Case study

Comparison of Innovation Policy and Transfer of Technology from Public Institutions in Japan, France, Germany and the United Kingdom

Part 1 French and Japanese Case study

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1 Introduction

To read that the economical development of a country is based upon innovation, technology transfer, intellectual property, is one of the most common understatements you find in literature. It is well known that innovation is a central element of economic performance and actually every country playing a role in the global market economy tries to use its knowledge and special competences to position itself as a leader in the various new “high tech fields”. Each country tries to make value out of the results that have been obtained by its researchers, either in public or in private organizations. Using the knowledge and competences existing in public organizations is also *a litotes*, especially coming from countries which spend large funds in R&D activities. Why is it this expertise not well utilized?

According to our analysis this is connected with various factors. On the public side we can consider for example university professor’s long tradition of not patenting, of not doing applied research, and of not marketing the results of their research, and on the government side of not often allowing industry to use the results of research done with public funding. On the industrial side factors include companies’ reluctance to entrust public researchers to develop applied research, to pay the “right price” for the discovery and even if they “own” the rights of the patent they may not use it. Finally banks often have been reluctant to provide the necessary funding to support the innovation process, etc.

The situation in the last twenty years though has been changing, starting with the Bayh-Dole Act in the USA in 1980 which encouraged the utilization of inventions produced under federal funding, as well as the development of “business angels”, etc. In 1986 the Federal Technology Transfer Act opened the doors to research and development partnerships between federal laboratories and Industry and encouraged the sharing of knowledge and facilities between the partners. Technology transfer was then realized as the main route for the movement of public research results to private companies so that products can be developed and commercialized based on this new knowledge. Others nation followed and introduced changes in regulations and tried to change the behavior of public researchers, banks and companies. Nevertheless it has to be remembered that you cannot simply copy “best practice” and “success stories” and expect them to work! Each country has to find its own route to improve performance, learning from the experience of others, but being aware that the “model” has to be adjusted to suit the national culture, conditions and objectives.

In this paper we intend to make a comparison of the evolution in technology transfer policy in Japan and some European countries having an important role in the global market economy. We will not further consider the situation in the USA as many papers have been written on that subject.

2 Defining the Notion of Innovation and Technology Transfer

2.1 Joseph Schumpeter [quoted in 1] is often mentioned as the first economist having drawn attention to the importance of innovation and he defined five types of innovation ranging from introducing a new product to changes in industrial organization. The Oslo Manual [1] clarified the definition of the two more technical definitions but still it appears that “innovation” is not easy to define precisely.

In 1999 in his key note address Mills [2] gave some simple definitions: *Science*: how to understand things; *Technology*: how to do things; *Management*: how to get things done. He also defined: *Creation*: bringing into existence; *Invention*: devising something new or a new way to do things, *Innovation*: turning an idea into income!

David Archibald [3], who created UK IDEA in 2001 which specializes in "Supplying the Worlds-Best Innovation Technology", considers that innovation is a science and explains what innovation and creativity means by these simple formulas:

1. Creativity = Idea + Action

By this Archibald means that the 'idea' is just the beginning and to truly create something you have to take action starting from the idea. Accordingly you must do something to bring the idea into reality to create something new.

2. Innovation = Creativity + Productivity

In reality the sequence is: get an idea, test or prototype it, produce a finished item and bring it into use. In the case of artists this corresponds to: get inspiration, sketch it, put it down on canvas, and finally exhibit the work.

For many businesses the ultimate goal is for the idea to produce profit. In this case innovation must come from ideas that lead to sales.

3. Profitable Innovation = Innovation + Marketing

In general people, following Schumpter proposals, consider that innovation can result from technology transfer or through the development of new business concepts. It can be technological, organizational or presentational [4]. There is now a good understanding of the links between research and innovation, with the research laboratory being the starting point. This model is sometimes called the "linear model" of innovation [4]. Nowadays people have started to look at others forms of innovation that are less dependent on research and they speak of second, third generation of innovation policy or sometime of the network innovation model [5] but at any rate the direct link innovation-research must be kept. According to the definition given by The London Development Agency, innovation is the successful exploitation of new ideas and is a vital ingredient for competitiveness, productivity and social gain within businesses and organizations. It appears clear that innovation occurs when businesses introduce new products or services to the market place or adopt new ways of making products or services. The innovation process is a combination of various activities starting from research but including design, market investigation, process development and may also include organizational restructuring, employee development, etc. Innovation implies creativity and dynamism that will benefit the company and result in a higher standard of living. However, as a conclusion it must be kept in mind that measurement of innovation is likely to be very difficult.

2.2 Technology transfer is the process by which existing knowledge and capabilities developed under public R&D funding are used to fulfill public and private needs. It is the sharing of knowledge and facilities among public institutions and private organizations to increase productivity, generate new industry, improve living standards and public services. Technology transfer from public research institutions can occurs either by natural mechanisms such as scientific publications, training of students or continuing education of engineers already working in industry or by specific measures. The specific mechanisms will always be based on Intellectual Property policy of the public institution and must involve, during the discussion with private partners, specialists as such specific items like cost evaluation, patents, licenses, confidentially agreement, etc. will be considered and negotiated.

3 General Figures concerning the R&D policy of Japan, France, Germany and UK and Innovation

3.1 Quantifying the 'Input' side of R&D policy

According to the OECD Statistics based on the Frascati Manual [6], Japan, Germany, France and UK are, after the USA, the OECD countries which spend most on R&D [7].

Figure 1 represents the evolution of Gross Domestic Expenditure on R&D (GERD) expressed in Purchasing Power Parity (PPP). PPP expresses each national currency data in terms of US $, allowing us to compare the growth in prices in each country with that in the US. It is clear that up to 1994 the tendency remains almost uniform, with the USA spending about 2.25 times more than Japan which

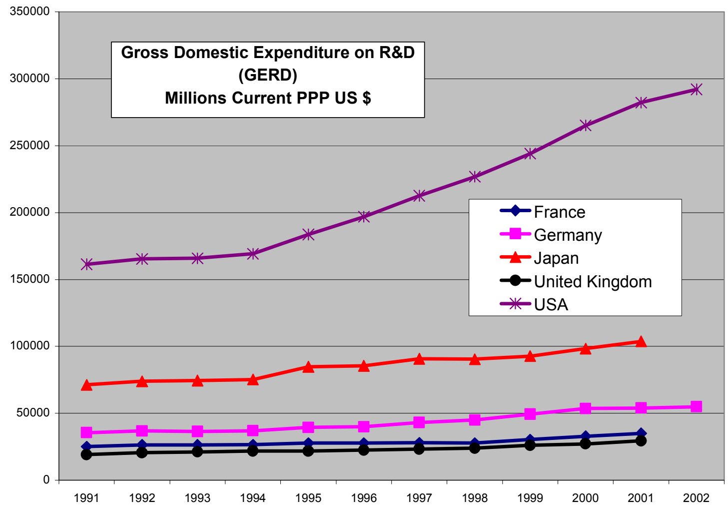

Fig. 1: Evolution of General Expenditures on R&D (GERD) in Purchasing Power Parity (PPP)

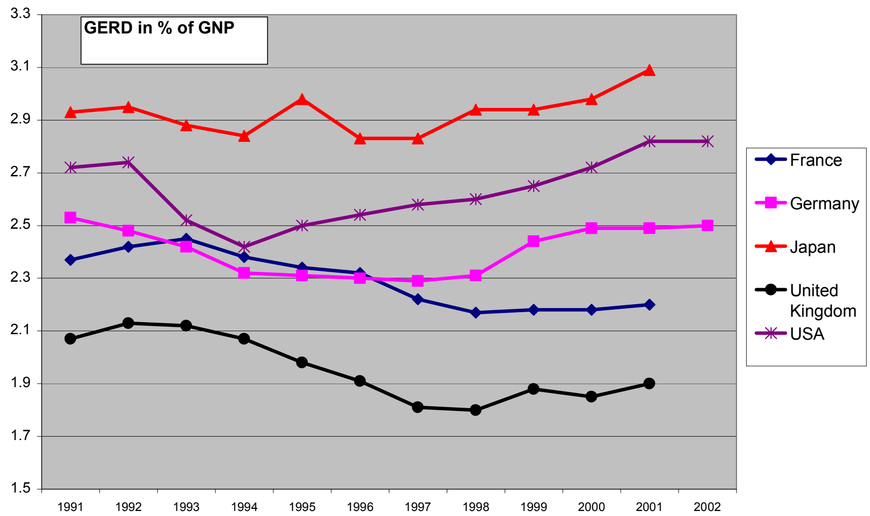

Fig. 2: Evolution of General Expenditures on R&D (GERD) as % of Gross Domestic Product

spent around 2.03 more than Germany, 2.84 more than France and 3.46 more than United Kingdom. After that period the gap between the USA and the others countries increased reaching in 2001, 2.7 between USA and Japan. Japan and Germany then increased their expenditures in R&D and in 2001 Japan spent 1.92 more than Germany, but 2.96 more than France and 3.53 more than UK. In fact Japan spent in R&D almost the same amount in R&D than Germany, France and UK combined.

We see that each year Japan continued to spend more in R&D even in the midst of difficult economical circumstances of the 90's and early 2000's as Science and Technology has always been one of the strategic economic priorities. Over the same period Germany also increased its expenditure even if the rate of increase is smaller. On the contrary in the case of France and UK in recent years the expenditure has remained almost constant. If we consider the GERD as a percentage of the GDP Japan is number one in the world (Fig.2). It was in 2001 around 3.1%, before the USA, 2.82%. For Germany after a decrease in 1993 and 1994, there was a "plateau" at 2.3% until 1998 and after that an increase to reach 2.49% in 2001 and still slightly increasing. In the case of France and the UK there has been a real decrease since 1993 and nowadays it is just 2.2% for France and 1.9% for UK.

It is also relevant to consider how the GERD is financed in the different countries (Fig.3). In that respect the situation in Japan is quite different from the others countries as

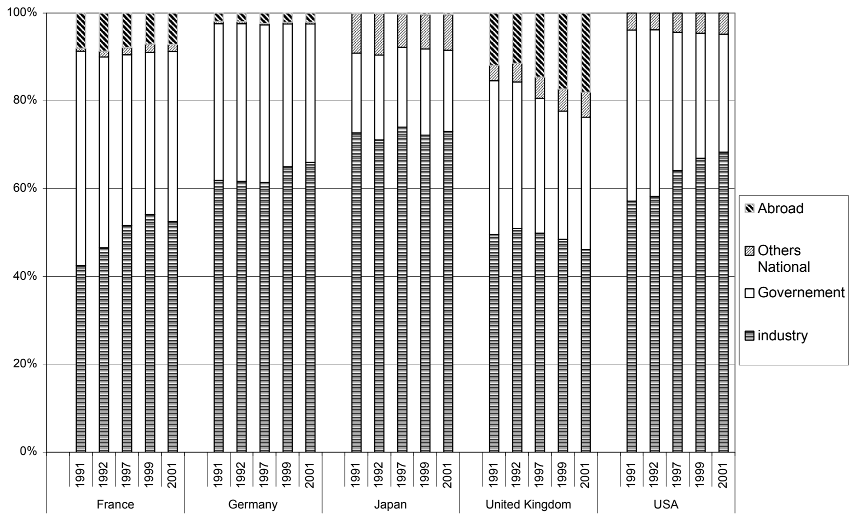

Fig. 3: Origin of the Funding of the GERD (in %)

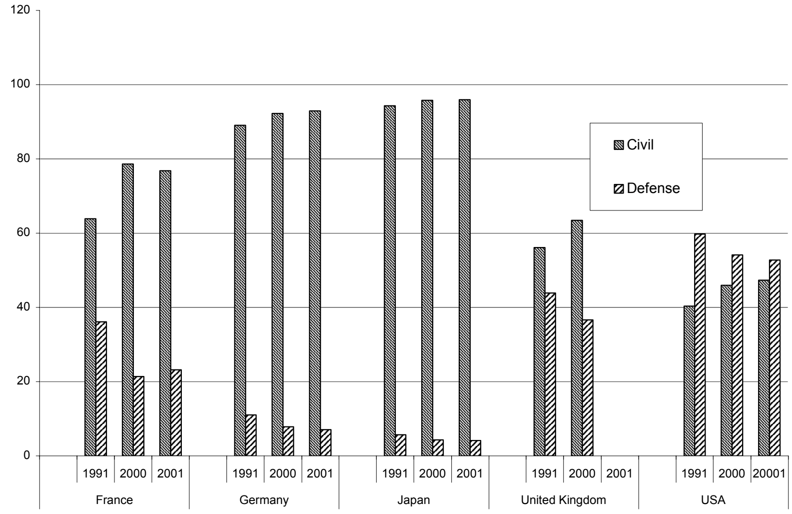

Fig. 4: Share of Civil and Defense budget en percentage of Total Governmental Budget

funding by industry always represents between 72 and 74% and the funding by "Government", although recently increasing, is usually between 18.2 and 19.6%. In the case of other countries the funding from "Government" is higher even if the tendency is towards an overall decrease, from 49.0 to 38.7% in France, 35.7 to 31.5% in Germany, 35.0 to 30.2% in UK, and 38.9 to 26.9% in the USA. The importance of funding from abroad as defined in OECD statistics for France, Germany and UK results mainly from the European Commission programs.

But how is the "Government funding" employed? In that respect an important point is to consider the percentage of total governmental budget that is spent on civil objectives (Fig.4). In all the countries the Defense budget has been steadily decreasing since the beginning of the 90's. In 2001 Japan spent around 4.1%, Germany 7.1%, France 23.2% UK 36.6% (2000) and USA 52.7%. If civil governmental budget expenditures are considered, once again Japan has a peculiar position (cf. Fig.5) as around 34% of the public money are dedicated to "research economical oriented" and until recently less than 15% of the public finding was for "non oriented research".

To have a global overview of the R&D input and activities the number of researchers has to be mentioned. In all the considered countries the number is increasing. In 1999, the USA had around 1,261,230 researchers in Full Time Equivalent (FTE) employment, in 2001 Japan had 675,900, Germany 259,600, UK around 157,800 (2000) and France

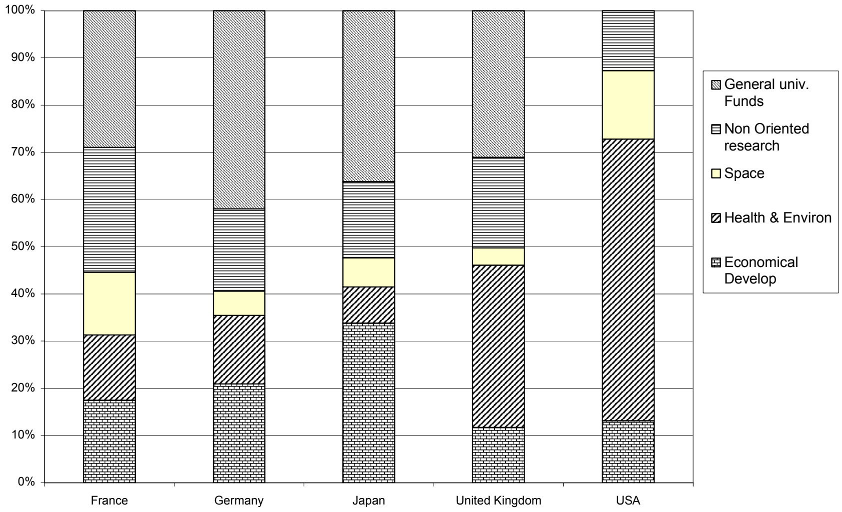

Fig. 5: Civil Governmental Budget Appropriation by Socio-economic objectives (%)

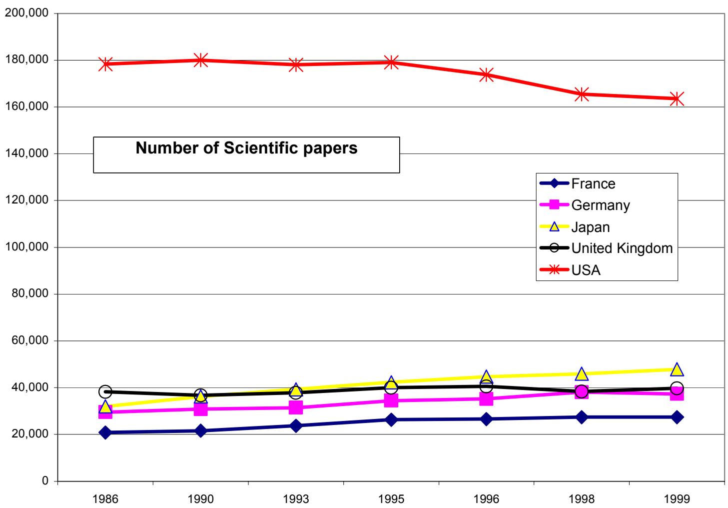

Fig. 6: Evolution of Scientific publications1986-1999

172,100 (2000): Japan has more than the 3 countries combined. In Japan, around 440,000 FTE researchers are working in industrial laboratories, 65% of the total, instead for France, Germany and UK the proportion of "public" researchers is between 40 and 50%.

