Fiscal Incentives to R&D in Mexico: An Evaluation of the Governmental Programme from 2001 to 2006

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Abstract

The present work is an independent academic evaluation of the tax incentives to R&D programme implemented in Mexico in recent years. The study covers the years from 2001 to 2006 and is mainly based on information publicly available. Our main findings show that fiscal incentives in Mexico have been mainly granted to large firms concentrated in a few developed regions of the country (the capital of the country and the northern state of Nuevo Leon). While the latter is not surprising since Mexican industry is highly concentrated in these regions, the overall results suggest that some fine tuning in the design of the scheme could be desirable to achieve a better distribution of resources including other important regions of industrial activity as well as micro– and SMEs. In addition, we observed that the projects submitted by firms to compete for tax credits, correspond to a relatively low level of technological complexity and novelty. Therefore, it is suggested too that the fine tuning of the policy instrument could be directed to develop business capabilities in scientific research and emerging areas of technology. We conclude with a series of recommendations concerning general and particular aspects of the design of the fiscal incentives programme. These are mainly focused on the need for a more vertical or oriented approach of the scheme as well as its urgent integration with other areas of innovation policy. Our conclusions also include a brief consideration regarding the impact that a fiscal reform, passed by the Congress in 2007, could have on the tax incentives programme

1. Introduction

Innovation policies, understood as a synthesis of science, technology and industrial policies comprise diverse mechanisms used by governments to promote the generation and diffusion of technological innovations within a national economy. In market economies, these derive from three premises: (1) the rate of innovation in a country is positively associated with the national capacity of wealth creation; (2) there is a positive correlation between the innovative capabilities of firms and their overall expenditure on research and development (R&D); (3) the occurrence of diverse market failures prevents the achievement of a socially desirable level of resources allocated to knowledge generation activities by means of the market mechanism.

From these premises it is inferred that government intervention is needed to correct market failures to achieve the desirable levels of R&D expenditure, and consequently, increasing the firms' capabilities to innovate. This in turn would help to raise the national capacity of wealth creation. Among the wide variety of innovation policies, the more frequently used are aimed at reducing business research and development costs. These consist of two general types: direct measures, such as R&D financing

programmes; and indirect measures, mainly constituted by fiscal incentives. These latter generally provide a tax credit or allowance for some portion of firms' R&D expenditures, reducing the cost of research and development activities and raising the net present value of prospective research projects.

Depending on diverse specific circumstances, R&D tax incentives can be an effective instrument for inducing certain levels of business sector research. Some studies show that this type of policy can increase private spending by an amount equal to the loss in tax revenue on average.[1] However, the effectiveness of fiscal measures depends very much on the design of the scheme relative to policy objectives. Among the main design issues we can mention aspects of administration, for governments and firms; form of the incentive, allowances or credits; type of spending eligibility, volume or increment; type and scope of innovation and R&D activities; and, foreign firm eligibility.[2]

In Mexico, diverse but limited fiscal incentives have been used to promote technology development since the 1960s, but only recently a more aggressive approach has been implemented by the Mexican government.[3] In the current scheme, firms submit R&D projects, which were developed during the fiscal year, to be evaluated by an inter-ministerial committee[4] which can be helped by several specialists' boards. The federal government also establishes a budget ceiling to the fiscal credits which are granted each year. Therefore the projects are evaluated in terms of the fulfillment of minimum requirements and their scientific and technological relevance.

According to the OECD STI Scoreboard 2007, Mexico has currently one of the most generous tax incentives schemes within the OECD[5]. Given this success in shifting the orientation and scope of a previously largely unattended innovation policy measure, the present work is oriented to analyse and evaluate the characteristics and application of the fiscal incentives programme implemented by the Mexican government from 2001 to 2006, corresponding to the stage in which this type of measures have received special attention as innovation policy instruments. Our main goal for the study concerns the in–depth analysis of the programme from the point of view that the generosity of the scheme does not necessarily is associated with the accomplishment of internal science, technology and innovation policy goals. Subsequently, we will arrive to some policy recommendations regarding the design and scope of these measures in order to better achieve their goals.

