinator
European Commission DGXIII G6

Table of Contents: Main Report

Table of Contents: Annexes

Executive Summary

The PIM mission to provide an overview of the ranked Proposals, following |evaluation

This report summarises the conclusions of a Programme Integration and Management (PIM) study of the first IST call for proposals. The work was conducted by 17 independent experts over a two week period. The PIM team's mission was to provide a unique and independent overview of the proposals ranked after the evaluation of the first call and report on relationships and dependencies, opportunities for synergy and the coverage of the workplan.

The strategic analysis of the proposals was wide ranging

The PIM Team analysed and classified the ranked proposals and built a database of information, which it used to identify potential relationships and dependencies between the proposals that could be exploited to integrate and manage the programme. It also conducted an analysis of the strengths, weaknesses, opportunities and threats facing the programme and its constituent proposals and analysed the risk profile of the programme.

Broad scope of the applications is world class

The analysis showed that there is good coverage of the workplan. The proposals cover a broad range of technologies and markets and user organisations are well represented in the consortia. The first call for proposals forms a solid base for establishing IST as the world's leading RTD Programme with respect to the broad scope of the applications and the broad multi-disciplinary spectrum of actors participating in the work. The adoption of Internet technology was a theme visible throughout the programme and proposals. The majority of the proposals will produce results, which will be marketable within approximately five years. The FET section of the programme also contained innovative proposals for work which will bear fruit in the 10 - 20 year timeframe. There is however relatively little of the proposed work targeted on the 5 - 10year timeframe.

Risk profile of IST is moderate

The group identified proposal and programme level risks and countermeasures and divided the proposals into two broad groups. One group consists of those proposals with high exploitation risks, and high potential rewards due to dependence on dynamic technologies and market requirements (mainly Internet related proposals), and the second group consists of proposals working with more predictable technologies and markets with lower risk. The combined overall risk is moderate and balanced.

Key issues were identified ….

The key issues identified:

- Critical mass and synchronisation for impact of results on global markets, international standards and technological progress
- Technology serving society and the citizen
- Proactive support to ensure growth
- Management of the anticipated risks
- The 2005 to 2010 timeframe

…and recommendations were made.

The PIM study team made the following recommendations:

- Build on European strengths and use these as a focal points for developing critical mass in key areas (Eg the 21st century home, Internet services over mobile networks and shared platforms for business service support)
- Investigate the potential of the links identified by the PIM team for clustering activities to integrate the programme
- Develop inter- and intra-programme links between 5th framework programme proposals
- Provide extra support for high potential proposals after the end of the first proposal year
- Actively manage the risks at programme and proposal level
- Increase the amount of RTD targeted on in the 2005 to 2010 timeframe in order to maintain the flow of new technology
- Ensure widespread awareness of the IST programme at local level

1 Introduction

This report contains the findings of a Programme Integration and Management (PIM) study of the first IST Call for Proposals. This was conducted by 17experts (listed in Annex 1) during the two weeks 19 July – 1 August 1999.

The structure and process for the study was founded on the positive experiences previous integration studies undertaken for the 4th Framework Programmes ACTS and Esprit, which covered smaller groups of proposals. These studies made a significant contribution to the successful implementation of these programmes, and have been taken forward here as the launch of a determined drive towards integrating the IST Programme.

1.1 Mission

The terms of reference for the PIM study were to help integrate the IST Programme by:

* providing a unique and independent overview of the First Call of the IST Programme
* reporting on :
  - relationships and dependencies
  - opportunities for synergy
  - coverage of the workprogramme.

The findings included in this report are to be used to brief :

* external advisors and Member States
* the Directors, and the negotiators of proposals within the Commission team.

The main body of the report contains the conclusions and recommendations of the study team. The annexes contain detailed findings to help negotiators and Project Officers identify and encourage cross-programme synergies.

1.2 Working method

The approach used is described in more detail in Annex 2.

The baseline information provided to the team was the 641 proposals that had been "ranked" by the evaluation panels. Each ranked proposal was read by a single member of the team, to obtain an overview of its focus / scope and results, this being written-up as a single-page résumé. Regular team sessions were held to discuss the résumés and classify the proposals according to:

A: Technology,
B: Market type,
C: Project Focus
D: Involvement of end users
E: Evaluation Panel (the existing "classification")

The classifications, together a one or two-line summary of the scope of each proposal and the themes used by the Commission for allocating the proposals to individual evaluation panels, were captured in a centralised Microsoft Access database.

The team faced a massive 'Data Mining' task of analysing over 600 proposals in five dimensions in order to identify synergies that would help the Commission and the IST programme Committee (IST-C) integrate and manage the programme. The approach used was multicriteria analysis, in which two-dimensional data-sets were extracted from the overall database and analysed one at a time.

In order to examine as many data sets as possible during this 'consolidation-stage' the team divided into four working groups, which agreed a more refined set of classifications for technology and markets. In parallel with this reclassification exercise, the working groups began to identify clusters of proposals within the 5 dimensional data space. These clusters were then examined in more detail, referring to the proposal résumés, to identify potential links and synergies that were unlikely to have been picked up by individual evaluation panels and might form the basis for programme integration.

A presentation of the interim findings of the PIM study was made to IST Directors on Wednesday 28 July. Discussions with the Directors following the presentation yielded useful (and generally very positive) feedback on the direction the study had been taking.

The final stages of the PIM study were centred on

- Drawing out patterns and synergies amongst the proposals via further multi-criteria analysis of the database
- Establishing recommendations agreed by the entire PIM team, based on these results
- Assembling this report.

2 Strategic analysis of the proposals

2.1 Introduction

By its reading of full proposals, the team developed a broad overview of the emerging content of the IST Programme. This section summarises findings made at a strategic level, about the scope of proposals and coverage of the IST Workprogramme. The general results of a statistical analysis of the proposals are presented, followed by an analysis of Strengths, Weaknesses Opportunities and Threats (S.W.O.T), comments on the risk profile of the Programme, the organisations participating and key issues for the Programme.

2.2 Statistical Analysis of ranked proposals

The PIM team analysed 641 proposals which had been ranked by the IST evaluation panels. Figure 1 shows the breakdown by evaluation panel.