3. 2 Quantifying the 'Output' side of R&D policy

Let us consider now the "results" of the investment in R&D obtained by the different countries. To have an estimation of the results of the R&D policy not only the number of scientific publications has to be taken into consideration but also the number of patents and the Technology Balance of Payments (TBP). The number of publications gives an idea of national scientific production but it is generally accepted that the quality of scientific work is more closely linked to the "Citation Index". This is because the number of publications does not allow us to judge the effectiveness of the national scientific policy but measures the reaction speed of the individual national funding systems.

The last edition published by NSF "Science and Engineering Indicators-2002" [8] gives detailed information concerning scientific publications. On a world-wide basis the increase of scientific papers published between 1986 and 1999 has been around 14% to reach 529,000. This is mainly because of the increase in Europe and in Asia driven by Japan (Fig.6). During that period Japan, despite economical problems, greatly increased its R&D expendi-

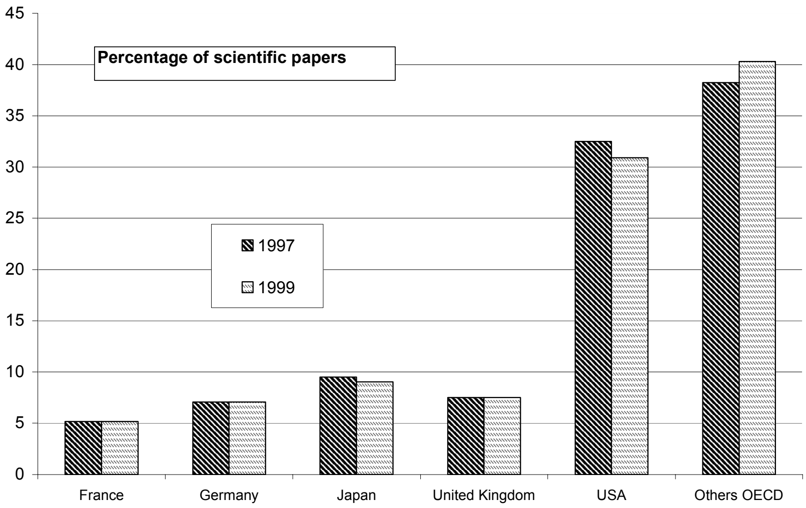

Fig. 7: Percentage of Scientific papers per countries 1997

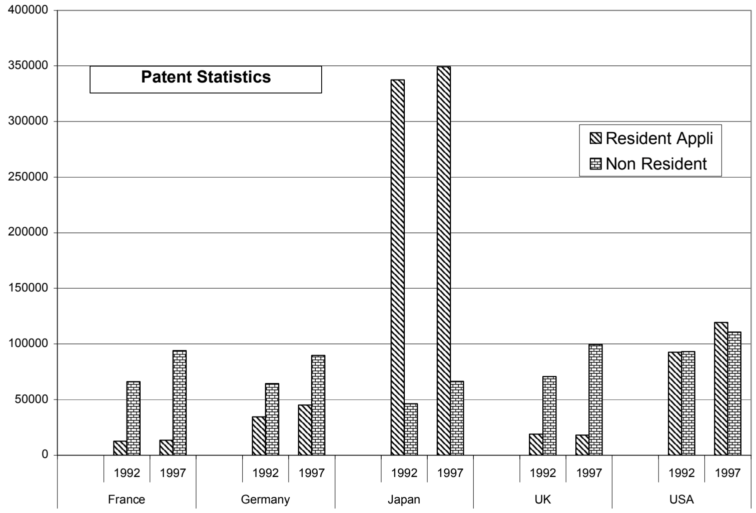

Fig. 8: Total Number of Patent applications to EPO, JPO, USPTO

ture and its output of articles grew by almost 50%. On the other hand the output from the USA decreased but still nevertheless accounting for 31 .0% of the total (Fig.7). In 1999 USA, Japan, Germany, UK and France accounted for more than 60% of world wide publications.

Patent indicators provide a measure of "output" of inventive activity that complements the "input" measures like R&D. The difficulty with patents is that the "philosophy in patenting" varies widely, especially between Japan and others countries. Figure 8 represents the evolution of the number of patents filed either at the European Patent Office (EPO) or the Japanese Patent Office [JPO] or the US Patent & Trade Mark Office (USPTO) [6]. The high values for Japan result partly from the fact that quite often each "claim" is considered as a new patent instead whereas in other countries many claims are included in the original patent.

On the other hand sometimes in Japan patents may concern design and trade mark protection. In a recent survey Watanabe [10] showed that the number of patent applications requested to JPO increased regularly and reached almost 440,000 in 2001 with a rapid growth of international applications. Conversely, Arai [11] concluded that Japan is not a "patent superpower" as only 130,000 patents are issued per year. He mentioned that for USA there are roughly 300,000 applications per year and 160,000 are issued. Another important difference between Japan and the others countries is that the proportion of application by non-resident is very small: between 1 "foreign application" for 5 to 7 "national applications", according to the

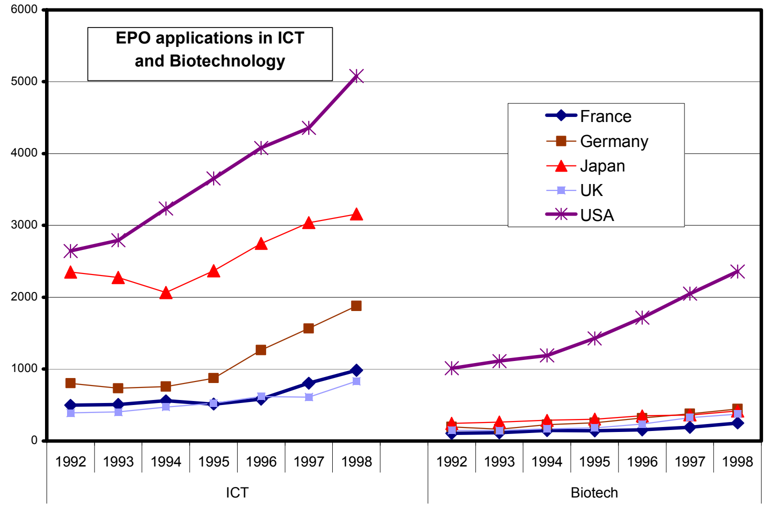

Fig. 9: Number of Patents in ICT and Biotechnology sectors (EPO applications, priority year)

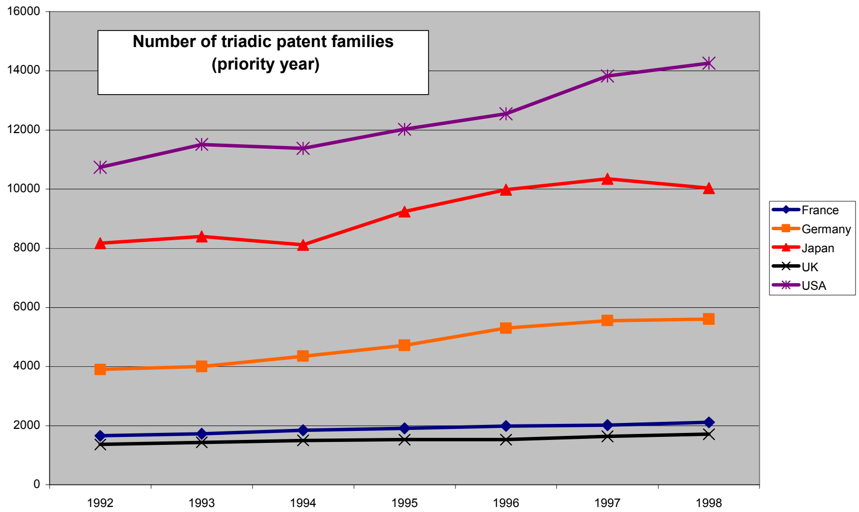

Fig. 10: Number of "triadic" patent families (priority year)

reference year. In the case of France, Germany or UK it is the opposite: around 2 “foreign applications” for 1 “national” in Germany, 4 to 5 in UK and 5 to 7 in France. In the case of two specific “High Tech” sectors, Information/Communication Technology (ICT) and Biotechnology, the EPO patent applications shows [7] that Japan is really one of the world leaders in ICT (Fig. 9) even if it is behind the USA. In the case of Biotechnology, the USA is by far the front runner, Germany, Japan and UK following. It is certainly one of the reasons why Japan has invested very heavily in that sector in recent years in the frame of its various S&T plans.

To reduce or suppress the major weaknesses of traditional patent indicators, the OECD has developed a set of indicators based on “triadic” patent families [12]. A patent family is defined as a set of patents taken in various countries to protect a single invention. The “triadic” patent families’ indicator relates to patents applied for at the EPO and the JPO and patents granted by the USPTO. They are based on the following counting method: fractional counts by inventor’s country of residence and priority date. In its last “Science, Technology and Industry Scoreboard 2001” [9], OECD brought together the latest internationally comparable data in order to analyze trends in the knowledge-based economy. Figure 10 represents the evolution of number of “triadic” families between 1992 and 1999 and has been updated in July 2003. USA represents always around 35 to 36% of the total world share, Japan 25 to

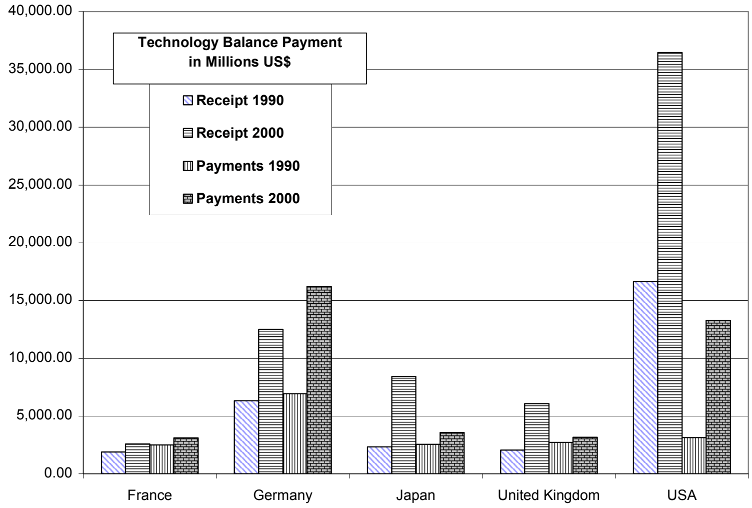

Fig. 11: Technology Balance Payment in Millions US $

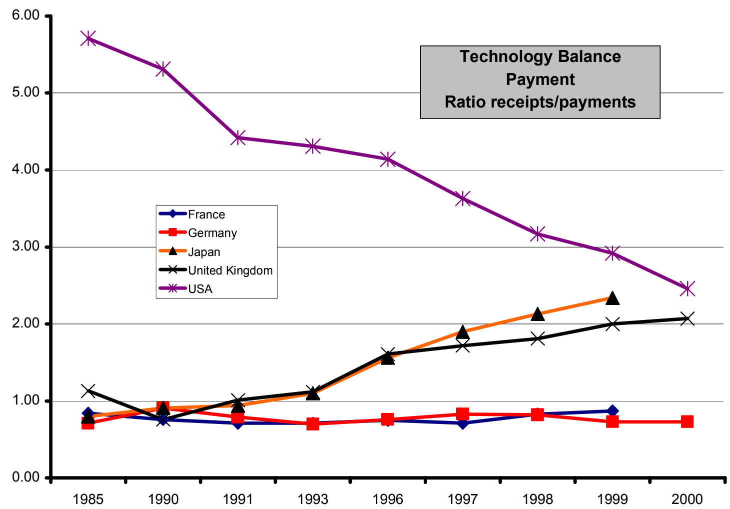

Fig. 12: Technology Balance Payment Ratio Re-ceipts/Payments

27% and Germany around 14%. In 1999 the total number of triadic families was estimated at 42,600 representing an increase of 38% from 1991.

Another way of "measuring" the "results" of R&D policy is to consider the Technology Balance of Payments (TBP) of the country for instance by measuring the ratio between the "Receipts" and the "Payments". The TBP measures international technology transfer (licenses, patents, know-how, etc.) but unlike R&D expenditures these are payments for production-ready technologies. Although the balance reflects the country's ability to sell its technology abroad and its use of foreign technologies a deficit may result from increased import or declining receipts. Likewise a surplus may have different reasons. On the other hand transactions may correspond to operations between parent companies and affiliates which is typically the case for Switzerland (TBP is very positive), or Ireland (TBP is very negative). The TBP in millions US $ for 1990 and 2000 is given in Figure 11. The evolution of the balance between receipts and payments between 1985 and 2000 is presented on Figure 12: the ratio for USA is decreasing but still over 2, on the contrary it is increasing for Japan and UK to reach a value greater than 2. In the case of France and Germany it remained negative during that period.

Payments of imported technology as a percentage of GERD give an indication of the share of imported technology to domestic R&D efforts (Fig.13). In that respect

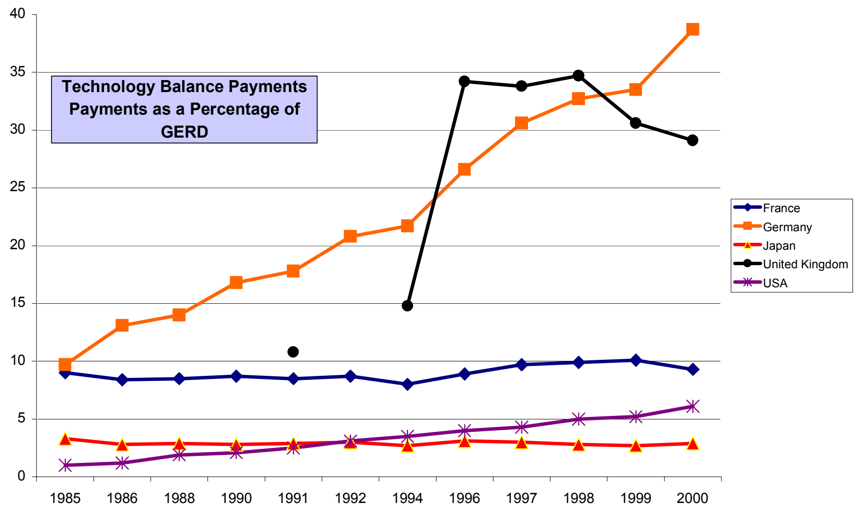

Fig. 13: Technology Balance Payment: payments as percentage of GERD

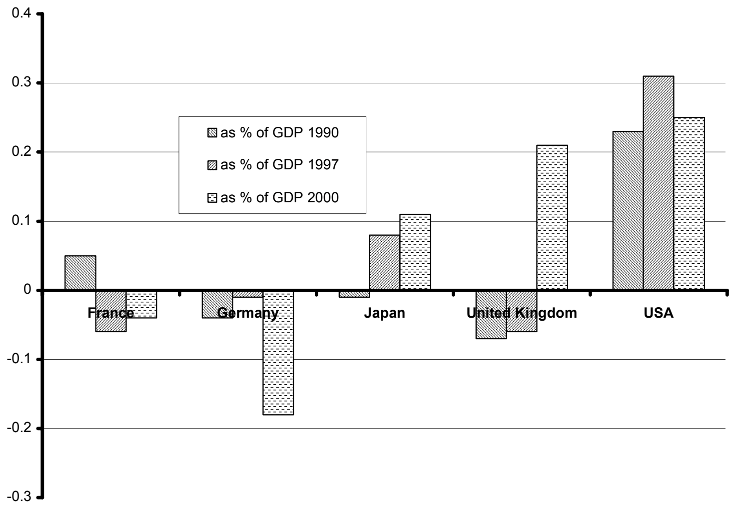

Fig. 14: Technology Balance Payment: payments as percentage of GDP

the situation for France and Japan has remained broadly similar without any important change. On the contrary there is an important change for Germany with an increase from 10% in 1985 to almost 40% in 2000. It is the same for the UK even if the variation is not as significant. Figure 14 represents the TBP percentage of the GDP: it had been always positive for USA and also in recent years for Japan.