2. Methodology

Our study is mainly based on the analysis of policy documents, legislation and statistical information concerning the fiscal incentives to R&D programme. Given the lack of reliable *ex ante* data on business R&D activities in Mexico, the problem of additionality of the fiscal measures is not fully addressed in our study. However, we

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1 OECD (2002)

2 Ibid note 1. See also: OECD (1996) and European Commission (2003).

3 For a detailed analysis about the changes of diverse fiscal measures schemes in Mexico see Ciceri & Diaz (2003).

4 Which includes participants from the National Council of Science and Technology (CONACYT), and the ministries of Economics, Finance and Education.

5 As measured by the *B index*, OECD (2007).

have attempted to shed some light on this issue by means of the detailed analysis of a stratified random sample of projects from firms which participated in the scheme.

We used the following sources of information for our study: (i) a database provided by the National Council of Science and Technology (CONACYT), responsible of the administration of the programme, including 7211 projects (cases) which received fiscal credits during the period under study and six variables: year, name of the firm, firm size, location of the firm, granted fiscal credit[6] and an internal code; (ii) final or provisional versions of diverse evaluation studies commissioned by CONACYT and carried out by academic organizations;[7] (iii) abstracts from the projects which received fiscal credits, taken from the Official Journal of the Federation —where government acts and decrees are published and provided in CONACYT's Web page;[8] (iv) other legal and regulatory documents.[9]

The first part of the study consisted in the descriptive statistical analysis of the database to obtain a general view of the programme during the whole period of the study. Additional multivariate techniques such as cluster analysis were performed to analyse information about the location of the firms and their corresponding amounts of fiscal credits.

The second part of the study corresponded to a detailed analysis of the projects which received fiscal credits in 2006. For this part a stratified random sample was selected from the general database, whose characteristics are shown in Table 1.

Table 1 Characteristics of the sample

Firm Size	Total number of projects approved in 2006	Sample* of Projects (confidence level 95%)	Confidence interval (%)*	Fiscal credit granted to the projects of the sample (millions USD)
Micro	76	43	9.9	3.98
Small	131	83	6.5	12.74
Medium	351	184	5.0	33.09
Large	1059	282	5.0	116.75
Total	1617	592		166.56

* Confidence intervals for micro and small firms could not be kept at 5% due to the lack of valid information; the 43 and 83 projects analyzed were the only available.

The abstracts of the 592 projects of the sample were analysed and a database was created with information about the following variables: economic activity sector of the firm, technological area of the project, type of R&D or resulting innovation (I+R&D), scope of the I+R&D activities, collaboration with public research centres or higher education institutions[10], and expected impacts of the projects (in addition to the

[6] All currency conversions take as base 2001 USD.

[7] Mainly, ITAM (2007) and Unger et al (2008)

[8] CONACYT web (2008).

[9] DOF (2006 a and b)

[10] Since collaboration is one of the criteria for the evaluation and acceptance of the projects, according to the call for projects.

economic impacts for the firm). The technological areas were mainly considered according to the fundamental discipline or specialty involved in the project. However several projects included the participation of diverse areas of engineering and were thus only classified as 'engineering'.

The type and scope of I+R&D were evaluated with respect to standard *Frascati* and *Oslo Manuals*[11] definitions. Concerning the type, we identified the following I+R&D activities: basic and applied research, experimental development, and product and process innovations. In addition there were projects classified as different from I+R&D, including infrastructure, organisational system, procedures and operations, feasibility studies and training. Regarding innovations, it has to be noted that due to the period under study and the nature and characteristics of the Mexican tax incentives scheme, the revised 2005 edition of the Oslo Manual[12] was not used. Therefore, we considered the definitions to identify **technological product and process innovations** (TPP), and excluded as no–I+R&D those activities concerning marketing and organisational innovation, according to the latest edition of the manual.

For the same reason, the scope of the projects was evaluated with two variables, one for technologically new and improved products and processes —radical and incremental innovations; and other for the novelty to the firm and to the market i.e., worldwide and firm–only TPP innovation.[13] The combinations of these variables were used to generate a single indicator of scope or novelty of the projects, in accordance with Table 2. Whenever possible, these scope classifications were used in research and experimental development, taking into account the innovation potential of their outcomes.