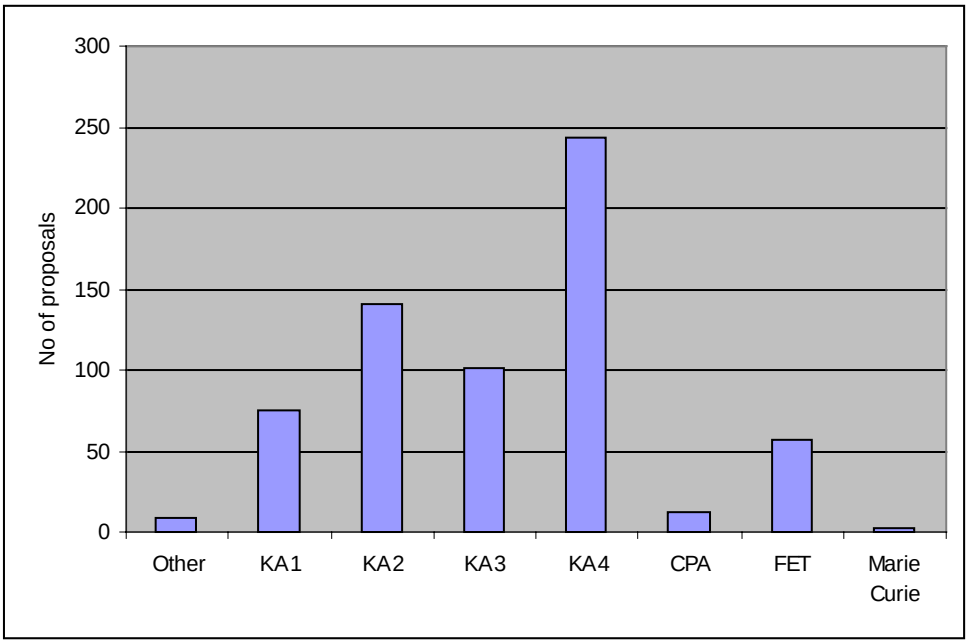

Figure 1: Distribution of proposals by Key Action

This information is purely factual and contains no value judgements by the PIM team.

In analysing the proposals, the PIM team identified 25 technology categories and 17 market categories, against which they classified the proposals. This classification was developed independently of the workprogramme structure, based on the reading of proposals. Figure 2 shows the breakdown of the proposals by technology categories.

There are significant numbers of proposals in the areas of knowledge engineering, software engineering, service platforms,-facilities and human interfacing including virtual reality.

	Technology Categories
1	Value/Support/Accompanying measures (Non Techn)
2	Technology of (or for achieving) optimisation
3	Software engineering (simulation, DP, integration)
4	Interoperability technology
5	Knowledge engineering and management
6	Security
7	Agent/Middleware
8	Technology for generic applications
9	Service platforms and facilities technology
10	Human interfacing inc. virtual reality
18	UMTS Software Radio
19	GPS GSM Terminals
20	Wireless access OPN/wireless LAN
21	Optical networks, physical access networks
22	IP Plus Management node
23	Strategic Initiatives / clustering
24	Advanced optoelectronic-design-co-ordination action
25	Advanced microelec-design-co-ordination action
26	Semiconductor processes-equipment-material
27	Microsystems
28	Microwave devices and antennas
29	Quantum research
30	Basic research
31	Display and components

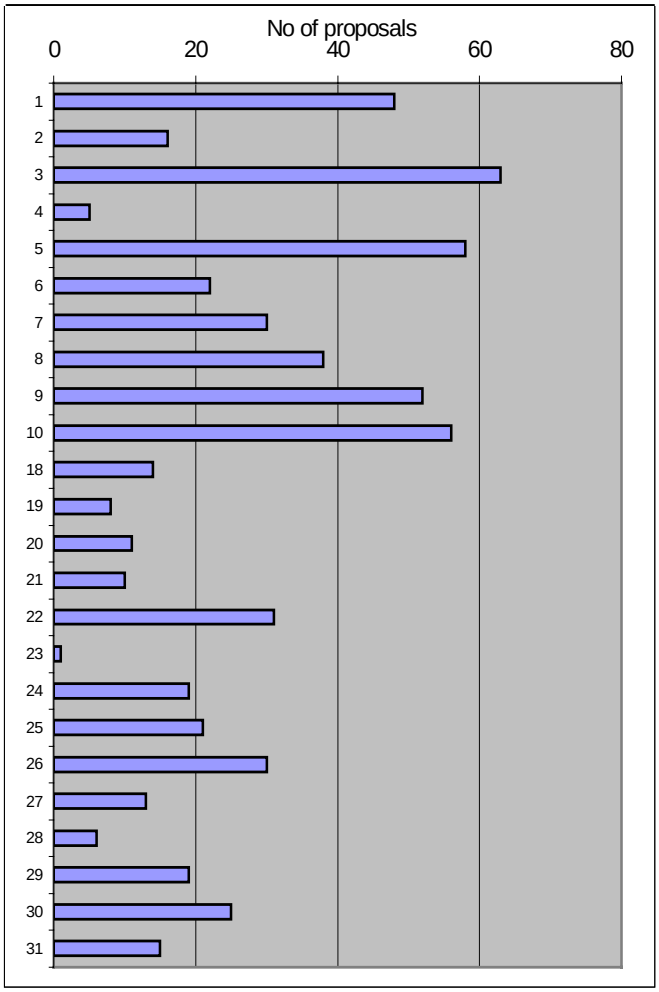

Figure 2: Distribution of Proposals by technology category

	Market Categories
1	Administration/Non-profit/Public Sector/EU-support
2	Software Market
3	Financial Banking
4	Manufacturing Processes (inc. Construction)
5	Retail/ Consumer Processes(inc. Tourism)
6	Services market
7	Healthcare (inc. Disable)
8	Media (inc. Advertising)
9	Education and awareness
10	Electronic Industry
11	Network and service operators
12	Telecom manufactures
13	Emergency Services
14	Autoindustry, manufacture and users
15	Non telecom service provider
16	Transport service provider
17	Longer term support project

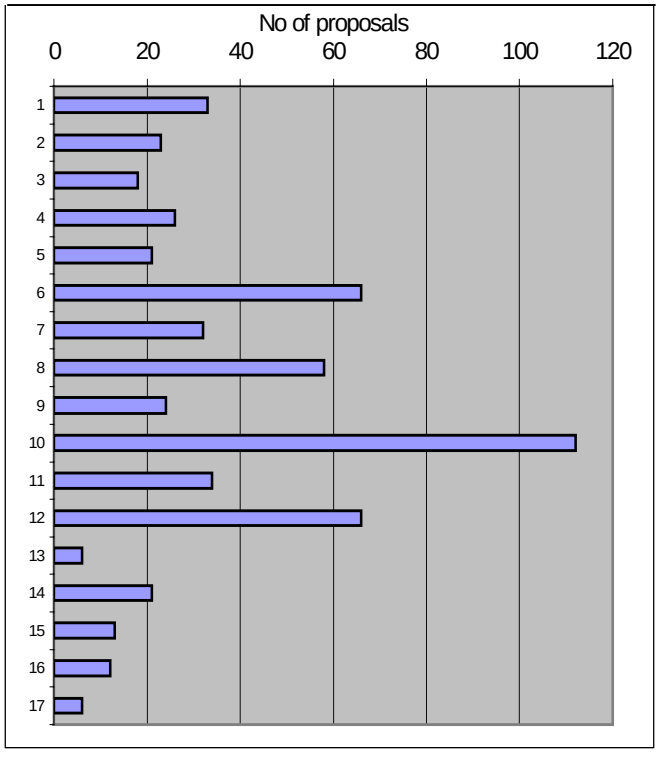

Figure 3: Distribution of Proposals by market category

Figure 3 shows a similar breakdown of the proposals by market categories.