3. 3 Innovative firms and incubators

One of the key results of research is the creation of start-ups -innovative firms- based on the transfer of technology. This process normally takes time, money and a special infrastructure called an *incubator* (cf. Fig.15, from [13]). In a recent paper Albert and Gaynorn [14] compared

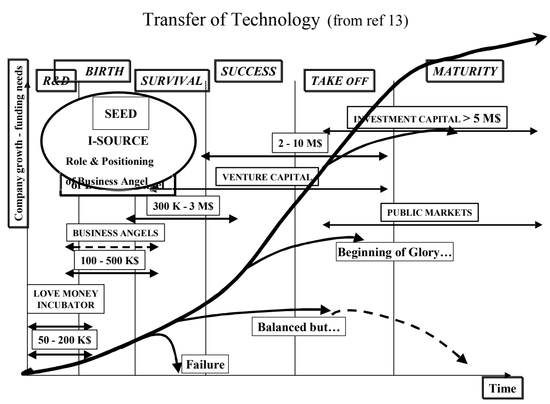

Fig. 15: Transfer of Technology (from ref 13)

Table. 1: Contextual Factors Affecting the Pace and Type of Evolution in Incubator Landscapes [14]

Contextual Factors	*USA*	*UK*	*GERMANY*	*FRANCE*	*JAPAN*
Degree of decentralisation	High	Low	High	Low	Low
Legal framework and economic philosophy	Laissez Faire	Laissez Faire	Bureaucratic	Bureaucratic	Bureaucratic
Role of state laboratories and universities	Strong	Weak	Strong	Strong	Weak
Entrepreneurship and innovation	Strong	Average	Weak	Weak	Weak
Dynamism of financial markets and level of informal investment in start ups	Strong	Strong	Average to weak	Average to weak	Weak
Legacy of industrial revolution and level of State support for industry (Rate of change in the industrial profile)	Rapid	Rapid	Slow	Slow	Slow
Existence and roles of representative agencies for promoting incubation	Strong	Average	Quite strong	Average	Weak

the situation in the USA, France, Germany and UK. They have considered the four main incubator "families": Local economic development incubators, Academic and scientific incubators, Corporate incubators and Private investors incubators. Albert and Gaynorn identified the contextual factors having a significant effect on the pace and type of evolution of each of these "families" in each of the countries (Table 1). Although we must acknowledge that the recent policy in Japan will bring changes we have added what in our opinion corresponds to the situation until recently.

In the scope of our paper we will consider only the academic and scientific incubators. France, Germany and Japan have an important network of "national" laboratories outside universities which can generate intellectual properties. On the contrary the UK relies more on universities laboratories. Until recently this potential was not exploited in Europe or Japan and incubators emerging from higher education institutions or national laboratories were very rare or did not exist. As we will describe later on the situation has changed recently in these countries due to the new European and/or national innovation policy.

4 Transfer of Technology and Innovation Policy in France

4.1 The Law for Innovation and Research

For many years the different French ministers for Science and Technology have spoken of technology transfer and innovation but it was Minister Claude Allegre who really took action and prepared in 1998/1999 the "basic law for innovation and research" to help the creation of innovative technology enterprises using the results from public institutions. In fact the Law helped to materialize the result of a long process of evolution in the innovation and research policy of France leading to the "disappearance" of the Colbertist state [15]. The law, called the "Innovation Act" by Laredo and Mustar [16], was approved and published in the Official Journal July 12, 1999. The main target as minister Allegre said, was to "transform Science and Technology into economic growth and job creation".

The law was made up of 4 parts:

- For personnel: the possibility for civil servants working in universities and national research institutes to participate in the creation of companies that develop and commercialize the results of their research i.e, creation of a start-up that would apply to his/her research. They are allowed to invest in the start-up company and have shares, up to 15% of the total capital. They can be scientific advisors and also members of the Board without leaving their current working status.
- For the institutions: universities and national research institutes can establish Departments for Industrial and Commercial Activities (SAIC). They can also set up incubators to welcome and nurture innovative companies. All these possibilities are aimed at increasing the cooperation

between industry and the educational and research institutions. Although at the level of "Vocational schools" they will be allowed to develop technological platforms.

- For innovative companies: the fiscal system was changed in order that they can benefit from direct investment from individuals and also from "Investment Funds in Innovation" dedicated to Small and Medium size Enterprises (SME). Such investment requires the agreement of the National Agency for Innovation- ANVAR. In total 1042 enterprises are qualified as of July 2003. On the other hand tax reduction for investment of companies in R&D activities was expanded.
- For innovative companies: instead of Limited Company, a new legal status was proposed as "simplified joint stock company", so they can easily adapt their status, their funding, and their administrative burden to their expansion.

To implement the Law and promote the creation of innovative firms different actions were simultaneously taken including a national annual competition on the creation of innovative firms, creation of special program to support the creation of incubators, creation of special "seed-funds" for initial start-up, training of entrepreneurship in higher education institutions mainly engineering and management schools, etc.

4.2 The national annual competition on the creation of firms based upon innovative technologies.

The main goal is to support and nurture projects up to the very stage when they are ready for launching as a start-up. There are 2 categories of projects with different funding characteristics:

- "emerging project" that corresponds mainly to an *idea* that needs further development on the technological, organizational, industrial, legal and financial aspects before reaching the stage to be launched;
- "launching projects" which corresponds to the creation of a start-up.

Each year since 1999 there is a "call for proposal" at the beginning of the year. The projects are received at the regional level and some are selected by a regional Jury comprising representatives from ANVAR, industry, banks and also specialists from public sectors. The various regional proposals are sent to a national Jury chaired by a well-known CEO of an enterprise. The national jury will make a new selection and the final results are known beginning of July.

The budget in 1999 was 15.24 millions € as the call for projects was published after the Law was passed in July. The following years it has been 30.00 millions € each time.

The results of the annual competition are given on Table 2 [17, 18]

The average funding given to an "emerging project" is around 35,000 € and for a "launching project" it is around 204,000 € but each year some very promising "launching projects" receive the maximum allocation of 450,000 €.

In total during 5 years, 8103 projects have been submitted and 1195 selected. At the end of December 2002 as a result of the 4 previous years, 466 corporations were launched and 2,800 jobs created but some awardees of the 2002 competition at that time had not yet created their company. Figure 16 represents the repartition of the se-

Table. 2: Results of the Annual National Competition on the Creation of Innovative Firms

	1999	2000	2001	2002	2003
budget Millions €	15.24	30	30	30	30
number of proposals	1913	1805	1481	1465	1439
Total regional selection	379	380	350	345	322
National selected projects	244	296	238	224	193
Emerging projects	165	158	139	106	105
Average funding €		45,000 €	39,340	32,200	41,705
Launching projects	79	138	99	118	88
Average funding €			221,000	225,500	250,367

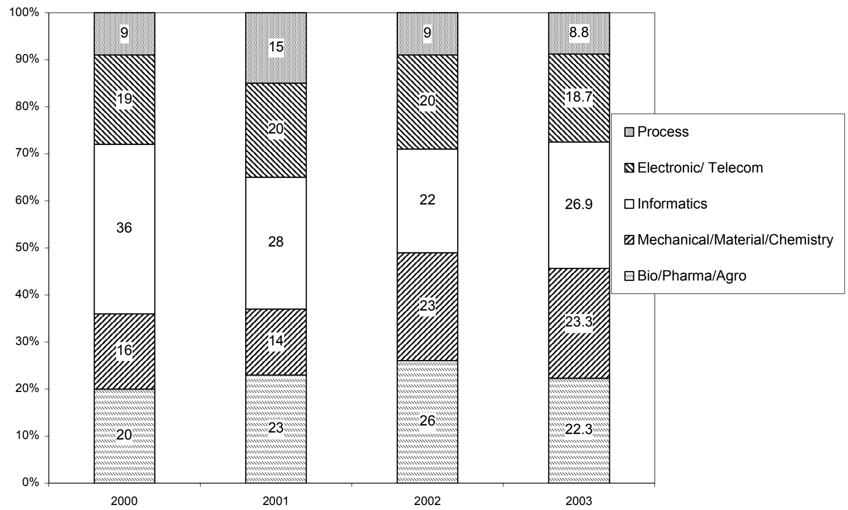

Fig. 16: Repartition per domains of the creation of innovative firms (annual national competition)

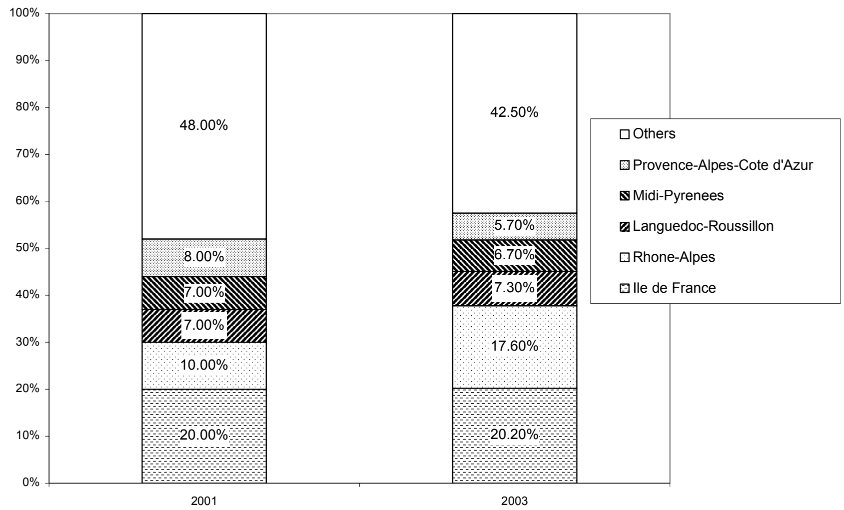

Fig. 17: Repartition per Province domains of the creation of innovative firms (annual national competi-tion)

selected projects between the different domains: it should be noted that usually "Informatics" and "Biotechnology/Pharmacy" are the leading sectors but in 2003 the more traditional sectors Mechanics/chemistry/materials represent the second highest percentage after "Informatics". It is also interesting to consider the geographical repartition (cf. Fig.17). Ile de France (Paris and its surrounding) always represents around 22% of the selected projects, Rhone-Alpes (Lyon-Grenoble) is second with around 10% and then 3 Regions, Provence-Cote d'Azur (Marseille-Nice), Midi-Pyrenees (Toulouse), and Languedoc Roussillon (Montpellier) always represent each around 7 to 8% of the projects: it is in these places that most of the researchers of the public sector are located.

It is also interesting to note some further trends: for example, in accordance with the aim of creating a public to private technology transfer in 2003, 43% of the awardees belonged to the public sector. Moreover, in 2003, 30% of the awardees of the "launching projects" selected had been supported in previous years as "emerging projects" candidates, thereby confirming the quality of the previous selections. It has been proposed this year that for the projects which have not been supported at national level they receive some support from their region.

4.3 Incubators policy

After the Law was passed the universities and national research agencies and/or institutes were authorized to establish Departments for Industrial and Commercial Activities (SAIC) and to set up incubators to welcome and nurture innovative companies. A call for proposals was immediately launched for the creation of incubators with a budget of 15.3 millions €. The idea was to encourage national organizations to implement new structures for incubation with preference given to partnership with private enterprises. An incubator was defined as a place hosting and assisting holders of innovative firm start-up projects. In 1999, 18 incubators have been selected and funded. In total there are presently 31 incubators, with a minimum of one per administrative region, sometime more as in Ile de France (5), PACA (3), Rhone-Alps (2). Two incubators are dedicated to biotechnologies and one to educative multimedia, all the others are multi-domains. A survey done at the end of December 2002 [15] showed that 733 projects had been incubated in these places, 344 firms launched and 1315 jobs created: 47% of the incubated projects had led to the launching of a firm. In total since the beginning of the special program the Ministry has spent 24.64 million € to support the selected incubators up to 50% of their expenses, other funds coming from regional authorities and from the laboratories themselves.

Last July [18] it was confirmed that in 2003, 16 incubators received 1.8 million € and that in total 31 will be evaluated and, according to their performance, they will be supported for the period 2004-2006.

4. 4 Seed funds

At the same time (1999) a budget of 15.3 million € was allocated as "seed money" to endow seed capital funds by state subsidies, in partnership with private funds, for initial funding of start-ups resulting from public research results. In total 22.87 millions € have been allocated [17] with a target to obtain in total 136.52 million €. As result of the call for projects 10 "seed capital funds" existed in December 2002, 3 "national-theme oriented" and 7 "regional-theme independent". In fact 2 other "national-theme oriented" existed before the call for projects including one by INRIA, I-Source (cf. Fig.20). In 2003, 2 more "national-theme oriented" will be created, one for "nano/microtechnologies" and one for "environment/energy".

4. 5 Other initiatives for improving the relationships public research and industry.

Many others measures and initiatives have been undertaken to improve the relationship between public and private partners.

- 4-5-1 Thematic Research and Innovation Networks (RRIT-Reseaux de Recherche et d'Innovation Technologiques). In a RRIT, research teams from public and private sectors come together to answer a strong demand from society in a specific domain. By the end of December 2002, 16 such a RRIT existed:
  - 4 in Information Technology including one in "Research Network on Telecommunications" (RNRT) which received 50.35 million €, one in Software engineering (RNTL), 37.11 million €, one in micro-nanotechnologies (RMNT), 30.56 million €,
  - 3 in Life sciences, Genhomme, 27.26 million €, Healthcare Technologies, 23 million € and Genoplant 22.51 million €
  - 2 in Aeronautic/Space,
  - 2 in Environment, water system (RITEAU), Sea pollution (RITMER),
  - various others in different fields, such as transport systems (PREDIT), 38.75 million €, energy (PACO), etc.
- 4-5-2 National Centers for Research in Technology (CNTR), dedicated to technological research with cooperation between public and industry. These centers are established in a specific location according to the existing specialist knowledge and equipment in a selected domain. CNTR funding is linked to the State-Region contract. In February 2003, 18 of these CNRT existed.
- 4-5-3 some others measures have been implemented at the level of universities and engineering schools: creation of "research teams in technology" in partnership with industry, 56 in February 2003, creation on an experimental base of 14 SIAC, insertion of young graduates in economical sectors (CIFRE, CORTECHS, DRT), Networks for Technology Diffusion (RDT), Thematic Centers for Technological Transfer (CRITT), Technology platform in connection with vocational schools, etc.

4. 6 CNRS case study

CNRS with more than 25,500 personnel including more than 12,000 full time researchers and an annual budget of more than 2.6 billion €, (around 13% (315 M €) coming

Table. 3: CNRS Key Figures for Partnership and Valorization (From ref 19)

36	Master agreements
1400	industrial contracts signed per year
3560	running industrial contracts signed per year
56 M €	income from industrial contracts for 2002
1040	industrial partners including 500 SME
27	Common Laboratories involving enterprises
500	invention disclosures in 2002
230	priority patents in 2002
1390	families patent
535	licenses running
42.4 M €	royalties 2002 (37.6 M€ in 2001)
104	Start-up creation since 1999
600	consultants within staff

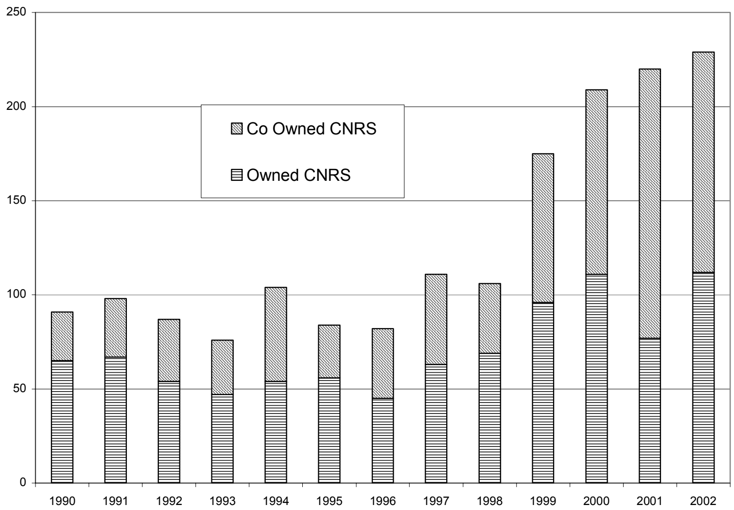

Fig. 18: CNRS Patent Applications (from ref 19)

from its own resources) is the biggest public multidisciplinary research Agency in France. After the Innovation Act was enacted CNRS developed a very active policy for improving its relationship with industry, patenting, transfer of technology, start-up creation, etc. The last key figures for partnership and valorization are presented in Table 3 [19].

Figure 18 represents the evolution of numbers of patents owned by CNRS: from 1998 to 2002 the numbers almost doubled. At the same time the royalties increased from around 15 M € to 42.4 M €. On the other hand since 1999, 104 start-ups have been launched from CNRS laboratories. Figure 19 represents the domains of CNRS start-ups: 36% correspond to Bio/pharmaceutical sector, 34% to NTIC, 9% to materials, 7% to environment, etc. In November 2002 the CNRS inaugurated the CNRS's Entrepreneurs Club.

4.7 INRIA case

Institut de Recherche en Informatique Appliquee (INRIA), a research Institute at the "heart of the information society", with a budget of 120 M €, 25% from grant-in-aid and own resources, 900 permanent positions, 700 post-doctoral researchers and personnel under contract, 450 researchers from others institutions, and 700 Ph.D. students, is one of the largest institutes for research in informatics. There are 600 on-going contracts with industry and INRIA teams participated in 250 Europeans pro-

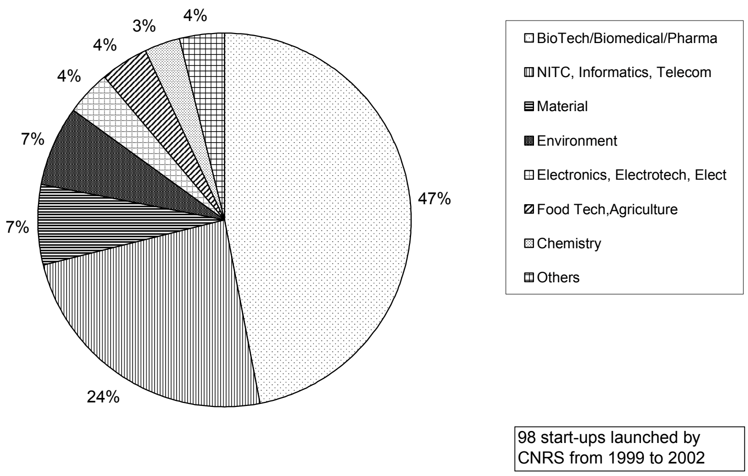

Fig. 19: Domains of CNRS start-ups

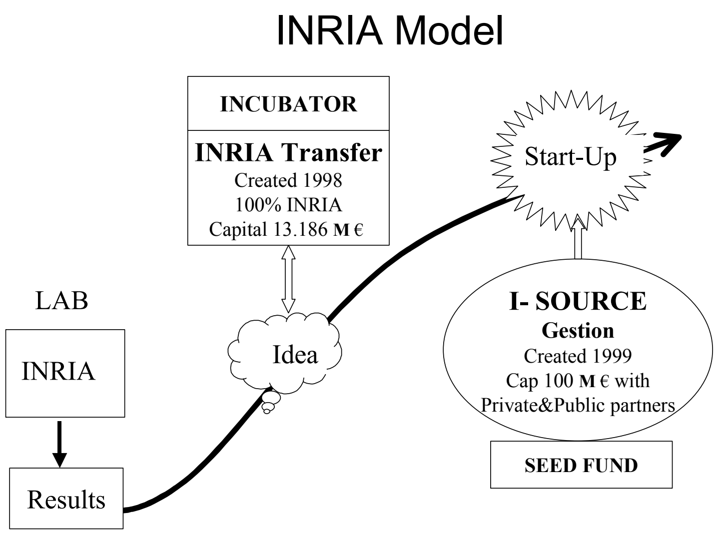

Fig. 20: "INRIA model" of innovation strategy

jects mainly in cooperation with industry. For many years INRIA has developed an innovation strategy (cf. Fig.20) creating its own incubator "INRIA transfert" and facilitating seed funds I-Source 1, I-Source 2, C-Source and T-Source. As a result of that policy more than 60 start-ups have been created from Simulog to Ilog which today has a Nasdaq listing, 12 in 2000, 4 in 2001, 3 in 2002, 4 in 2003. Total Gross sales in 2002 were 120 M €, with 1400 employees.

4.8 The new "Innovation Plan" (April 2003)

In April 2003, the Minister for Research and the Minister for Industry launched a new plan called "Innovation Plan" [20] aimed at increasing the private sector share of investment in R&D and to improve the exploitation of public research sector results.

4.8.1 A new status for "Business Angels"

The number of "Business Angels" in France is very low 3,000 to 4,000, a tenth of what it is in UK, with an average annual investment of 70,000 €. A new legal status for investment by "Business Angels" (Societe Unipersonnelle d'Investissement Providentiel-SUIP) will allow to invest in companies less than 5 years old, free of income tax and capital gains tax for the 10 first years of investment. This measure aims to encourage more individuals to invest in innovative companies at an early stage.

4.8.2 New status for "Young Innovative Companies" (Jeunes enterprises Innovantes)

This measure is aimed at supporting Young High Tech companies with heavy R&D expenditure during the difficult early years while they may not be making a profit. To be eligible the company must be SME, less than 8 years old and spend more than 15% of turnover on R&D. It will be eligible for a number of fiscal advantages to reduce the overall tax burden to the level of that in the UK or USA: it will be exempt for 8 years of social cost for R&D personnel, corporation tax for 3 years then 50% for the two following years, local taxes, capital gains tax for shareholders holding shares for over 3 years, etc.

The benefit of these two measures (SIUP and Young Innovative Companies) are not applicable to subsidiaries of large companies.

4.8.3 R&D tax credit

This measure aims at extending the tax credit to all R&D investments instead of applying it on year-to-year increases in R&D spending. Moreover there will be an acceleration of the depreciation values for all the R&D assets to the same rate as it is in USA.

4.8.4 "Making an easier access to Public funding for Companies"

There are presently a plethora of Government schemes to aid innovation, administrated either directly from Ministries or through ANVAR. Additionally there are innovation funds available at regional level. It is proposed that ANVAR, with its local offices, is the "network animator" for all innovation funding in liaison with local authorities and also providing guidance on participation to EU programs.

4.8.5 "Closer links between public and industrial research"

A high proportion of France's R&D expenses is invested in the public sector but there is a lack of exploitation of the results: in 1990 French patents represented 8.4% of world patents and only 7.2% in 1999. Part of the problem may be that there are still few formal links between public and industrial research especially with SME: only 10% of SME have an university partnership, in Europe the average is 25% and it is 55% in Nordic countries. A number of measures have been proposed to increase the public/industry links and to boost the progress from existing implementation of the Innovation Act from 1999:

- double the number of Ph.D. students in industry to reach a level of 1500 in 2010
- encourage Ph.D. students to spend 6 months internship in industry
- subsidize industry sponsored research projects carried out in public laboratory
- develop the SIAC system and improve their working conditions with more professionals involved and "best practices" guidance,
- introduce "innovation indicators" for evaluation of individuals and institutions
- take actions to increase the number of patents either at individual level (return of benefit) or institution level
- devote a further 30 M € by special government banking system (CDC) to seed funding in the frame of "SME's innovation" program.

4.8.6 **More measures are announced** like making innovation a national and European priority, support for strategic industrial R&D, including Eureka clusters and development of center of excellence for industrial R&D.

4.9 The recent Law to encourage sponsorship and creation of foundations (July 21, 2003)

Generally speaking the role of foundations and sponsorship in France is very limited. In a recent survey [21] it was mentioned that in the USA, sponsorship represented in 2001, 217 billion € or 2.1% of GNP instead in France it was only 1.26 billions € or 0.09% of GNP. There are 12,000 foundations in USA, 3,000 charity trusts in UK, 2,000 foundations in Germany as well as 473 foundations in France, 2/3 of which almost inactive, plus the "Fondation de France", and 73 foundations from companies. Among the foundations around 50 include supporting research activities [22]. As far as research support by foundations, it represents 0.24% of GNP in Japan, 0.16% in Sweden, 0.11% in USA, 0.10% in UK and only 0.04% in France [22]. In 2000, Germany and the UK, and more recently Spain, introduced new measures to boost foundation funding. France decided to do the same and a Law was passed on July 21, 2003 and published on August 1, 2003, which gives substantial tax benefits to individuals and enterprises and greatly facilitates the creation of foundations and their operation.

4. 10 Conclusion

After the Innovation Act was passed in July 1999 different actions have been implemented to support the creation of innovative firms and transfer of technology mainly from public research laboratories. The target, which has been fixed at the European level, of 3% of GNP spent in R&D activities by 2010 can't be reached in France without increasing the share of the private sector. In order to reach that level an "Innovation Plan" was launched in April 2003 and a Law was passed in July 2003 to boost the creation of foundations and their support for cultural, research and environment activities. In order to back research and innovation policy inside companies different measures, including tax reduction, have been proposed in the frame of the 2004 budget for R&D [23] which will be increased by 3.9% from 2003.

5 New JAPAN Science and Technology Policy, Transfer of Technology and Innovation Policy

5. 1 Constants and Changes in the Science and Technology Japanese Policy [24]

Science and Technology has always played an important role in the development of Japanese economy [25] and for instance just looking at postwar reconstruction the government in its declaration in September 1946 pointed out that: *"Technology has to play a principal role in the Japanese economy. The basic direction of the reconstruction of the Japanese economy is toward a democratization of the economy and an elevation of technological standard. Japanese technology must get rid of its traditional imitationcentered "colonialistic" character. Japan must strive to develop its own technology which fits nation's environment, observe world trends to absorb into the country all kind of industries that are considered not disadvantageous to productive national activities. National technology must support, creation of new resources making unutilized resources useful, sophisticated product processing, reduction of product wastage. Japan must maintain a superiority know-how over other Asian countries by constant advancement of its own technology so it can export industrial manufactures to them. Technology must contribute to the elimination of cheap labor, etc."*

Since this period that has been the motto for Science and Technology budgets but the government adopted a new approach in the 1990s [26]. Presently the key points are:

- **1995** Science and Technology Basic Law
- **July 1996** Science and Technology Basic Plan, five years plan (1996-2001), 17 trillions JPY
- **1997** Recommendations for evaluation
- **1998** Law for Facilitating Governmental Research Exchange
- **May 1998** Law for Promoting University-Industry Technology Transfer, establish Technology Licensing Organizations (TLO) which deal with obtaining patents, marketing and licensing on the sake of university researchers,
- **1999** Law on special measures for industrial revitalization to speed Japanese industry toward a vital recovery, by making it easier for entrepreneurs to restructure their businesses, encouraging the creation of new businesses and the cultivation of new business by small and medium enterprises, vitalizing research aimed at maximizing Japan's management resources, and otherwise acting in order to improve productivity by utilizing Japan's management resources more efficiently.
- **April 2000** Law to Strengthen Industrial Technical Ability, and special measures for industrial revitalization (Japanese Bayh-Dole Act). It corresponds to deregulation and incentive in National Institutions for Technology Transfer. On the other hand 56 among 83 national research institutes were transformed into "independent administrative institutions". One of the most famous was the AIST, a research Institute linked to METI, which kept the same acronym but with a different meaning (National Institute of Advanced Industrial Science and Technology) and was totally re-organized. In the "former" system AIST operated 15 research Institutes, 8 in Tsukaba and 7 around Japan. Its new organization was developed to maximize the advantages of an independent administrative institution and to ensure the autonomous function of the organization. For ex-

ample, to adapt to the characteristics of individual research fields and respond to the multiple phases of each research mission and research and development project, several different types of research units were established:

- 32 Research Centers to promote pioneering and strategic projects by giving priority to research resources such as budget and human resources; each Research Center is a flexible organization with top-down management established for a specified period of time.
- 21 Research Institutes each with a bottom-up organization based on research proposals submitted by individual researchers.
- 2 Special Divisions, each is an experimental organization designed to support all stages of research and development activities—from basic research to practical applications—in a unifying and flexible way. Its purpose is to bring together different fields of research by developing, for example, new research directions based on the large-scale industrial research that has accumulated in the Kansai region.
- 8 Research Initiatives to promote specific research projects with flexibility, for a specified period of time, especially those with a high possibility of cross-field application or with relevance to immediate administrative needs.

After transformation the research activities of all the new independent administrative institutions have changed. They can have collaboration with industries and universities but they still have restriction on the use of their budget.

- **January 2001** Administrative reform including the merging of Ministry of Education, Science, Sports and Culture (Monbusho) with the Science and Technology Agency (STA) in a Ministry of Education, Culture, Sports, Science and Technology (Monbukagakusho-MEXT). This Ministry will manage around 2/3 of the public Science and Technology budget. Figure 21 represents the new organization of S&T administration and Figure 22 the Keys Ministries and organisms.
- **2001** in the frame of the Administrative reform creation of the “Council for Science Technology Policy” (CSTP) which will cover all disciplines including

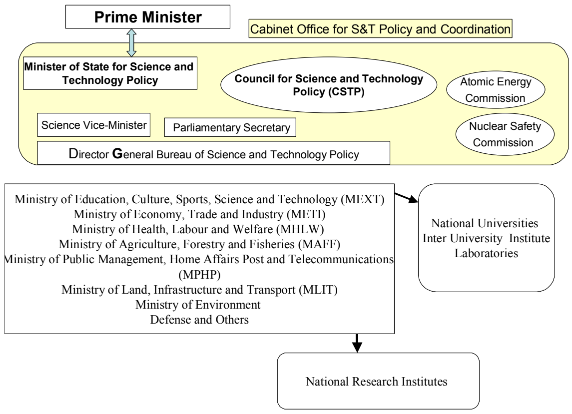

Fig. 21: New Organization of Administration of Public S&T in Japan (After 2001)

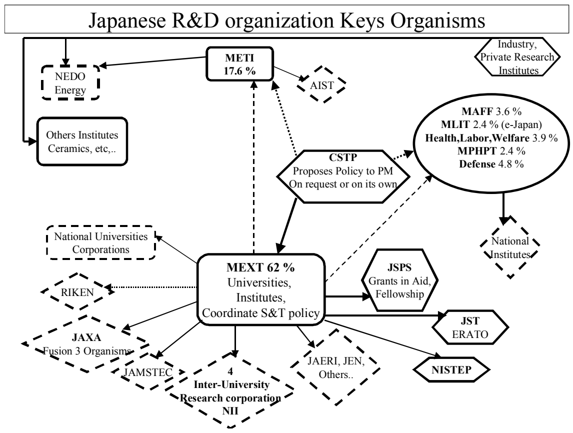

Fig. 22: Keys Ministries and organisms of R&D in Japan (as November 2003)

Social Sciences and Humanities and will make an evaluation of the demand from Ministries for important projects. Moreover CSTP can decide to investigate any subject it considers important for S&T Japanese policy (cf. § 5-2)

- **March 2001** Second Science and Technology Basic Plan, five years plan (2001-2006, 24 trillions JPY) which identifies four research themes as principal priority areas for emphasis during its five-year time span (life sciences, information technologies, environmental science, nanotechnology and materials, emerging fields [27]). The secondary priority areas are: energy science, manufacturing technologies, social infrastructure and frontier science. The Plan specifies that approximately 50 percent of the government’s research budget from JFY 2001 through 2005 should be devoted to supporting research in these priority areas, with the remaining 50 these priority areas, with the remaining 50 percent to be used to support research in other areas of science and technology. The Plan aims to double the percentage of government research support allotted on a competitive basis from 9 to 18 percent over its five-year time span. It also mentioned the re-enforcement of University-Business cooperation. Because these objectives can be addressed largely, though not exclusively, by means of the government's annual budgets, the CSTP has considerable control over its implementation, although perhaps not so much control as it does over the allocation of funds to specific research areas. For example, the combined budgets of MEXT and the Japan Society for the Promotion of Science (JSPS) for awarding competitive Grants-in Aid for Research have been increased substantially during the past years (cf. Fig.23), with the possibility that those budgets will have been doubled by the final year of the Plan. If this outcome actually occurs, the goal of doubling the percentage of funds awarded competitively would be realized.