As might be expected, the proposals are mostly targeted at electronics, services and telecommunications industries.

The study classifies proposals according to whether users are involved in the consortium. In some cases, one of the technology providers in the consortium was identified as the principal user. Unless a genuine end-user could also be identified, the PIM team generally classified such proposals as not having user involvement. There were also cases where it was not clear whether users were involved. Figure 4 presents a pie chart of user involvement in the ranked proposals.

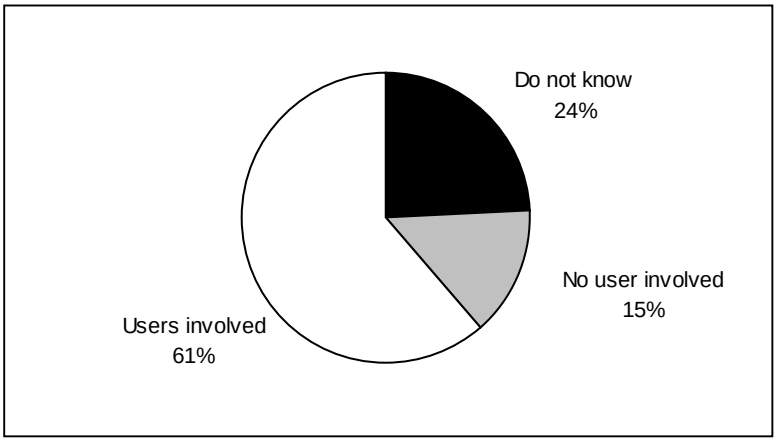

Figure 4: Pie chart showing user involvement in proposals

It would seem that a significant number of proposals involve no end-users and this raises some concern about effective exploitation of the results. However, almost half of the proposals with no user involvement were in the area of long term research.

Figure 5 shows how the proposals were distributed across the focus categories used in the PIM analysis. 55% of proposals were focused on developing infrastructure for the Information Society (networks, services and content creation). 24% were focused on developing solutions to support business activities and 12% were focussed on supporting the individual. A relatively small number of proposals supported new forms of governance within the Information Society.

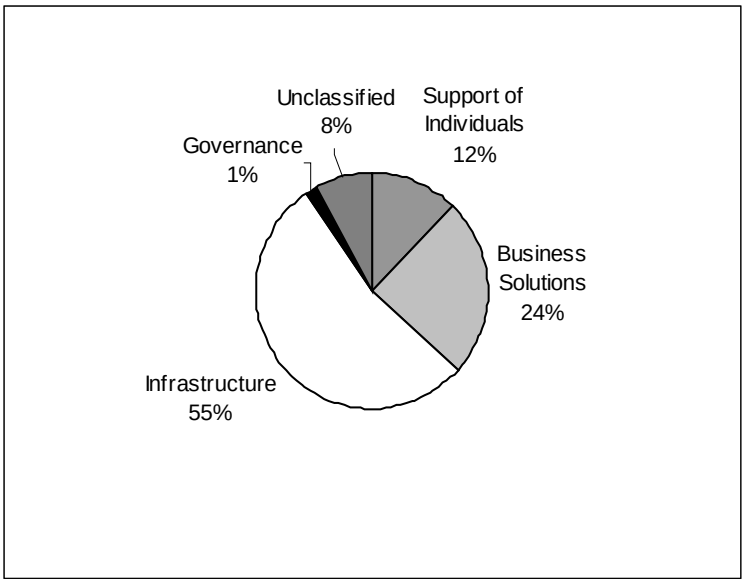

Figure 5: Proposals distributed by focus category

The PIM database (see Annex 3) is effectively a five dimensional data space and can be used to generate a rich variety of statistical information about the programme. Two dimensional projections of the data space can produce interesting perspectives on the programme.

Figure 6 presents the number of proposals addressing particular combinations of technology and market categories. (These categories are explained in Figures 2 & 3). This projection is particularly useful because it identifies 'hot-spots' within the programme where a large number of proposals are addressing a particular market with the same technology. In addition the columns of the table highlight the markets being targeted by a particular technology and the rows highlight the technologies addressing a particular market. markets targeted by particular technologies.

The table shows, for example, that there are a significant number of proposals addressing the electronics industry (mainly about semi-conductors and basic research) and a significant number of proposals addressing knowledge engineering for services.

Techno-logy Market	n/c	1	2	3	4	5	6	7	8	9	10	18	19	20	21	22	23	24	25	26	27	28	29	30	31	Σ
n/c	15	5		14	1		4	1	8	8	6	1	1	1		2				1			1		1	70
1		21		2		3		1	1	3	2															33
2	1		1	7		5	1	5		1	2															23
3	2	1		2		3	4	3	1		2															18
4	1		3	3	1	5			3	3	4				1			1							1	26
5		2				1	1	5	3	1	6				1							1				21
6		4		10	1	19	3	6	5	7	10					1										66
7	5	1	1	4		3	1		3	7	2					1			1		1	1			1	32
8	4	2	1	8	1	2	7	1	2	10	9	2	2	1	1	3									2	58
9		3		2		10			2	1	2					1		1			2					24
10	1	2		2		2			1	1								7	16	27	8		13	23	9	112
11		2						2	1	4	2	4	1	2	3	11		1						1		34
12		1	2	2		3	1	1			4	7	2	6	4	11		6	2	2	2	4	5	1		66
13									1	2			2			1										6
14			2	5				4	2	1	1			1				3	1						1	21
15			2	1	1	1		1	4	2	1															13
16	1	2	4	1		1			1	1									1							12
17		2									3						1									6
Σ	30	48	16	63	5	58	22	30	38	52	56	14	8	11	10	31	1	19	21	30	13	6	19	25	15	641

Figure 6: Mapping between markets and technologies (see figures 2&3 for lists of categories)

2.3 Analysis of Strengths-Weaknesses-Opportunities-Threats (SWOT)

2.3.1 Strengths

Broad scope of applications work

The broad scope of the range of application domains for which innovative applications are being developed is a major strength of the Programme. The IST Programme is one of the world's leading Programme of RTD in respect to the scope of the applications being developed and the broad spectrum of actors participating in the work.