- **June 2001** the University-based Structural Reform Plan for Revitalizing the Japanese Economy with 3 main objectives:
  - Creating Universities that conform to the highest international standards thorough implementation of competitive principles based on evaluations, accelerating the creation of new industry generating in universities (e.g. boost the number of patent acquired from 100 per year to 1500 in 10 years, create companies to apply the patents from 70 per year to about 700 in five years-TLO, create 10 "Japanese Silicon Valley" in 10 years, etc.), transform the management of national universities by applying private sector principles
  - Making Japan a nation that produces professionals with capabilities at the highest international level by developing professionals capable of functioning anywhere in the world and developing personnel capable of responding to changes in society and employment (e.g. develop satellite campuses, e-universities, etc.)
  - Revitalizing cities and regional areas in adapting universities to integrate cities and regional areas
- **Toyama Plan** also known as the "Center of Excellence Program for the 21st Century" (cf.§ 5-4)
- **December 2002** Intellectual Property Law. The Law aims at strengthening industrial competitiveness by reviewing the treatment of inventors and shortening the patent review period, to ultimately revitalize the economy. The detailed policies on the treatment of inventors will be discussed at the IPR Strategy HQ. The IPR HQ was established within the Cabinet in March 2003, to promote in a focused and systematic manner policies relating to the creation, protection and application of intellectual property, in light of the increased need to strengthen the international

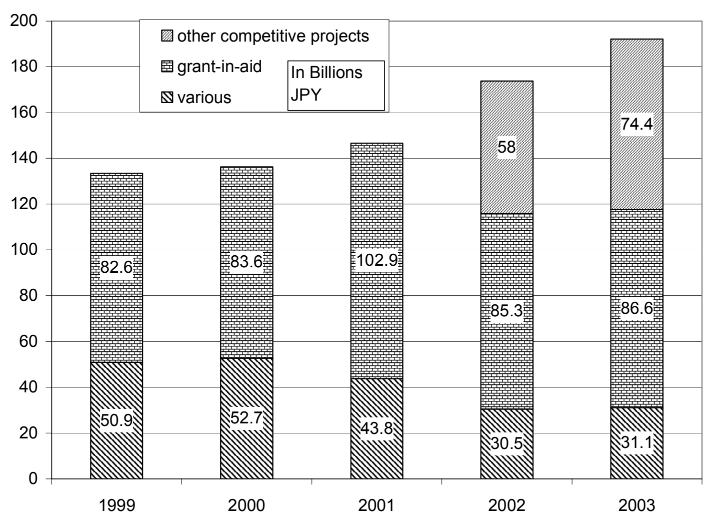

Fig. 23: Evolution of JSPS "Competitive Funds"

competitiveness of Japanese industry. In the first meeting of the IPR HQ that took place in March it was decided to compile by July the Intellectual Property Promotion Plan. At the end of June the Government's Committee for Intellectual Property Strategies revealed its Guidelines for Intellectual Property. The guidelines include 50 reforms that the Government should make by the year 2005, such as introduction of a system which evaluates university faculty by the number of patents obtained, establishment of a graduate university which fosters experts both in advanced technologies and intellectual property to support the government to implement creation, protection and application of intellectual property, the company can obtain the patent of an invention resulting from "Industry-Government collaborative research" but they are restricted to licensing abroad, etc. The swiftness of the actions demonstrates the will of the government to take action in that very critical issues

- **July 2003** National University Reform Bills to transform "national universities" into independent administrative organizations in April 2004. The National University Reform Bills will bring five new laws in particular one for National University Corporations. By that time national universities become independent university corporations. Mergers are scheduled to take place and as a result the original number of 99 national universities will be decreased to 87 four-years national university corporations plus two-years national university corporations, making a total of 89 national university corporations. Moreover the present 15 inter-university research facilities will be incorporated into four independent organizations "Inter-University Research Facility Corporations". According to the Law the following major changes are expected to take place:
  - Management autonomy will be left with each corporation.
  - Management board will be established.
  - Outside Executive staff will be involved in the management.
  - Employees will become non-government employees.
  - Evaluation will be made by a third party.

In other words the "national" universities will be independent from the government, to take their own decisions on management and education and research. They will remain nationally funded but the allocation will be submitted to an evaluation of the performance for each school. Each university is required to submit mid-term goals and strategies to achieve these goals.

All these very recent measures correspond to the establishment of Japan as a "Science and Technology oriented Nation".

In his speech on January 2003 at the Diet to present the FY 2003 Budget (S&T and Education Policy) Prime Minister Koizumi said:

- We will maintain our effort in order to achieve "a nation built on the platform of scientific and technological creativity", the budget for promotion of S&T is to be increased by 3.9%.
- We will lend intensive support to R&D projects that will make possible prevention and treatment of disease in individuals at a genetic level.
- We will apply R&D and investment Tax reduction* (* 8 to 10%).
- We will support new technologies for the promotion of new industries, e.g. public and private sector will unite in developing biotechnology.
- We will promote the world environmental leading industries by promoting S&T.
- We will promote a "zero waste society".
- We will establish Japan as a nation built on the platform of Intellectual Property.
- We will establish a "Graduate School of S& T" in Okinawa.
- The modalities of education will be drastically transferred from being uniform and passive to being independent and active (reform of elementary, junior-high Schools and Universities).

Lets also remember that for FY 2004 the demand for S&T budget has been forecasted to increase by 11.3% (cf. § 5-3)

5. 2 Role of the Council for Science and Technology Policy (CSTP)

The National Council for Science and Technology Policy (CSTP), established in 2001, is chaired officially by the Prime Minister but quite often by the Minister of State for Science and Technology. It consists of seven appointed Executive Members, three of them permanent and the remaining four "distinguished scientists or engineers" appointed for two year terms, the Chief Cabinet Secretary, the ministers who head four relevant ministries (MEXT, METI, the Ministry of Public Management, Home Affairs, Post and Telecommunications-MPHPT-, and the Ministry of Finance) and the President of the Science Council of Japan. With the creation of the CSTP a means existed whereby the government could impose a measure of discipline on its science and technology-related ministries, and thereby attempt to address the objectives of the 2nd Science and Technology Basic Plan coherently and effectively. At its first monthly conference on January 18, 2001, more than two months prior to the formal adoption of the Plan, the CSTP established five expert panels. Three of these, S&T Promotion Strategy, Evaluation, and R&D System Reform, corresponded to one of the principal objectives of the Plan.

Since its creation the CSTP has met on a monthly base and discussed the following items which correspond to the second S&T plan and published its conclusions

- Adopting a strategic approach to government research investments;
- Building a competitive research environment;
- Enhancing the independence and mobility of young researchers;
- Improving the research evaluation system;
- Utilizing research outcomes by promoting cooperation among the academic, industrial and government research sectors;
- Enhancing communications with society.

Since the CSTP was established in order to function as "a control tower to promote science and technology" in Japan, a good deal can be learned about trends in Japanese science policy since January 2001 by examining actions of the CSTP and the relevant science and technology-related ministries, particularly MEXT and METI.

Among different matters CSTP is responsible for preparing the government's final S&T budget based on submissions by the separate ministries after evaluations and the formulation of the government's science- and technology policy. It is worth noting that implementing such a strategic approach to the Japanese government S&T budget would have been impossible prior to the creation of the Cabinet Office and the CSTP in January 2001.

The CSTP completed in October 2002 its ranking of 311 S&T projects requested for **JFY 2003**. They were ranked as follows:

S Very important research projects which should be strongly encouraged to be promoted, 90 projects (20% of the total reviewed projects)

A Important research projects which should be implemented, 129 projects (41% of the total requested projects)

B Projects that have weaknesses to be addressed before being implemented effectively and efficiently, 65 projects (21% of the total reviewed projects)

C Those projects whose research content, plan, and promotion methods must be revised, 27 projects (9% of the total reviewed projects)

As examples of S projects ranked lets mention: COE Program for 21st Century, the Competitive Research Funds: Grants-in-Aid for Scientific Research, Industrial Technology Research, Industry-University-Government Collaboration: Establishment of Intellectual Property Management Offices at Universities, R&D on Creating University-oriented Venture Companies.

The CSTP's recommendations were fully endorsed by the Council on Economic and Fiscal Policy and the Government.

For FY 2004 CSTP made public their rating results on October 17, 2003. This year the rating was made for those projects whose requested budgets were more than 1 billion JPY. The rating results for 198 projects were as follows:

S: 32 projects (16%), **A**: 91 projects (46%), **B**: 59 projects (30%), **C**: 16 projects (8%).

Among projects ranked **S** lets mention a numbers that correspond to improvement of relation University-Industry, Technology Transfer and competitive funds: Software engineering by industry-university collaboration (METI), Grants-in-aid for scientific research (MEXT) with an important increase to 202,300 millions JPY compare with 176,500 FY 2003, Coordination funds for promoting S&T (MEXT), Intelligent cluster and urban area industry-university-government collaboration (MEXT), New industry creation technology development (METI), Creative technology for vitalization of local areas (METI), University IPR HQ (MEXT), Technology transfer (METI), Graduate University in Okinawa which will receive more that 4 billions JPY.

In January 2003 the CSTP mentioned his willingness to improve the system for competitive research funds. It said that the current budget allocation is based on the old system, which has been used since the time when the research funds were more limited. As a result, funding of a competent researcher may be in excess as he receives funds from several competitive programs run by government organizations. It is time to establish a robust research management system, which would be materialized by the introduction of a Program Officer (PO) or Program Director (PD) system. The detailed roles of PO and PD should be defined by each funding system. Each system should secure appropriate number of POs and PDs. The positions of PO and PD should be in the career path. Industry, academia, and government research institutions should make efforts to provide excellent POs and PDs. Funding agencies should be prepared with training systems for fostering POs and PDs. Under the initiative of the CSTP, meetings for each funding agency's PDs should be organized.

In April a CSTP team compiled a revision to the allocation of competitive funds. The revision allows company researchers to receive Grants-in-Aid, which has so far been restricted to university researchers. It also encourages young researchers to seek more competitive funds than before. Further, in an effort to promote internal competitiveness at universities, it requires national universities to reflect the amounts received by individual researchers as competitive research funds in salary and personnel matters. An English summary of the main recommendations of CSTP was given in June [27].

In August MEXT announced that it totally review the Grants-in-Aid for Scientific Research system, solicitation-type research grants for researchers at universities and public research institutions, so that company researchers will be able to apply for the grants, whereas it has not been possible. Other items to be improved will include placing more value on the evaluation of research plan rather than the previous record of receiving the grants, enabling carry-over of unused research funds to the next fiscal year, and hiring of experts who make decision on the priority research themes based on the research trends.

In August, in an effort to promote science and technology, CSTP announced that after April 2004, it will initiate its own evaluation on the management method of national university corporations. Presently it is the National Institute for Academic Degrees (NIAD) which makes the evaluation of national universities and inter-university research institutes. Last April NIAD made public the results of its fourth evaluation that focused on "general education" and "cooperation with the society through research activities." They had five evaluation standards: 1: needs to be considerably improved; 2: needs to be improved; 3: makes contributions to these points, but still needs improvement; 4: makes contributions considerably, but slightly needs improvement; 5: makes full contributions. According to NIAD, 36 percent were rated as achieving standard "5" with regard to industry-university-government collaboration; 54 percent as "4"; 8 percent as "3". It is forecasted that National university corporations will be evaluated by the "Evaluation Committee for National University Corporations" on their mid-term goals and the progress in their plans, the result of which will be reflected on their budgets from the central government. In September the names of the 16 members of the committee were made public, four members are from industry sector. In addition, three females and one foreigner serve to provide social diversity. They will evaluate national university corporations' mid-term from angles of education/research as well as management. CSTP will give high priority in the evaluation to the use of young researchers, introduction of a tenure system, and the way of promoting R&D. It will publicize the evaluation results. As one thirds of the national research budget goes to the national universities, CSTP feels the need of examining their budgets from its standpoint of the nation's S&T policy planner. The CSTP's evaluation is different from the Committee's, but will affect the management at national university corporations.

5. 3 Recent figures concerning R&D budget

Since the bursting of the economical bubble at the end of the 80's Japan is suffering from an economical recession, nevertheless the expenses for Science and Technology is regularly increasing. If we consider the last two fiscal years, 2000 and 2001, for which a national survey on research and development (R&D) expenditures and related data has been published by the MPHPT after a national survey, the results are impressive.

For the fiscal Year 2000 (April 2000 - March 2001), the total R&D expenditures were 16, 289.3 billion JPY (around 163 billion € at exchange rate of 0.01), a 1.7% increase from the previous year and a marked increase over 1998. That represented 3.18% of GNP! The breakdown of R&D expenditures by performing organizations were: 10,860.2 billion JPY by companies, 66.7% of the total expenditures; 2,220.7 billion JPY by research institutions, 13.6%; and 3,20 8.4 billion JPY by universities, 19.7%. The sources of the R&D expenditures were 12,684.2 billion JPY from the private sector, 77.9% of the total expenditure, an increase from the previous year by 1.9%, and 3,540.8 billion JPY from the central and local governments and non-profit organizations, 21.7% of the total expenditure, an increase from the previous year by 1.1%.

The character of R&D expenditures for natural science were 2,119.5 billion JPY for basic research, a 2.6% increase from the previous year; 3,566.5 billion JPY for applied research, a 3.5% increase from the previous year; 9,187.4 billion JPY for development research, a 1.1% increase from the previous year. The income from technology exports was 1,057.9 billion JPY a 10.1% increase from the previous year. The payment for technology imports was 443.3 billion JPY, a 8.0 % increase from the previous year. As a result the technology trade balance (the ratio of income against payment) was 2.39, the largest in history.

For Fiscal year 2001 (April 2001 - March 2002) the total R&D expenditures were 16,528 billion JPY (around 157 billion € at an exchange rate of 0.0095), a 1.5% increase from the previous year. The ratio of R&D expenditures against GDP was 3.29%, an increase of 0.13% from the previous year. The breakdown of R&D expenditures by performing organizations were: 11,451 billion JPY by companies, 69.3% of the total expenditures; 1,843.6 billion JPY by research institutions, 11.2%; and 3,233.4 billion JPY by universities, 19.6%. The sources of the R&D expenditures were 12,986.1 billion JPY from private sector, 78.6 % of the total expenditure and an increase from the previous year by 2.4%, and 3,476.9 billion JPY from the central and local governments and nonprofit organizations, 21% of the total expenditure and a decrease from the previous year by 1.8%. The character of R&D expenditures for natural science were 2,203.7 billion JPY for basic research; 3,525.8 billion JPY for applied research; 9,359.6 billion JPY for development research. The income from technology exports was 1,246.8 billion JPY a 17.9 percent increase from the previous year. Payments for technology import were 548.4 billion JPY, a 23.7 percent increase from the previous year. As a result, the technology trade balance was 2.27.

The total S&T-related public budget for JFY 2003 (April 2003 - March 2004), as approved by the Diet and under execution are 3,591.6 billion JPY (around 28 billion € at an exchange rate of 0.0078), an increase by 47.2 billion JPY from the previous year. For the first time the CSTP made a ranking of the different big projects and its suggestions were fully endorsed. Table 4 gives the distribution of part of the budget into the 4 mains domains.

If we consider just one of the main sectors ICT Table 5 shows that many projects have started this Fiscal Year

According to a survey conducted by the Nihon Keizai Newspaper last July on major 444 companies, the planned R&D expenditures for JFY 2003 will increase by 3.9 percent to total Yen 8,950.1 billion. The increase is attributed to companies' readiness for severe market competition and development into new businesses. Lets remind that in FY 2003 the government introduce tax cuts for company R&D, 8 to 10% of the total R&D amount will be deducted from corporate tax. Further, the reduction rate will be 10-12 percent in the first three years of the plan. The central and local governments estimate the tax reduction will reach 1.2 trillion JPY.

Table. 4: Distribution of Public S&T Budgets for Major Four Fields

Fields	JFY2003 Total Budget (Billion Yen)	JFY2002 Total Budget (Billion Yen)
Life Science	431.6	417.3
Information Science	277.1	262.3
Environment	720.1	758.4
Nanotechnology/Materials	149.1	135.2

Table. 5: ICT Sector Public Budget for FY 2003 (Billion JPY)

Ubiquitous Network	MPMHAPT	2.5	NEW
Software for E-society	MEXT	1.2	NEW
Strategic Information/Communication R&D	MPMHAPT	2.5	1.5
National Grid Computing Network Project	MEXT	2.0	NEW
Business Grid Computing Project	METI	2.7	NEW

Table. 6: S&T Budget Requests for FY 2004 (Billion yens)

Ministry/Agency	Ordinary Account	Special Account	Total Budget	Per cent of Total
Education, Culture, Sport, Science Technology (MEXT)	1,267.9 [1,050.5]**	158.0	2,476.4	62.0
Economy, Trade, Industry	242.2	460.4	702.5	17.6
Defense Agency	192.7	-	192.7	4.8
Agriculture, Forestry, Fisheries	143.1	1.5	144.6	3.6
Health, Labor and Welfare	133.3	23.3	156.7	3.9
Public Management, Home Affairs, Posts and Telecommunications	81.6	12.6	94.2	2.4
Cabinet Secretariat	67.1	-	67.1	1.7
Land, Infrastructure, and Transport	61.3	33.3	94.6	2.4
Environment	34.5	1.3	35.8	0.9
Others	32.3	-	32.3	0.7
TOTAL	**2,255.9 (1,050.5)****	**690.4**	**3,996.8**	

** to be budgeted to National University Corporations

For next fiscal year, April 2004 - March 2005, which will be discussed by the new Diet, the total demand is 3,996.8 billion JPY an increase of 11.3 percent over the previous year. It is important to notice that the proposal introduce drastic changes as a consequence of the Law that was passed in July concerning the University to become independent administrative agencies. For instance the abolishment of the "Special Account for National Schools" occurred in accordance with the national universities' shift to independent university corporations. The "Special Account for National Schools" was an account that mostly comprised the income gained from the national universities' tuition as well as income gained at the university-affiliated hospitals. As any income obtained at each national university corporation becomes its own income as of April 2004, the national university corporations will no longer need to transfer this income to the central government. Ultimately, as a consequence, the "Special Account for National Schools" will no longer exist. Instead, from April 2004 each national university corporation will request from the central government a budget that reflects the income they will have directly received.