IST forms a European focus point

The IST Programme forms a focus for European level initiatives in ICT, which are comparable in scale to those of other continents and are needed to assure the competitive position of Europe in global markets.

Multi-disciplinary collaboration is enabled
The broad scope of technical work represents the key areas of RTD needed in Europe and ensures that collaboration between relevant organisations in Europe is encouraged and that organisations of different types (research institutes, large and small companies, user organisations) have a framework for joint work.

IST will scale up results towards marketable products
The Programme, as a whole, will make a valuable contribution to scaling up the results of research and development leading to both improvements in society and to marketable products.

IST is building a New Generation of Internet based applications
The Programme is encouraging and enabling all application sectors to develop a new generation of applications which make use of new technologies (in particular Internet technologies). The Programme will thus make a major contribution to assuring the take-up of Internet technology across all sectors of European society and thus to international competitiveness.

IST results will be marketable within 5 years
The majority of proposals appear to be developing results, which will be marketable within approximately 5 years.

Proposals are well defined and innovative
Proposals have clearly justified, achievable objectives.
A high level of innovation and creativity is evident in the proposals.

Motivation to achieve is high
The motivation of the proposers to make technological advances is evident when reading the proposals. Technological progress will be made visible internationally. Many contributions to all the major International Standard Bodies will be made using the results of the projects. Many technical and scientific publications will result from the proposed projects and this will contribute to strengthening the global competitive position of Europe as a location for research and development.

IST encourages innovation
High interest in cross-disciplinary collaboration by sector actors is evident and this will enable and encourage innovation in Europe.

2.3.2 Weaknesses

Coverage is broad, but too thin in places
Workprogramme coverage is broad, but may be too thin in some of the enabling technology areas, for research conducted within the Programme to have a significant impact.

The medium term technology gap
The majority of proposals address highly dynamic markets and technologies and a typical time-frame for market relevance of their results would be 3 to 5 years. The results of such projects must be continuously fed into user organisations during the project life-time, as they can quickly lose relevance as technologies and markets advance. Most FET proposals have longer term relevance (the 10 to 20 year timeframe). Research which will produce results applicable in the 5 to 10 year timeframe is only present in a few areas of the Programme. There is a gap in the Programme with respect to RTD addressing the development of a new generation of systems aimed at market introduction in the 5 to 10 year timeframe.

Dependency on rapidly evolving and difficult to predict technology and user requirements
Many proposals re-engineering business processes depend on technology will evolve rapidly during their lifetimes. In addition many application proposals address user requirements and markets which may change substantially during the lifetime of the projects.

2.3.3 Opportunities

Building critical mass through the development of shared vision
The development of a clear direction for research in closely related technological areas of the programme would improve the depth of the work and add a more focussed vision to the Programme. Initiatives aimed at encouraging clusters of projects to develop shared goals will help to develop the critical mass needed to have significant impact on markets, standards and technologies. Examples of areas where such initiatives would be valuable include:

- Helping applications and service platform projects to work towards functional commonality and open interfaces to their systems.
- Helping communications projects to develop a coherent strategy for downstreaming their results into markets and standards.

Building critical mass by linking user oriented projects with technology oriented projects
The broad scope of applications projects could be combined with the broad scope of technology projects to reduce risks for both groups. Such links will improve synchronisation between technology results and evolving user needs. These links will give each group of projects access to specialist knowledge of the other and enable the development of critical mass in markets, standards and technological progress and ultimately in the quality of life of citizens. Strong user participation is a prerequisite.

Building applications on Internet technology is often a high risk, high reward venture
All application sectors represented in the Programme are addressing the integration of Internet into their business processes and many are addressing the use of Internet to enhance their business operations. Many of these proposals show low awareness of, for example, the potential of current and forthcoming wireless technologies to further enhance their business processes. The opportunity to create awareness within applications projects of the potential benefits of wireless technologies would build on Europe's strength in wireless technologies, and in addition give all applications projects access to this European competitive advantage.

Taking a multi-disciplinary approach to living and working environments
The multi-disciplinary participation in the Programme creates the opportunity to create a multi-disciplinary approach to specific environments, such as "The Home" and "The Organisation" and "The Mobile" environments and to create critical mass in technology, markets and standards addressing them.

Help accelerate legislation to develop European scale markets
Successful exploitation of research results in some areas requires European legislation to create a single European market for their applications. In badly fragmented markets, any products developed will lack the scale of market sales needed to secure the survival and growth of the organisations developing them. In addition, many new products will only become economically viable when multinational market in Europe can be addressed by a single product. The transport and electronic commerce sectors are examples of sectors, which would benefit from European legislation, implemented within the lifetime of the projects. The results of some of the IST Programme projects will provide input to the definition of European legislation.

2.3.4 Threats

Potential lack of synchronisation
The potential lack of synchronisation between the evolution of market requirements and technology could endanger the results of related projects, if not addressed.

Potential lack of critical mass
The lack of critical mass will endanger the overall impact of the IST results on the European economy, if not addressed.

Potential lack of shared direction
The lack of a clear shared direction for projects working in the same research area will have the effect of diluting the results of the Programme, if not addressed.

2.4 Participation

Participation in the Programme is broadly based with all types of organisations being well represented. Universities and public and private research organisations predominate in the FET proposals, major industrial and commercial organisations are well represented in Key Action 4. The level of representation of SME's in the Programme proved difficult to quantify but seemed low rather than high. However, consulting companies seemed to be represented in Key Actions I,II and III but the statistical information required to verify this was not available at the time of the study. Statistical analysis of the database showed that only a minority of proposals address the needs of the citizen directly. Many proposals, however, address the citizen indirectly (for example, through the development of new transport safety technology or new environmental monitoring technology).

The analysis also shows that the majority of proposals have a potential user of their results directly involved as a project partner. . However, such users are often organisations, which are themselves developing technology within the project. It was not clear that this would be sufficient to ensure that the proposal addresses real end-user needs, as the chain of links from the identified user of project results to the final customer is too long.

The solution to this potential problem is complex and there is no single recommendation, which can be made for all proposals. Adding more user organisations to the consortium may only add to the communication overhead, and detract from the resources available for technical development. A better alternative in some cases, is to establish links from the project to organisations representing groups of users.

2.5 Risk profile

2.5.1 Types of risks faced by the programme and the projects

Potential risks faced by the projects can be divided into two broad categories:

- Programme level risks - those risks which are outside the control of the project and require Programme level support to counteract them and those risks which are external to the Programme.
- Project level risks - those risks which are inherent to the project and can be counteracted by project activities, and

2.5.1.1 Programme level risks

Programme Level Risks	Countermeasure
Technology rapidly evolving or changing completely	Better access to real-time information Better collaboration between projects
Market and user requirements rapidly evolving or changing radically	Better access to end user focus groups Clear identification of the target market segment
Regulations or standards imposed during the life of the projects	Access to close to real-time information on the development and proposed evolution of standards and regulations and proactive participation of projects in developing standards is needed
Lack of critical mass and momentum	Define clusters and cross-programme actions to achieve critical mass for a range of key areas
Industrial re-organisation and re-structuring within sectors	The impact of large scale industrial restructuring should be assessed at a political level and reflected in the Workprogramme
Lack of supporting actions for technology test-beds, information provision or other aspects of the projects work, such as special flexible support to help promising SME's develop rapidly	The IST Programme should establish appropriate support actions in conjunction with National and international organisations as foreseen to some extent in the Work Programme

2.5.1.2 Project level risks

The PIM team compiled a list of generic risks facing RTD projects, which are not necessarily evident from reading the proposals themselves. While some of these risks may be apparent before a project starts, they more often develop during the life-time of the project and need to be addressed jointly by the project participants and the Commission staff. Such risks also need to be taken into account in the formulation and management of project Clusters.

- User requirements may be unclear as users can often only define needs in relation to the next version of a known product but can't state their requirements for completely new products until they are confronted by the new product,
- The availability of independent users to test and evaluate the projects plans and initial results may be inadequate as the project may be addressing a market which is in an embryonic state.
- The project may not have adequately investigated the Intellectual Property Rights situation for the Intellectual Property that it plans to use. This issue needs investigation in many of the projects addressing the development of tools.
- Projects may underestimate the need to produce a rapid prototype within 6 to 9 months of the project start which is to be shown to potential customers so that their reactions can be included in a larger scale prototype to be developed within a two or three year timeframe. Doing so improves the acceptability of the final product in the market. Given the pace of development of technology, a new version of a prototype needs to be demonstrated to customers every 6 to 9 months during the lifetime of the project. At the end of a two or three-year project, the prototype should be ready for industrialisation and market launch as a product.
- Projects may underestimate the "slow-down" effect of having a very large consortium of partners. The problems associated with achieving agreement on changes of direction in a project with many partners lead to inflexibility in making changes to the plan as there are so many dependencies to consider. Perceived changes in user needs, markets or technologies clear to some, but not all of the project partners, may not be taken into account in the project plan until it is too late to correct the project direction and the project result may have greatly reduced impact as a result.
- Projects may underestimate the wide range of skills needed by the project manager of a large international project consisting of a consortium of multi-disciplinary organisations. A large consortium or project generally requires a team of two or three people to manage the operational, administrative and technical aspects of the project.
- Projects may have chosen very broad objectives, and underestimated the difficulty of achieving them in the light of present technological capabilities or limitations.
- Projects may not given sufficient thought to the exploitation plan for their project results. The work of preparing the exploitation of the results needs to start with the first year of the project if it is to be effective. It usually takes several years to prepare the market for the product and if this is started only towards the end of the project, the product will be outdated before it has achieved significant presence in the market.
- Projects may underestimate the speed with which the market is developing and may have proposed a time-scale for product development, which is too long to have market relevance. By the time the product is developed, the market will have new requirements and the project may miss its window of opportunity. All projects need to ensure that they have good personal lines of communication with groups, which are closely following the market development, either internally within their company or through external consultants or associated companies.
- Projects may underestimate the regulatory and standards constraints inherent to particular markets and products particularly when the project addresses a market sector new to the participants.
- Projects may underestimate the benefits of collaboration with other projects in the programme. The benefits of increased access to the knowledge of other projects facing similar problems and issues outweigh the overhead of increased time devoted to communication. Links between projects need to be focussed and implemented by the most efficient means possible – an e-mail exchange in conjunction with occasional meetings held at events, at which both projects are represented in any case, is often very effective.
- While at project level the need to build consensus and awareness of social / societal impacts is important, at Cluster-level these are critical.

2.5.2 Moderate risk profile of the IST Programme

The risk profile of the programme can be characterised by placing proposals into two main categories:

High exploitation risk, high potential reward projects
These proposals address applications, which depend on technology, markets and user needs which will change quite radically during the life of the projects. Most of the exploitation risks relate to the use of rapidly evolving and unpredictable Internet technology and business models and processes. These proposals have medium to high-risk levels. They may not achieve their expected results if no support actions are undertaken to reduce the risks. The high level of risk is counterbalanced by the high potential reward. Many of these higher risk, high reward proposals are in Key Actions 1,2, and 3.

Projects dealing with more predictable technologies and markets
These proposals are developing systems and technology in areas where the advance of technology is more predictable and the rate of development in the functionality of systems is moderated by international standards. These proposals have a lower risk level but also have a lower potential impact. Many of these lower risk, lower potential proposals are in Key Action 4 and FET.

In all areas, the need for developing critical mass is evident and there is a risk that the results of the Programme will not significantly affect the European economy. Even if critical mass is achieved, the resulting impact on the European economy will not be evident for several years after the results of the project become available and then build up penetration in the market.

A balanced risk
The overall risk level resulting from a combination of these two project types within the Programme is balanced but a clearer focus on a smaller number of technologies and markets could greatly improve its overall impact.

3 Synergies between the ranked proposals

3.1 Programme integration model

The objective of the PIM study was to help identify ways of integrating the IST programme, in the light of the results of the first call. For this reason the team concentrated on looking for cross programme synergies rather than synergies within single Action Lines.

The stated aim of the IST programme is to help create a user friendly Information Society. This is reflected in the IST workprogramme which presents the Key Actions as overlapping activities on a spectrum that runs from technology to demonstration.

.