As already mentioned CSTP has made a ranking of the different projects (cf. § 5-2)

5. 4 The Center of Excellence (CEO) Program for the 21st century

The Toyama Plan was released on June 11, 2001 and at that time a Japanese newspaper article said it has emerge just like a "black ship" which in Japan means a sign that brings a nation-level drastic change. In fact it was first introduced as the "top 30 Universities" but it was renamed in January 2002 the "CEO Program for the 21st century".

It emphasis three points

- drastically promote reorganization and consolidation of national Universities (Scrap and built)
- introduce management methods used in private sector to the management of national universities(Quick shift to independent Administrative organizations)
- introduce a competitive principle to universities by means of external evaluation (Top 30 universities)

For the first year (FY 2002) five fields were selected: Life Science, Chemistry/Materials Science, Information/Electrics/Electronics, Human Literature, Interdisciplinary/New Areas. A budget of 18.2 billion JPY was allocated in JFY 2002. Each of the selected universities will receive between Yen 100 to 500 million per year for five years, with an interim review after the first two years. MEXT received 464 applications from 163 universities in a total of five fields. The Expert committee members reviewed the applications. In November 2003 the results were published: 113 projects from 50 universities were selected in the different fields.

Life Science: 28 projects

Chemistry/Materials Science: 21 projects

Information/Electric/Electronics: 20 projects

Human Literature: 20 projects

Interdisciplinary/New fields: 24 projects

In total national universities projects represented 74.3% of the total and they received 77.6% of the funds, private universities received 19.2% of the funds, the rest going to "Provincial" universities.

For the second year, JFY2003 five different fields were selected: Medical Science Mathematics/Physics/Earth Science, Mechanical/Civil and Construction Engineering, Social Science, Interdisciplinary, New Areas. The Expert committee members have selected 133 projects from 56 universities out of 611 applications from 225 universities.

Medical science 35

Mathematics/Physics/Geoscience 24

Machinery/Civil engineering/Construction/Other engineering 23

Social science 26

Interdisciplinary/New fields 25

For the two years in total 246 projects have been selected from 85 universities The total number awarded per universities are: Tokyo University 25, Kyoto University 22, Osaka University 14, Nagoya University 13, Tohoku University 12, Keio University 12, Hokkaido University 10, Tokyo Institute of Technology 9, Waseda University 9, Kyushu University 8, Kobe University 7, etc.

Due to the success and efficiency of the CEO program MEXT announced in August to have another round in JFY 2004. It will be a challenging opportunity for those universities which were not selected as COEs in the first two years. The fields to be solicited will be the same as in the first round: life science, chemistry/materials science, information/electrics/electronics, human science, and interdisciplinary areas. In its evaluation CSTP ranked the demand **A** with 41,746 millions JPY instead of 33,383 FY 2003.

5.5 Relation between University and Industry and Technology Transfer

5.5.1 Introduction

In order to attain the Government of Japan's goal of becoming a "technology-oriented nation" in the 21st Century, the need to establish better mechanisms for facilitating research collaboration among university-industry-government has been receiving a great deal of attention.

The important changes that influenced the relationship between University-Industry and Transfer of Technology started of course with the "1998 Law for Promoting University-Industry Technology Transfer (creation of TLO)" but it was mainly the "Law to Strengthen Industrial Technical Ability- the "Japanese Bayh-Dole Act" that boosted things. It corresponds to Deregulation and Incentive in National Technology Transfer. For instance

- National and local government facilitate the acceptance of funds from the private sector to national and public universities (long term contract),
- National government approves the unremunerated use of nationally owned assets (national university campus) of TLO.
- Deregulation of side businesses (outside working hours) of national and public instructors and researchers: They can work as officers of private corporation for the sake of transfer of technology to private sector, when the corporation plans to commercialize the results of their research. They can work as auditors of Private corporation. They can work as officers or consultants of TLOs that are related to technology transfer. They can obtain equities

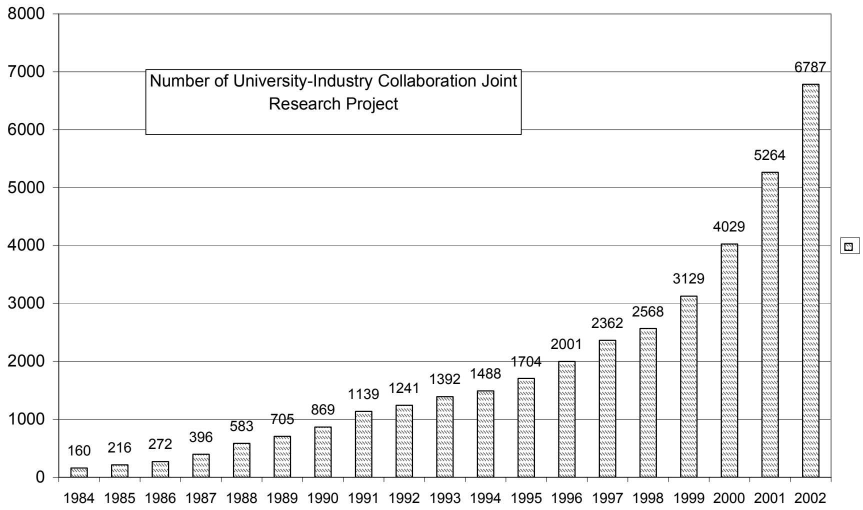

Fig. 24: Evolution of Joint Research projects between

(stock options) as remuneration from their Venture Companies (2002). Also MEXT abandoned the ceiling of 6 millions yens on compensation money for patent and recommended 25 to 30% of the profit to be paid to the inventor

The effects of the two Laws can be seen in Figure 24 on the number of University-Industry joint research for National Universities: the increase is spectacular. At the same time the number of Cooperative Research Center also increased rapidly: 3 in FY 1987, 23 in FY 1991 and 63 FY 2002.

After the two Laws were promulgated there was an acceleration of the process, including the creation of "Intellectual Clusters", "City area program", "Industrial Clusters", etc., and the Intellectual Property Law in 2002 just before the National University Bills in 2003 were the last elements to foster innovation policy in "national" institutions.

To improve what was widely regarded as the inflexible and insufficient mechanism for University-Industry collaboration the first Summit Meeting for Collaboration among Industry, University, and Government was held on November 2001. It was followed by industry-university-government summit meetings at various places across Japan. During the Second Business-Academia-Government Summit held one year later in Tokyo in November 2002 with as a topic "Strategies for Business-Academia-Government Collaboration", and attended by more than one thousand people, it was mentioned that collaboration among the three sectors has been producing successful results at a national level. For instance, the number of cooperative research projects has exceeded 5,200, a 30 percent increase from the previous year, the number of university-related venture companies has reached 453, which marked a large increase of 65 percent from the previous year. Also, the positive economic effect delivered through the activity of TLOs was said to have reached 10 billion Japanese Yen. One of the facts that was pointed out was the importance of developing new industries at the local level and therefore to increase contacts at that level. A system of awards to universities and companies that are exemplary in promoting collaboration has been created and the awards has been presented at the Business-Academia-Government Summit. The Third meeting took place recently, November 17 and focused on IP and University-Industry relation. It is interesting to remember that MEXT has a special program for "university patent business" as universities will develop a IPR policy. In July 2003 it announced that it has chosen 34 institutions out of 83 applications to provide them with 40-80 MJPY per year for five years. The grants will be used for hiring IPR specialists. The investments will help materialize plans such as the University of Tokyo's plan to have 30 university-based venture companies in 2007, and Kyoto University's to have 150 patent applications in five years. Also, Tokyo Medical & Dental University has a plan to hire an IPR specialist from the U.S. At the same time MEXT announced that for FY 2004 it has requested special funds to provide subsidies to the universities which are making outstanding efforts for improving education by means of, for example, promoting industry-university-government collaboration and using distance learning. The total amount of the support will be about 20 BJPY. The subsidies to be made in JFY 2004 will come from the same source of funds for all types of universities "National", Public or Private, which is expected to enhance competition among universities.

In March 2002 a seminar was organized by the Advanced Technology Business Center (AcTeB) at the Research Center for Advanced Science and Technology (RCAST- Tokyo University) on "Industry-Academia Collaboration in a Knowledge-based Society: the Viewpoint of Academia". In that seminar the system reform plan for Industry-Academia- Government Collaboration was described by K. Isogai [29]. In the same seminar H. Arai, who is now the General Secretary of the IPR HQ, described the seven strategies for intellectual property to serve as a catalyst for the revival of the Japanese economy [30]. He emphases the role of TLO in promoting collaboration under the conditions that more flexibility is given to them…. In his conclusion he said: "universities must serve as source of basic inventions, as a vital engine in collaboration between business and academia and as a wellspring of venture business."

MEXT and METI are the two key partners in the development of university-industry relationship taking different actions. As an example METI is supporting each year through a program run by the "Regional Technology Division" different projects in R&D in which universities or public research Institutions are partners with industry: the budget for FY 2002 was 8.77 billion JPY, in FY 2003 it is 10.11 billion. According to Y. Tsukamoto, director of the division this program is very selective: 1 out of 10 requests is selected [31].

Another fact has to be mentioned: the number of "consortia", in which public institutions and companies join their efforts and potential in order to re-vitalize the competitiveness of Japanese industry in developing specific research, is increasing. For instance in June 2002, 16 research institutions, including NEC and Fujitsu, and 10 universities, including the University of Tokyo, announced that they will establish a research organization which will focus on research in "Grid Computing". The target is to establish the information infrastructure which is essential for research in biotechnology and space science. In November 2002 Kyoto University announced the creation of the "Organic Electronic Materials and Device Project" with the collaboration of five large companies NTT, Pioneer, Hitachi, Mitsubishi Chemical and Rohm, each company investing 50 MJPY/year. More recently in August 2003, 100 manufacturing companies, including Mitsubishi, Toshiba, announced that they will work with major universities in different fields. This program will benefit from METI support. On the other hand in June 2003 the Ministry of Public Management, Home Affairs, Post and Telecommunication announced that in 2004 it will establish a "government-industry" co-funding system, 50/50. In September 2003, a consortium of seven medical firms including Olympus Optical and Hitachi Medical Corp. announced that they have signed a 3 years contract with the University of Tokyo to develop a "cells data bank" in order to investigate research in regenerative medicine. Each company will pay 70 MJPY/year. The last example we will mention is the association in October between NEC and RIKEN to develop joint research in computing quantum.

5. 5. 2 Activities of Technology Licensing Organization (TLO)

The Law for Promoting University-Industry Technology Transfer, established Technology Licensing Organizations (TLO) which deal with obtaining patents, marketing and licensing on the sake of university researchers. Formally the TLO has to be approved/authorized by government which in return will give some subsidies and reduce the cost of patent application. MEXT and METI supported the TLO: METI is funding them, 30 MJPY/year for 5 years, MEXT is providing material support for IP, personnel, etc. In FY 2001 the Industrial Structure Improvement Fund gave about 300,000 € to each of the 26 approved TLO. Figure 25 represents the evolution of the number of TLO. The way TLO are performing is shown in Figure 26. Since the enactment of the Law, 36 TLO have been approved, as October 2003 (Fig.27), 27 from National Universities and 7 from Private Universities. Some are associated to a single university, some others are "regional TLO" associated with multiples universities, e.g. Kansai TLO located in the Kyoto Research Park, a privately owned organization

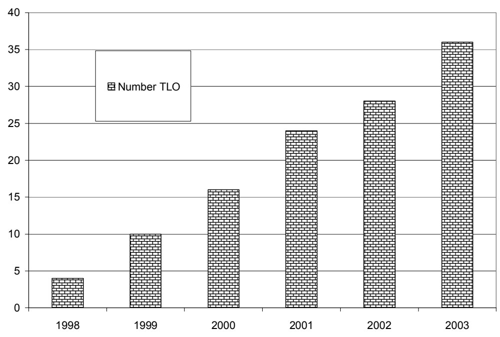

Fig. 25: Evolution of number of TLO

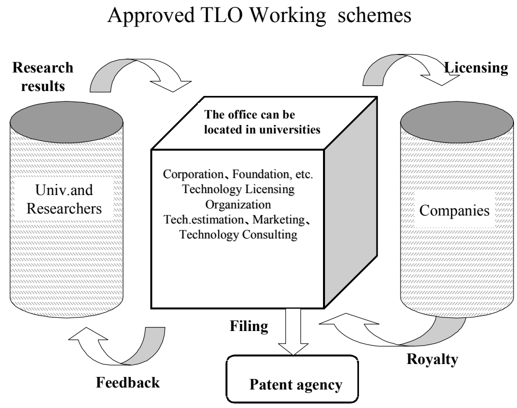

Fig. 26: Approved working scheme for TLO

which provides services to companies including incubation facilities for new companies. The legal status varies and they are either “Foundations” like Kumamoto Technology and Industry Foundation or Nagoya Industrial Science Research Institute, or the Foundation for the Promotion of Industrial Science, others are “Corporations” like Tohoku Techno Arch Co., Ltd or Kanazawa University Licensing Organization Co., Ltd, or TAMA-TLO Ltd, others are “University” like Waseda University Intellectual Property Center, or Keio Intellectual Property Center or Meiji University Property Center. In the Kanto area there are 13 TLO, 6 are “Corporations” like the most famous and oldest “Center for Advanced Science and Technology Incubation Ltd” -CASTI- from Tokyo University, 5 are “University”, 2 are “Foundations”. At the beginning there were some restriction in establishing TLO on university campus but nowadays that is possible.