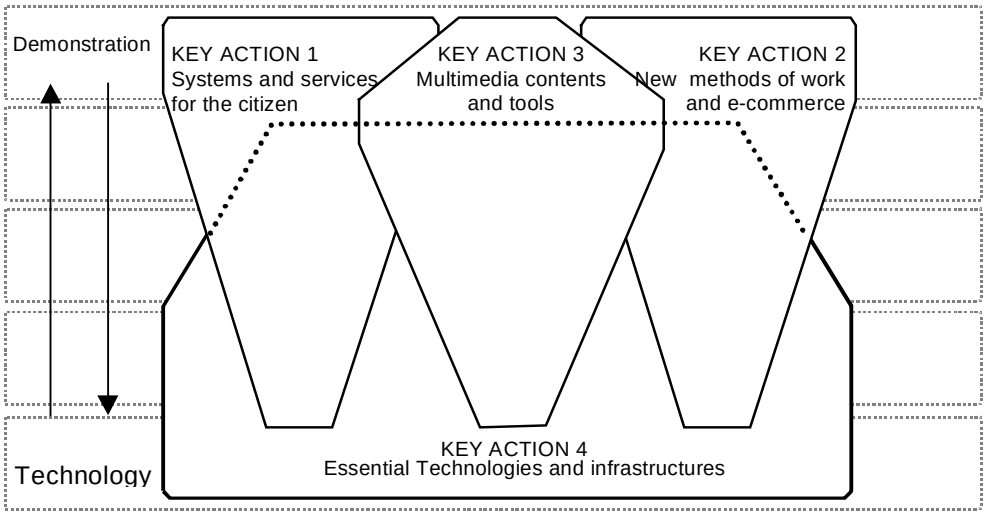

Figure 7: Integrated Key Actions (IST Workprogramme 1999)

As the PIM study progressed, it became increasingly obvious that the IST programme could be regarded as an 'engine' for integrating the technologies of computing, communications and broadcasting into solutions that meet the needs of individuals, businesses and governments within the information society. Several distinct stages could be identified between technology and solutions, namely components, platforms, and applications. Two other important elements of the IST engine are user requirements and interoperability.

Figure 8 below shows how the IST engine functions, advancing the "state of the art" through an iterative cycle, and at the same time bringing benefits to society.

This way of looking at the programme, independently of the key actions, makes it possible to position the various 'market battlegrounds' where the programme should provide extra support to improve the competitiveness of European industry.

It also emphasises the need for

- a steady flow of new technology to fuel the engine
- increasing involvement of users in the development of platforms, applications and solutions
- the importance of standards to ensure seamless interworking
- ensuring that the supporting technologies (of KAIV and FET) respond to the pull from user requirements (of KAI, KAII and KAIII).

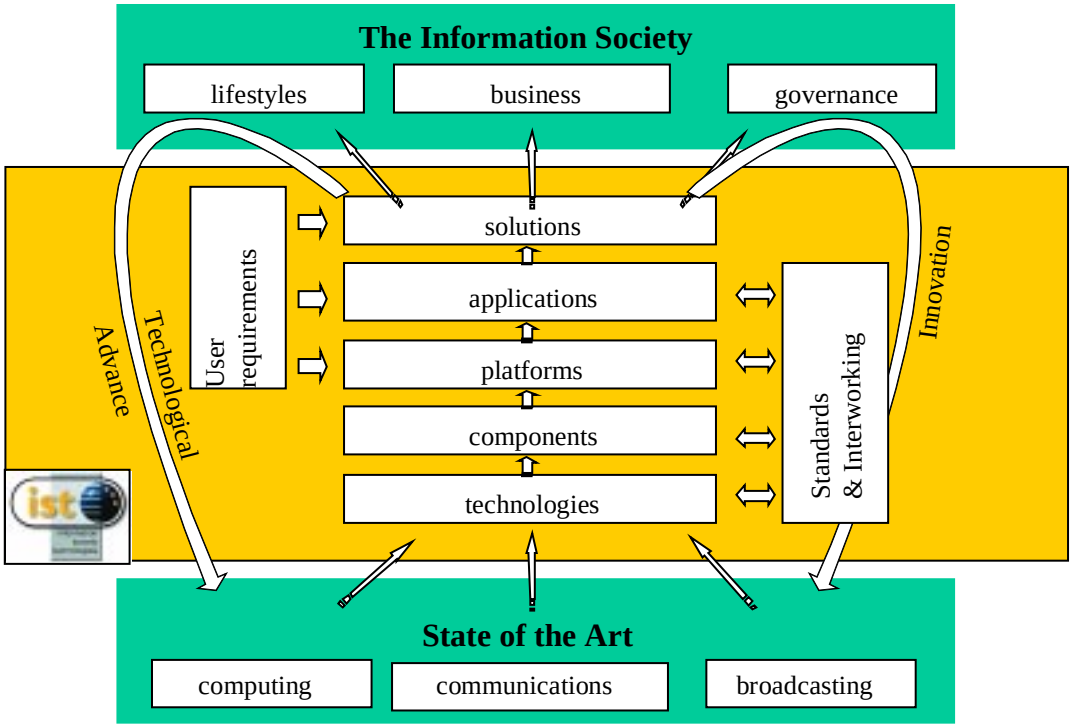

Figure8: The IST Engine

3.2 Links and clusters

Since the evaluation panels had been encouraged to identify links at Action Line level amongst the proposals, the PIM Study did not attempt to repeat this work. Instead it specified and identified links amongst the proposals both at the Key Action level and across the Programme. These links are either:

- links which the team can actually identify, comment on and/or draw conclusions from,
- links which can be identified via the multi-criteria analysis as an indicative link.

In the latter case, the team did not have the resources to pursue the link and instead are highlighting it for further research by European Commission staff. The majority of links identified in this study fall into the categories 2 & 3. in the table below.

Category of Link	Example	Explanation
1. Proximity Link (Evaluation Panel)	proposals with technical synergy	Intra (Evaluation) Panel. Not considered further by PIM
2. Proximity Link (PIM) : Scope for joint activities to be explored	Proposals within Key Action or across Key Actions with synergies identified through the Technology / Market / Focus classifications.	Inter Panel, Intra Key Action and Inter-Key Action (Cross Programme Links)
3. Proximity Link (PIM) Mutual awareness of consortia to be encouraged	As for Category 2, but synergies from info-sharing and mutual awareness only	Inter Panel, Intra Key Action and Inter-Key Action (Cross Programme Links)
4. Dependency Link (PIM)	Proposal could provide results to, or could use output from - other proposals	Intra Key Action and Inter-Key Action (Cross Programme Links)
5. External Dependency Link (PIM)	Conformance to Standards by (multiple) proposals	Links involving external bodies and / or RTD outside of IST
6. Added Value Link (PIM)	where a marketing or financial value can be derived via the link	Intra Key Action and Inter-Key Action (Cross Programme Links)
7. Strategic Link	Links that are vertical through IST, EC policy or beyond IST	Any combination of the above

3.3 Identified links

For the Purposes of the PIM Study, it was assumed that the evaluation panels had identified "proximity links" amongst the proposals allocated to a single panel. Attention was therefore concentrated on the identification of links spanning more than one panel, or in effect, more than one Action Line and / or more than one Key Action. The technology categories developed during the preliminary stages of the PIM study proved to be very effective for this.