METI made a survey concerning the 26 TLO supported in FY 2001. Its funding was 350 million JPY. The income of TLO were analyzed, the average was 58.504 MJPY,

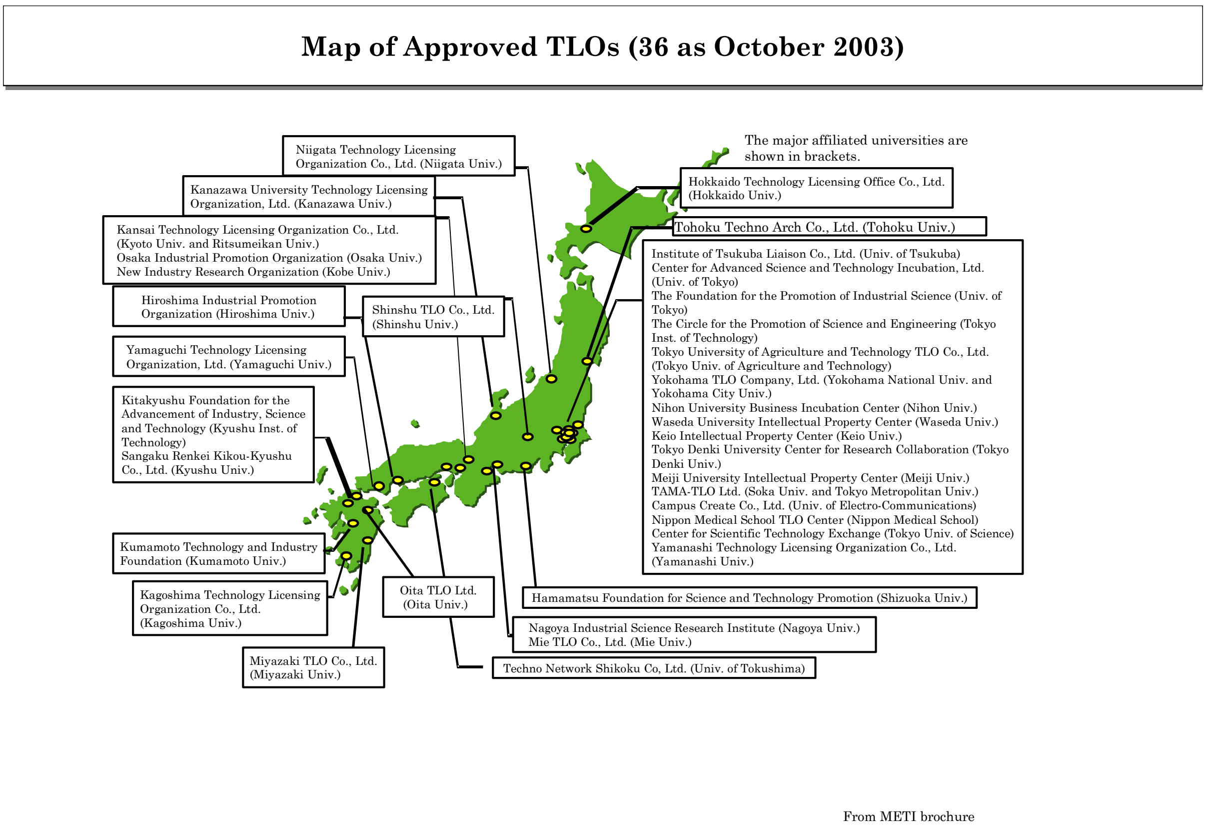

Fig. 27: Map of TLO in Japan

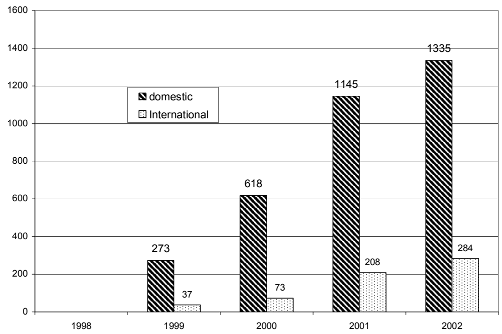

Fig. 28: Evolution of the number of patent applications in TLO

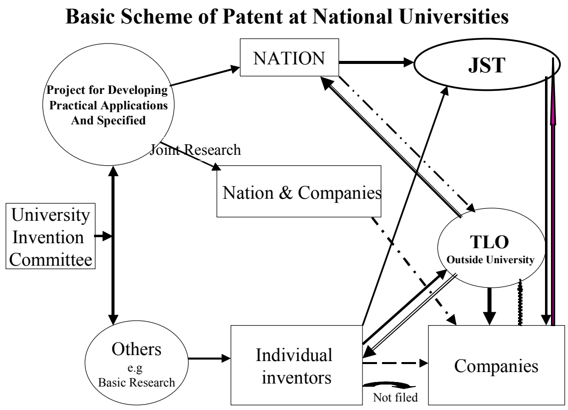

Fig. 29: Basic Scheme of patent at National University

11.079 MJPY from royalty, 14.706 MJPY from membership, 13.709 MJPY from METI, 16.909 MJPY from others resources and 2.101 MJPY from local government. As far as expenses are concerned the average were 49.388 MJPY, the main expenses been for filing fees 28.211 MJPY, 7.539 MJPY for technology transfer specialist, etc. As far as activities were concerned the number of patent applications were, domestic 1,145, international 208, the number of working licenses at that period was 231. The royalties returned to TLO were 300 MJPY of which 100 MJPY were returned to universities.

According to a new survey in 2003 the TLO's activities have been satisfactory: the number of patent applications increased very much from 33 in 1998 to 618 in 2000 and in total 3 378 from start until March 2003 (cf. Fig.28). For the period April 2003 to September the number of patent filed through TLO was 1,143 [32] At the same time the number of patent issued also increased from 1 in 1998 to 98 in 2000 and 705 in 2002. In FY 2002 the amount of royalties received by TLO was 546 MJPY an increase from 300 MJPY the year before. Let us remind that under the present system (cf. Fig.29) the researcher of a national university "inventor" who would like to apply for a patent must consult the university invention committee which will decide if the university will take the patent or not. If the decision is "yes" the Japan Science and Technology Corporation (JST) will take responsibility. If the answer is "no" the inventor will decide what to do and normally will contact the TLO if it exists. The number of patent filed through "government-national universities" was 149 in 1997, 609 in 2000, 641 in 2001 and 830 in FY 2002. The number of patent issued were for instance 90 in 1997 and 103 in 2002. The amount of royalties received by "government" was 261 MJPY in FY 2000 and 206 MJPY in FY 2001 [31, 35].

In the frame of the IP Law (July 2003) each Ministry has to prepare for next FY its "Intellectual Property Strategic Plan" for its relevant linked institutions. MEXT, taking into account the fact that in July 2004 national universities will become independent university corporations, has prepared its strategy both for the creation of IP and also for management and exploitation of IP. To foster the creation of IP, MEXT will promote high quality basic research and will implement "leading projects" in the priority fields. At the same time to manage and exploit IP, MEXT will support international patent applications through JST. MEXT will also establish "Intellectual Property Center" in 43 Universities which have been selected: they will receive a financial support. For FY 2004, MEXT has also request some funds to support the patent application from universities mainly for international patents.

5. 5. 3 Incubators

The policy concerning "incubators" is not as established as for TLO and again both MEXT and METI are the key partners. MEXT started its "incubator program" in 2001. In the frame of the " first supplementary budget" its dedicated 979 MJPY to build incubator facilities on the campus of 3 national universities. In the frame of the second supplementary budget for FY 2001, MEXT used 3,852 MJPY for expanding the "program" to 10 more national university. Starting July 2002 Nagoya University, Tokyo Institute of Technology and Tohoku University authorized their academic staff to use their incubators for launching their Venture business. In FY 2003 MEXT, also in the frame of the supplementary budget, added 10 new incubators in national universities for 3,852 MJPY. In total presently there are 23 "incubators facilities" on the campuses of national universities. MEXT use its money not only for the buildings but also to provide some equipment. Moreover there are also "incubators" in private universities. The innovative companies can stay 5 years inside the incubator paying a reduced fare for using all the facilities. MEXT developed also in some "Graduate Schools" what is called "Venture Business Laboratories" (VLB). VLB is aimed to use the capabilities and ideas of graduates students and provide them with material facilities to develop their project. VLB even organize contests between the students. MEXT has supported VLB in 39 universities.

METI announced in December 2002 that it has launched a special program for opening incubators close to universities which will support university-oriented venture companies. Faculty members and students will be housed in the incubator companies and experts will teach management, know-how and commercial development methods. Whereas the TLO and incubators established in the universities deal with technology transfer from universities to industries, METI's incubators will support transfer from the early stage of idea development through industrialization, and even through venture business. In 2002 METI dedicated 5.3 BJPY to that program. For 2003 METI selected Kashiwa campus of Tokyo University, Katsura campus of Kyoto University and Kasatsu campus of Ritsumeikan University and allocated around 2.0 BJPY.METI has requested 2.1 BJPY for FY 2004.

5. 5. 4 MEXT specific programs for Intellectual Clusters and City Area program

As it was announced in June 2001 by MEXT in his "University-based Structural Reform Plan for Revitalizing the Japanese Economy" different actions were launched to "Revitalize cities and regional areas in adapting universities to integrate cities and regional areas". More precisely one corresponds to the establishment of "Intellectual Clusters" in the frame of the Second S&T Plan. The idea is to use the regional R&D resources to upgrade and vary S&T in the country as well as to revitalize the Japanese economy through regional technical innovation and creation of new industries. An Intellectual Cluster is "a regional system of technological innovations in which a public research organization uses its R&D potential and other unique abilities to lead companies in and around a peculiar region". It is aimed at to promote several Industry-Academy-Government programs intensively. In 2000/2001 a task force studied the proposals from 30 local governments and after selection the program was launched in July 2002. Figure 30 represents the different Intellectual

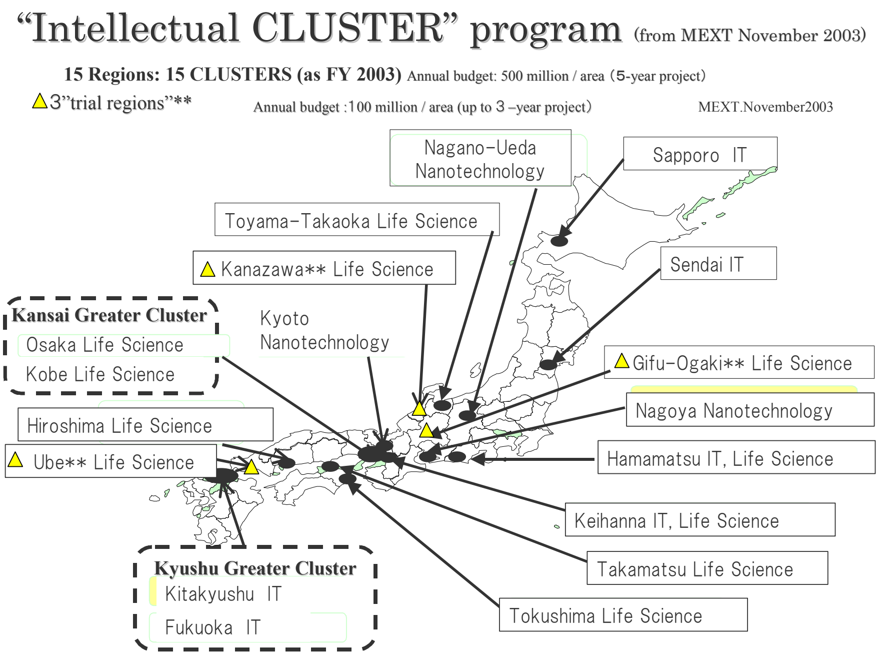

Fig. 30: Map of Intellectual Clusters

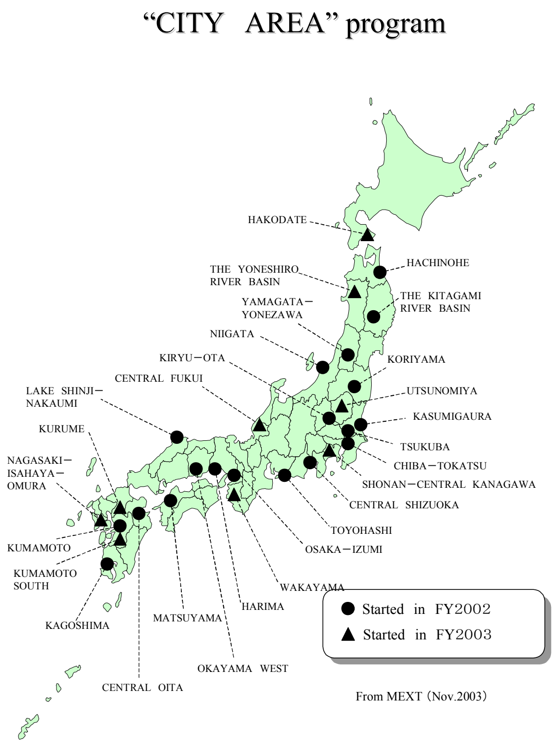

Fig. 31: Map of "City area" program

Clusters that have been selected with their fields. MEXT in FY 2002 invested 6 BJPY (around 57 M €) on the program, giving to each of the 13 Intellectual Clusters 500 MJPY per year for 5 years. At the same time MEXT established 3 “trial regions” providing each with maximum 100 MJPY/year for 3 years. Each intellectual cluster agglomerates universities, other public institutions, companies, R&D firms, etc. and was planned by local government which will also give some material support including location, building, personnel, etc. The activities will not consist only on research activities but also human resources training, formation to transfer of technology, IP, etc. The fields that have been selected correspond to Second S&T Plan priority fields, namely Life Science (10), Information Technology (5) and Nanotechnology (3). It must be mentioned that there is an important concentration in the Kansai area with Kyoto, Osaka, Kobe and Keihanna in Life Science. In Kyushu area two Intellectual clusters have been chosen in IT with the idea of supporting the “Silicon-Sea Belt “. It seems that in FY 2004, if the Ministry of Finance accepts MEXT’s budget proposal, there will be 16 clusters.

At the same time MEXT has developed another concept which is the “City area” program which deals in supporting cooperation for innovative technology and advanced research in what is called “evolutional area”. In fact it concerns “cities” and association at that level of public research institutions, industrial companies, etc., and the selected “cities” will benefit from MEXT’s support of 100 MJPY/year for 3 years. Figure 31 gives the distribution of “City area”. This program started in FY 2002 and among 33 reviewed proposals, MEXT supported 19. The following year among 26 reviewed projects only 9 were accepted and supported [33]. This program is very popular and more demand are expected for FY 2004.

5.5.5 Industrial Clusters

This program was initiated by METI. As H. Inoue [34] explained the reasons to establish such a program were:

- Changes in international competition environment
- Collapse of “Keiretsu” relationship between big enterprise and small and medium size enterprises (SME)
- Isolation of enterprises in local areas in spite of their high technical capabilities
- Stagnation of traditional regional industrial policy focusing moves of factories

Under that circumstances METI decided in 2001 to activate the network University-Research Institutions-Enterprise, mainly SME ones, without excluding of course the large ones. The METI regional offices, 8, played an important role in that program in the selection of the projects. Each year 500 to 600 MJPY are specifically devoted to that program but it is also supported by others R&D METI’s budget. The main participants are 5000 SME, 200 universities, the regional METI staff and Network organizations. The main activities are: Support for academic, business, government circles, the exchange program, seminars, workshops, the promotion of exchange and cooperation helped by coordinators. Figure 32 represents the location of the 19 Industrial Clusters existing as November 2003. The first industrial cluster established by METI was the “Technology-Advanced Metropolitan Area” (TAMA) project, including Tokyo, the south-west portion of Saitama Prefecture, and the central portion of Kanagawa Prefecture. In fact TAMA was prepared before the idea of industrial cluster was launched because of the industrial and technological base that existed in that area due to the relocation of dominant factories from inner-city district

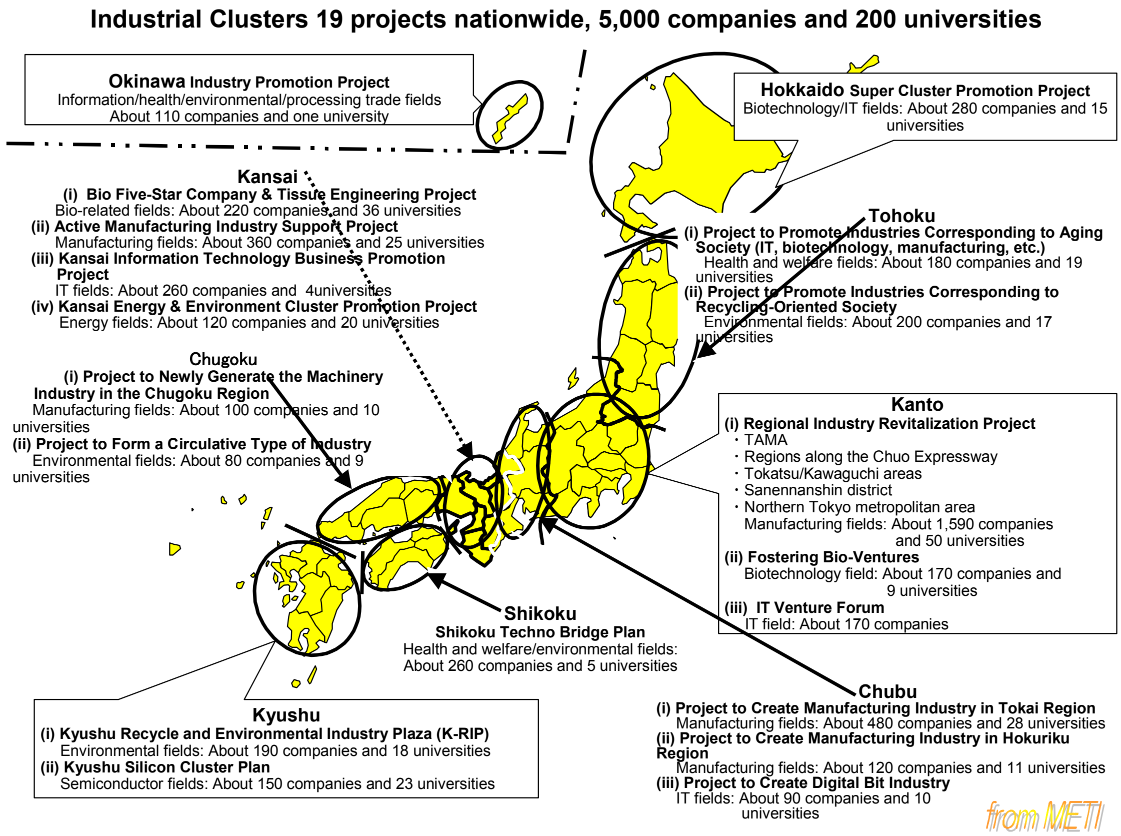

Fig. 32: Map of Industrial Clusters

and Keihin coastal area in pre-war era. As a consequence there was in TAMA an accumulation of subcontract enterprises: Electricity, Electron, Transportation, Precision machine, SME with product development abilities. In 1996 the METI Kanto office started a research about actual situation of enterprises and activities that utilize industrial accumulation and human network in wide Tama area. In 1997 a preparatory committee for wide Tama area local industrial vitalization council was established including enterprises, universities, official research organization, commerce groups, government organizations, etc. In 1998 TAMA industrial vitalization association was created with 328 members and TAMA activities started supported by MITI. Presently there are 17 Local governments, 28 Universities, 3 Public research institutes, 4 Business incubators, etc. In FY 2001, 1.73 billion JPY were invested in 37 cases concerning 56 companies and 17 universities. In April 2003 "TAMA Fund" a local venture capital company started with 500 million JPY.