The PIM team split into 4 working groups in order to identify as many potential links as possible in the time available. These were:

- Micro / Photonic Technologies
- Telecommunications and Transport
- Applications
- Enabling Technologies
-

Detailed findings of the Working Groups' analyses and the links identified are presented in Annexes 4, 5 and 6. An overview of the main themes (of links) emerging from the groups is as follows:

Proximity Links (Scope for joint activities)

Quantum Research	↔	Advanced opto-electronic
Microsystems	↔	Microwave devices and antenna
Software Radio	↔	GSM / GPRS
IP/Quality of Service	↔	Network Service and Service Management
Network Service Management	↔	UMTS
Service Platforms	↔	Agent/Interface
Others - from further study		

Proximity Links (Mutual Awareness and Information Sharing)

Advanced Optoelectronics	↔	Displays and Components
UMTS	↔	Auto Industry Manufacturers
IP / Quality of Service	↔	Service Platforms
IP / Quality of Service	↔	Human Interface and Virtual Reality
Service Platforms	↔	Agent/Interface
Others - from further study	↔	

Dependency Links (Potential for exchange of requirements and results):

from	Microelectronics	*to*	Telecommunication / Internet
from	Microelectronics	*to*	Telecommunications-UMTS & Wireless
from	Advanced Optoelectronics	*to*	Telecommunications – Optical Networks
from	Quantum Electronics	*to*	Security
from	Advanced Optroelectronic	*to*	Home networks
from	Security	*to*	to E-Commerce
	Others - from further study.		

External Dependency (Contributions to standardisation):

from	UMTS and Software radio, Satellite and DVB	*to*	Standardisation bodies (ETSI, ITU etc)
from	IP, networking nodes, content servers, NMS and components	*to*	Standardisation bodies (Eg IETF, MPEG)
	Others - from further study.		

Added Value Links

from	Agents	*to*	Networking nodes
from	Human Interface	*to*	Agent / Middleware
from	Agent / Middleware	*to*	Service Platforms
from	Service Platforms	*to*	Network Management
	Others - from further study.		

Strategic Links

from	IP / Quality of Service	*to*	UMTS
from	Software radio	*to*	GSM / GPRS
from	Networks	*to*	Service Platforms
	Others - from further study.		

Analysis based on market classifications proved to be extremely useful in identifying technology and RTD links of a less-obvious nature.

Cases of market synergies have been found where technologies developed for commercial exploitation in one market can be re-applied to another – often in conjunction with other very dissimilar technologies. Technologies which could provide tools for marketing/brokering/logistic support in one business sector, could also be used in another business sector. This implies that business-related proposals Eg. originating primarily from KAII can have synergy with other proposals in KAI, III and IV,

Full details of the market analysis can be found in Annexes 5- 6.

3.4 Working group findings

Micro / photonic technologies
Annex 4 contains a complete list of Micro / Photonic Technologies proposals examined in detail by the PIM working group A. Readers wanting a deeper understanding of how proposals within these technology categories interact are invited to look at this annex. The general findings of the Group are that the IST Programme should:

- Identify in each area the more promising and relevant technologies as well as the functionalities that could be encouraged further through clusters
- provide, through its Calls, the possibility of focusing on a few chosen technologies in order to reach critical mass of effort to meet market demand.
- develop and implement a process to spot breakthrough technologies and encourage the rapid development of these
- encourage the proactive exploitation of proposal results

As a general comment, the group felt that there is a need for proposals to strengthen the linkage between application and network oriented proposals on the one hand, and component oriented proposals on the other. Application oriented projects should work with the technology projects to define their exact technological needs in terms of :

- technical specification and functionality
- time scale at which it should be met
- maximum cost
- quantity.

Technology projects should work with the application projects in their assessment of technology prototypes and related performance appraisal.

Telecommunications and transport

Annex 5 covers in detail, the analysis of proposals in the Telecommunications and Transport sectors undertaken by working group B. Their general findings are that:

- Emphasis should be placed on strategies and contributions to the standardisation process in the telecom sector from the proposals.
- Emphasis should be placed on the implementation of the identified strategic links (integration of IP with wireless and fixed access networks) with the provision of additional funding for R&D.
- More emphasis should be given to long term telecom related R&D.
- Emphasis should be given to the development of technologies, products and services for the home environment.
- Cross fertilisation between IT&Telecom proposals and transport proposals should have special attention.

Enabling technologies and applications

Annex 6 covers the analysis of the more broadly based working groups (C & D) covering Enabling Technologies and Applications. Readers wanting a deeper understanding of how proposals within these various categories interact are recommended to look at this annex. The general findings of the Group are that:

- Special emphasis should be placed on proposals addressing the home environment
- SME participation should continue to be encouraged across all application areas in future Calls.
- Links from groups of related IST proposals should be established to commercial organisations, for example, for example, to organisations with an overview of user requirements in their sector.
- Critical mass and assess to users require links to be established. These links will be multi-cultural and multi-business in nature and their establishment will require further analysis so that critical mass can be created in key European business technologies.

4 Key issues and recommendations for the IST programme

Europe faces many challenges as it enters the 21st Century. The IST Programme will address many of these challenges and this report makes recommendations on how to optimise the impact of the Programme on European life, society and the European economy.

The key challenge is that of Globalisation of markets, economies and of society in general. The global deployment of communications technology in developed and developing countries and the rapid evolution and deployment of processing power has led to decreasing product life-cycles, shortened time-to-market and increased economies of scale, scope and integration in all aspects of economics and societal life. The ability of large organisations to survive depends on their ability to succeed as global marketplace leaders, and has an ever decreasing dependency on their success in individual national and regional marketplaces.

Society as a whole is being increasingly influenced by globalisation. Information on political developments is available world-wide in real-time. Cultures are being submerged in the globalisation of broadcast networks and disadvantaged groups are at risk of being left out of the global advances in quality of life. European citizens, society and organisations need to adapt or risk extinction. All segments of society must undertake major adaptations in order to maintain the quality of life in Europe and to ensure that Europe improves its ability to make a contribution to improving the quality of life of all the world's citizens. The IST Programme has a valuable role to play in ensuring the successful adaptation of Europe to the forces of globalisation.