Another interesting industrial cluster is the Hokkaido IT/Biotechnology Industrial Clusters (Hokkaido Super Cluster Promotion Project). There are about 230 IT companies, 50 Biotechnology companies. Hokkaido Prefecture and Sapporo City are involved in the project together with 15 universities, 5 Public research institutes, 5 Business incubators, 44 Fund supply. In FY 2001, 2.18 billion JPY were invested in 56 cases concerning 73 companies and 26 universities. Another relevant industrial cluster is the Kinki Bio Clusters (Bio Five-Star Company & Tissue Engineering Project) in which more than 220 companies participate with 9 Local governments, 36 Universities (Kyoto University, Osaka University, etc.), 14 Public research institutes (AIST Kansai, RIKEN Center for Developmental Biology, etc.), 20 Business incubators including Kyoto Research Park Co., Ltd. and 24 Fund supply. In FY 2001, 3.18 billion JPY were invested in 96 cases (81 companies and 93 universities).

It is relevant to mention that there are more and more joint actions between the "intellectual clusters" and the "industrial clusters": joint seminars, joint exhibitions, and more and more the "industrial clusters" take the relay for funding the "seeds" that have been selected and supported by "intellectual clusters".

5.5.6 Start-up Policy

The creation of companies based on the results of public research (Universities or "National" Institutes or Laboratories) is very recent in Japan. It started after the different Laws (1998-2000) were passed. In connection with the TLO it was proposed to link achievements of university research directly with creation of new businesses. In June 2001, T. Hiranuma, Minister in charge of METI, submitted a "Plan for 1000 Start-Ups Deriving From Universities". This Plan was accepted and became a National Plan. The Plan suggested various actions concerning "University-Originated Start-ups; Acceleration of Creating New Business". The first is to develop means of recruiting business persons for university professorships in order to educate and train competent young persons to set up new businesses. The creation of courses like Business and Management of Technology (MoT) at all colleges of science and engineering is encouraged. Each university is urged to recruit and appoint MoT professors. The second recommendation concerned a smooth supply of venture capital based on business needs. By recruiting more business persons as professors or researchers, and by fortifying matching mechanisms for "Joint Research", company needs should be reflected in university research activities, and also assistance for university-originated start-ups at their early stages should be promoted. The third recommendation is facilitating incubation by fortifying functions of TLO, relaxing control over usage of national university facilities by start up of university origins. On the other hand MEXT also proposed suggestions related to revitalization of economy, that was its "University-based Structural Reform Plan for Revitalizing the Japanese Economy": increasing the numbers of patents attained by universities to 1500 yearly within ten years, licensing a total of 700 such patents to private enterprises within five years, and creating 10 Japanese versions of "Silicon Valley" within ten years. In July 2002 the Chairman of the "Foundation for Advancement of International Science" in Tsukuba said "the resources at the Universities and research Institutes are the last treasure mountain left in Japan". In FY 2003 METI invested more than 14 Billion JPY to support start-ups including 5.2 BJPY for project to create university-based businesses and develop practical application, almost 2.5 BJPY for developing incubation facilities, 3 BJPY for "entrepreneur" program. One of the remaining difficulty for establishing a start-up was lifted in February 2003 when on METI's proposal it was accepted that to create a SME only one yen is necessary as initial capital and the normal 3 millions yens have to be brought in capital before 5 years.

As a result of these different changes there was a sharp increase of the number of Start-ups (cf. Fig.33) from 104 in 1998 to around 600 in August 2003 [35]. Figures 34, 35 and 36 represent the results of a survey made on January 2003 by MEXT concerning 427 start-ups: the domains are the same as in all countries namely, IT, bio/pharmacy, materials, etc. According to Tanaka [35] the percentage of start-ups issued from national universities is increasing,

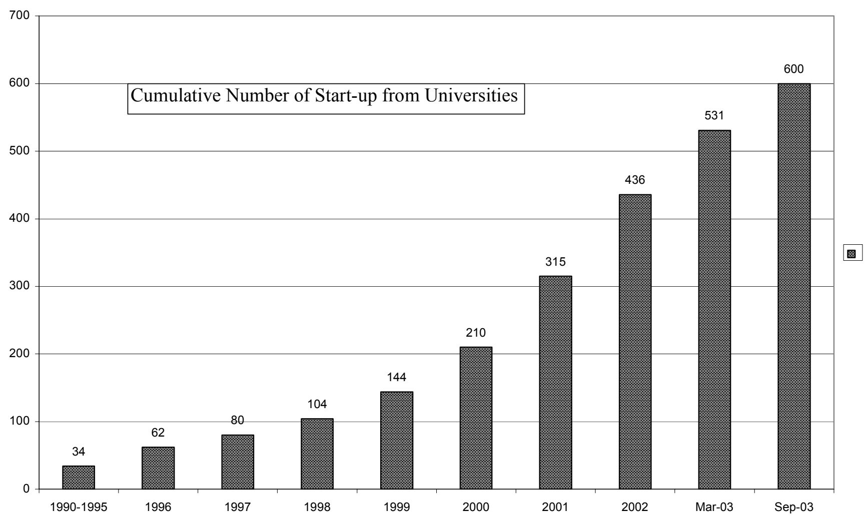

Fig. 33: Evolution of number of Start-ups

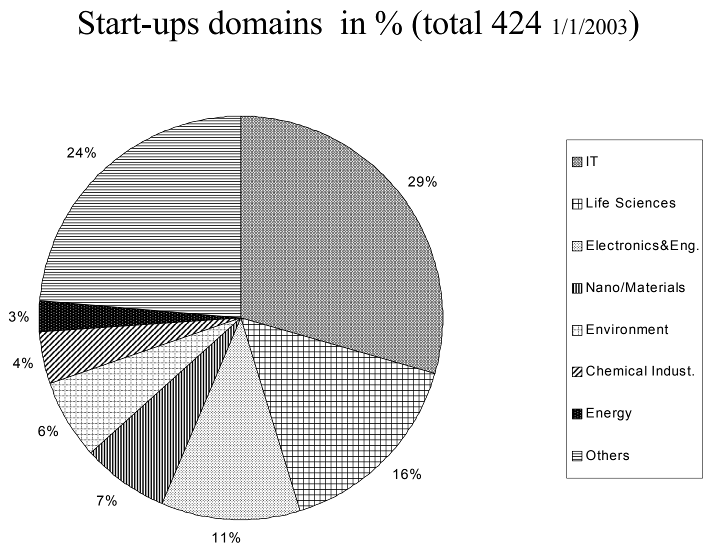

Fig. 34: Domains of Start-up (as March 2003)

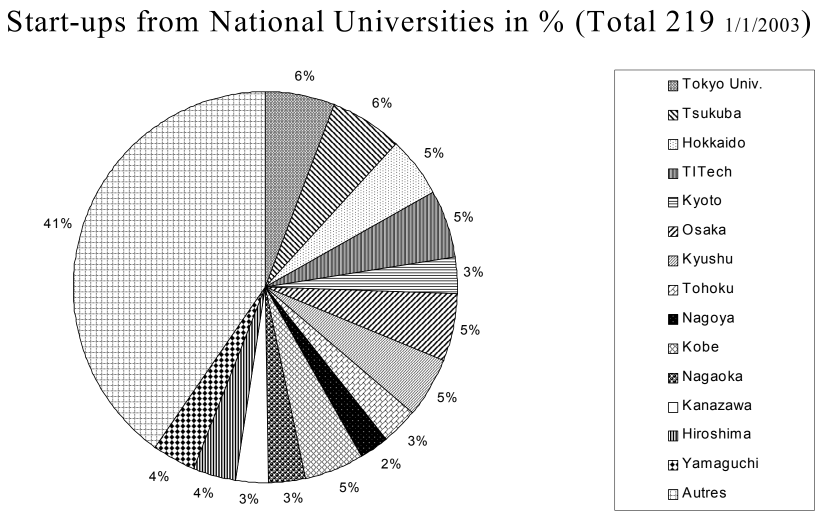

Fig. 35: Number of Star-ups from National universities

41% in 2000, 66% in 2002. It shows that private universities reacted immediately to the possibilities introduced by the Laws, instead national and pubic universities need some time to adapt themselves to the new environment. Moreover the private universities active in technological R&D are not so numerous (Keio, Waseda, Rietsumeikan, Nihon, Kochi,..) and therefore they have now less possibilities to exploit. According to a survey published in May 2003 by Nihon Keizai Shimbun, Waseda had 42 Start-ups, Tokyo University 32, Keio University 24, Kyoto University and Osaka University 23 each, etc. Among the various Start-ups, 20% have a plan to offer their stocks on the market. Another survey presented by METI [36] concerning financial aspects showed that the majority, 37%, have a capital between 10 and 30 Million JPY, 18% less than 10 million JPY and 13% between 30 and 50 MJPY (cf. Fig.37). In the same survey it was mentioned that for 28% sales represented less that 10 MJPY, for 38% between 10 and 100 MJPY, for 29% between 100 and 1,000 MJPY and for 5% above 1,000 MJPY. The strong points that were mentioned were name value of Institutions (61.8%) and facilities at low cost or free (39.3%), mentioned weak points were little experience in management (48.9%), financial instability (28.7%) and administrative limitations

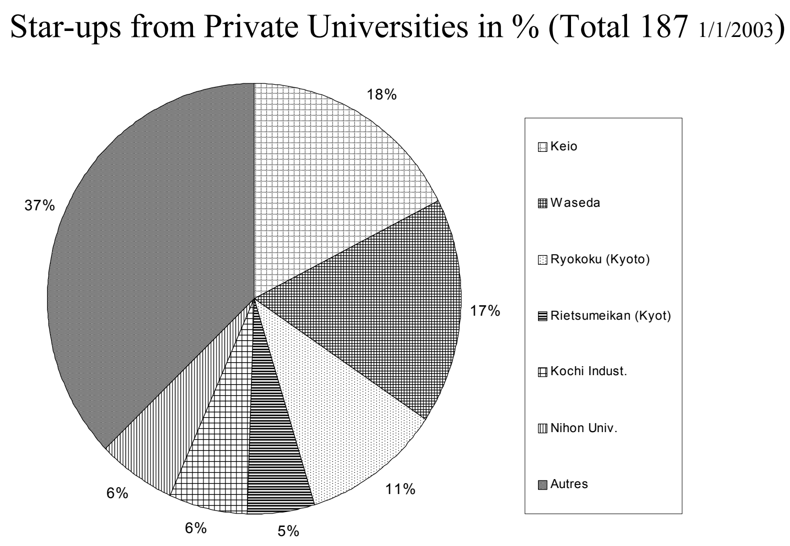

Fig. 36: Number of Star-ups from Private universities

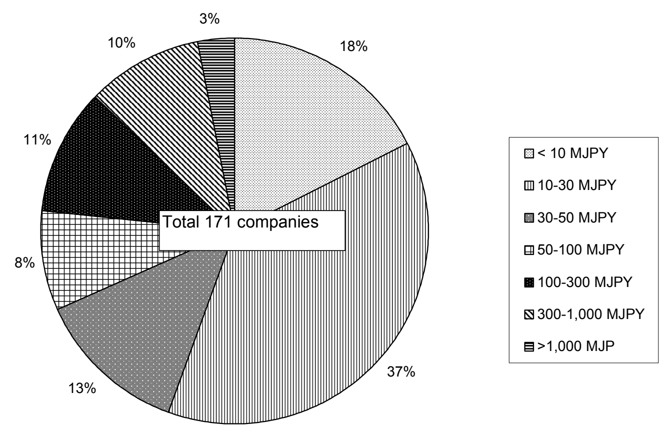

Fig. 37: Capital of Star-ups

(28.7%). One of the domain that draw more attention and financial support is the “Bio sector”. According to surveys conducted by Nihon Keizai Shimbun and Nikkei Industrial Consumption Research Institute, 99 venture business companies that answered selectively invest in universities technologies: biotechnologies and nanotechnologies. In FY 2002 they invested 167.3 BJPY, a 29% decrease from 2001, but investments in “bio-venture” were 8.8 BJPY, a 33% increase and 1.3 BJPY in nano-technology, 3.3 times more than 2001. METI has announced that in FY 2004 it will establish a new system for fostering consortia of bio-venture companies: it will support with one BJPY each consortium involving major pharmaceutical companies and bio-venture company. Also some major universities like Osaka, Tokyo, will have as previous years the competition “Bio Business Competition” in the frame of “university-industry-government” plan supported by METI. It is relevant to notice that Bio Ventures are increasingly registered on the Stock market, the first one was AnGesMG, a genetic treatment pharmaceutical company in fall 2002.

AIST deserves a special mention as since it has been an “independent organism” it has undertaken many reforms of structures (April 2001) and more important of culture. Of course the major part of the budget is coming from METI but with the new structures researchers have more freedom for their research directions but three individual external evaluations were carried out between April 2001 and March 2003 … Cooperation inside AIST (inter-units and interdisciplinary) has developed at the same time as it increased with industry: the number of researchers coming from industry to work full time at AIST in 2003 is more than 450, the number of cooperative research which represented 18 MJPY in 2000 reached 545 MJPY in 2002…. At the same time AIST changed its system of patent which is now very similar to the university system used in USA [39] using its TLO and granting 25% of royalty rights to the inventor. AIST for many years had roughly 1000 patent per years but the "return" was very low. For instance in FY 2000 with 149 licensing to industry royalties were 46 MJPY. In 2002 with 228 licensing the royalties reached 246 MJPY. In the case of Star-ups also AIST has launched a "new project" with the support of METI and also of MEXT. The start-up will benefit of the AIST facilities at reduced cost (25% is charged), intellectual property is 50% shared, etc. They open an office "AIST Innovation Center for Start-ups" located in the "industrial business Tokyo sector". AIST will benefit of a budget of 900 MJPY/year for 5 years. They have already 24 start-ups.

5.6 Conclusion

In recent years, after middle of the 90s, Japan adopted a new approach of its Science and Technology policy. This process accelerated tremendously after 1998 and even more after the creation of the CSTP in 2001, a "control tower" of the S&T policy which allows the Japanese government to have a strategic approach in that field.

Of course still some things have to be improved and that one of the targets of the Second Science and Technology Basic Plan. The Intellectual Property Law (December 2002) and the National University Reform Bill (July 2003) will have certainly more effects on the innovation process and Transfer of Technology process from "public" institutions. Among the benefit of the future changes lets us mention that the ownership of "public" inventions would be clear, the ministries bureaucracies have less control, the "public" institutions will have more flexibility in hiring and promotion of personnel (the famous RIKEN just announced it will introduce annual salary system), they can invest in Start-ups developing results of their researchers, etc. Still there are some issues to be taken care of like application measures for conflict of interest, university careers of young researchers, divided authority between TLO activities and the Intellectual Property Center that will be establish in agreement with the Law, and of course bureaucracy particularly in IP management! Nevertheless Japan is willing to use all its potential for Innovation and Technology Transfer and for that it is changing the culture of its researchers, industry seems to be ready to follow, business angels develop and even Banking system is establishing facilities under the "pressure" of the government.

6 Conclusion

The survey of the changes that appeared recently in France and Japan demonstrates that both countries are moving in the same direction to improve their innovation policy and technology transfer and that quite often they are using the "same recipes" hoping to obtain similar results: take advantage of all the potential that exists in "public institutions", "alleviating" the administrative burden and changing the culture in the different components involved in the process. It has to be remember as Ghosn [40], Nissan CEO, said "solutions are not transposable as they fit the proper existing situation of the company, its history, its men and women belonging to it", similar problems have to be faced by adapting the solutions to the national context.

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