4.1 Key Issue 1: Critical mass and synchronisation for impact

Critical mass is needed for global impact of results

Critical mass must be developed within the activities of the Programme in order that the results form projects have a significant impact on:

5 Global markets,
- International standards and
- Technological progress
- Society's needs.

Links between different areas of research are needed to create this critical mass. Projects working together can:

- Align their standards contributions,
- Share use of test facilities,
- Avoid unnecessary duplication of work,
- Exchange experiences of system development,
- Organise joint demonstrations and presentations at trade fairs and conferences,
- Establish joint focus groups for their market segments, and
- Establish virtual centres of excellence for their technologies.

Synchronisation of market needs with technology development becomes more difficult

Projects face particular difficulties in achieving synchronisation when both market requirements and technologies are evolving at increasing speed.

- Market requirements are driven by social needs, together with convergence of markets, industry re-structuring and the re-regulation of markets. Electronic Commerce is leading to business process re-engineering and having a profound effect on the requirements that users place on applications.
- Technology is acting as a driving force for change. Processing power and storage capacity continues to double every few years and the use of the Internet and mobile phones is growing exponentially. Improvements in battery technology and the introduction of sensor technology will drive the evolution of applications during the coming five years.

While evolution is predictable in some areas, projects dealing with the less predictable technologies and user needs are addressing the most rapidly growing markets and have the greatest potential impact.

The Internet is an example of a technology that is difficult to predict as are the user requirements for applications based on it. High risk is related to potentially high rewards and players that can survive in this difficult environment have the potential to become world leading companies..

Links between proposals would enable mutual awareness of key market and technology issues, leading to better synchronisation of technology development with market requirements and the development of critical mass in the use of programme results.

4.1.1 Recommendation 1: Focus on developing critical mass in key areas

The IST programme should build on Europe's strengths in wireless technology, consumer electronics and applications systems development to develop the critical mass needed for the successful market exploitation of programme results. The rich cultural heritage of Europe is a strength, which can be developed to encourage a local context for systems addressing a global market.

The key sectors for focus activities should be:

- **The 21st century home**
  The support of people spending a lot of time in the home should be highlighted as a special theme, as this group includes many people working from home, the young, the elderly, the retired and the unemployed. SME's operating from home form a substantial part of the European economy and addressing their specific needs will help to lift the economy of local areas as well as that of Europe as a whole. Future calls for proposals should consider specifically addressing the home environment.
- **Internet Services over mobile networks**
  The parallel, exponential growth of the Internet and mobile telephony markets has created an opportunity for Europe to lead in the provision of Internet services over mobile networks. Such a platform will ensure that the applications of Key Actions 1,2 and 3 will be able to run transparently over mobile connections. This topic is not well covered in the currently planned work and should be addressed in future calls for proposals.
- **Shared platforms for business service support**
  The opportunity created by the development of a new generation of platforms is to develop commonality of functionality between platforms for different functions. This will enable inter-working and the development of critical mass in the growing market for service and application platforms. The development of open, large-scale platforms with components developed by different companies would give all players the opportunity of participating, and to prove inter-working in the global marketplace. Otherwise, the many platforms developed would be unlikely to develop the market share to ensure their growth and survival in the marketplace. In addition, guidelines for the rapid development of low cost applications that can sit above the service platforms need to be developed and disseminated throughout Europe. Many small application products could be developed by SME's. This would support the growth of SMEs and ensure that the platforms are populated with a wide variety of applications, many of them developed for local or regional European needs.

The focus activities should include clustering, inter- and intra-programme links, support actions and inviting specific initiatives in future calls for proposals.

The database developed in the PIM study should be maintained and exploited to aid in implementing the clusters and links. In particular, the Commission should up date it once the schedule of first call proposals has been finalised and before contract negotiation begins. Negotiators should explore the links identified in the PIM study and use the database to identify further links that could form the basis of intra-programme synergies. An integrated programme will only emerge from the first IST calls if the Commission actively seeks out and promotes these synergies.

4.2 Key Issue 2: Technology serving society and the citizen

The successful deployment of new technology requires it to deliver real improvements in the quality of life of citizens and society. The EU's citizens need to be made aware of the opportunities offered by the IST Programme and of the positive benefits of the programme's results on their lives. Europe must maintain a positive attitude towards new technology in order to take advantages of its benefits at all levels of society.

4.2.1 Recommendation 2a - Ensure widespread awareness at the local level

Ensure the widespread awareness in Europe at all levels of the activities of the IST Programme in order to maximise the number of citizens and local organisations participating in and benefiting from the activities of the Programme.

4.2.2 Recommendation 2b - Develop appropriate inter-programme links the 5th framework programme

Many IST proposals address this issue and links between IST projects and projects sponsored under the other three themes of the First Activity of the Fifth Framework Programme

- Quality of life and management of living resources,
- Competitive and sustainable growth
- Energy, environment and sustainable development

would ensure the maximum impact of IST project results.

4.3 Key Issue 3: - Proactive support to ensure growth

Many IST projects will show promise during their first year. These "high potential" projects need proactive support on the part of the European Commission to help them grow.

4.3.1 Recommendation 3: - Provide extra support for high potential projects

In order to improve the chances that a project, or group of projects, will have large-scale impact, particular attention should be paid to identifying projects with high potential at the end of their first year and to provide extra support to this selected group of projects. The assessment of high potential could be in terms of likely market or technical breakthroughs. Such an approach has been implemented in many industry sectors in recent years and has proven its value as a method of encouraging the development of 'innovation cells' and spin-off companies,.

4.4 Key Issue 4: - Manage the anticipated risks

The potential risks to the success of individual projects and the IST Programme have been described in section 2. Many of the risks cannot be avoided and when problems surface, the tools to deal with them effectively should be prepared and available.

4.4.1 Recommendation 4: - Actively manage the risks at programme and project level

The risks can be actively managed through:

- Ensuring that the projects can flexibly change direction as needed to adapt to changing external factors,
- Providing a support infrastructure to help projects resolve problems caused by changing external factors,
- Ensuring the projects have access to appropriate information and test support infrastructures
- Ensure the projects have access to support for the commercial exploitation of results

4.5 Key Issue 5: - The 2005 to 2010 Timeframe

The strategic analysis presented in section 2 identified that few of the proposals address RTD that is expected to mature in the 5 to 10 year timeframe. The IST programme should aim to achieve a better balance between short and medium term RTD in order to maintain technical leadership in Europe.

4.5.1 Recommendation 5: Maintain the flow of technology

In order to assure the continued flow of technology in the medium term (5 to 10 years), future calls for proposals should place greater emphasis on RTD leading to marketable results in this timeframe.