Table 2 Scope and degree of novelty or innovation of the projects

Scope 1	Scope 2		Degree of Novelty
Radical, technologically new	New to the market (worldwide)	=	High Innovation
Incremental, technologically improved	New to the market (worldwide)	=	Medium Innovation
Incremental, technologically improved	New to the firm (firm–only)	=	Low Innovation
Other combinations or lack of a characteristic		=	No Innovation

3. Results

3.1. General analysis 2001-2006

Table 2 shows the main general results of the programme during the period under study. In a first general view, it seems to be quite successful: there was an important increase in the budget ceiling devoted to the scheme (from 37.4 to 428.4 millions USD); the total number of participating firms per year (including repeating firms) grew from 142 in 2001 to 483 in 2006 and the number of approved projects also increased from 506 to 1617.

[11] OECD (1997; 2002).

[12] OECD & Eurostat (2005).

[13] OECD (1997); see also Forfás (2006).

However, a more detailed analysis by firm size shows that although the budget ceiling increased considerably (Figure 2), the chief beneficiaries of this increment were large firms. Moreover, the analysis of the growth rate of the budget approved by firm size shows that the fiscal credit assigned only had an increasing trend in the case of large and medium firms (Figure 1). Similarly, when the frequency of use of the programme is considered, i.e., firms that participate in it for several years, as well as the incorporation of new firms, it can be observed that for all firm sizes there are decreasing growth rates (Figure 4). This indicates that the programme has not been appropriately directed at

Figure 2 Growth rate of the allocated budget by firm size, 2001–2006

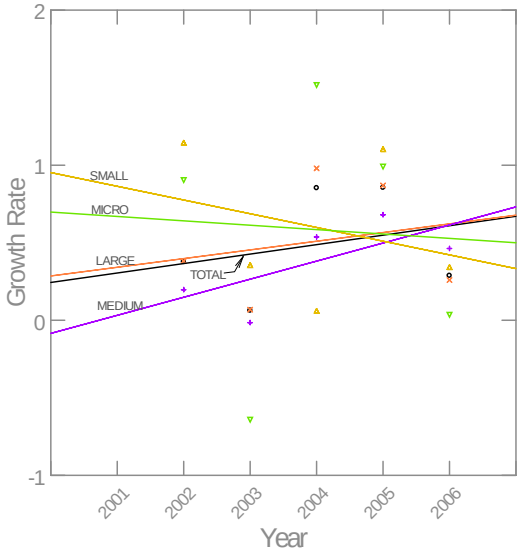
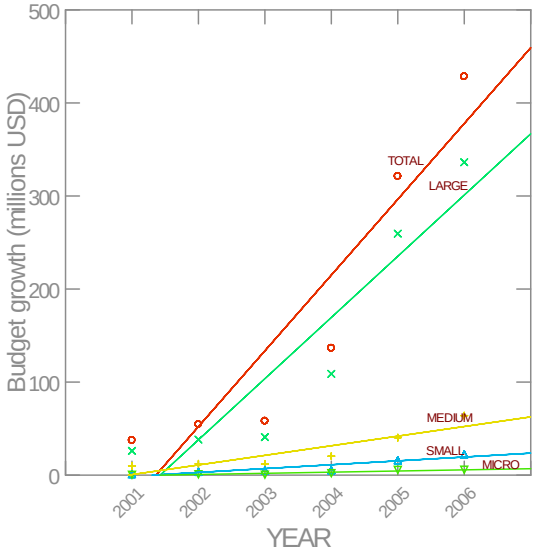


Figure 1 Growth of the allocated budget by firm size, 2001–2006



promoting R&D activities in a larger set of firms, and is also reflected in the regional concentration that will be discussed below.

Another important result which is evident from Table 2 and Figure 2, is the high concentration of the programme resources in large firms (78% of the budget during the six years). Furthermore, from the total amount of resources assigned during this period, only one per cent of the cases analyzed (21 out of 2030) corresponds to 15 firms that received 32% of the fiscal credits, equivalent to approximately 332 millions of dollars (from a total of 1036 millions USD, see Table 3). It is noteworthy from this latter table the pre–eminence of the automobile industry, which received during the period almost 251 millions USD, more than 24% of the FC granted during the six years. Apart from this high concentration in just a few firms and sectors, Figure 3 shows that the medians of the fiscal credits approved during the period fall between 10 thousand and 100 thousand USD for all firm sizes,[14] with the exception of large firms, which fall around 500 thousand USD.

[14] Except medium firms in 2006.

Figure 3 Distribution of FCs by year and firm size, 2001-2006

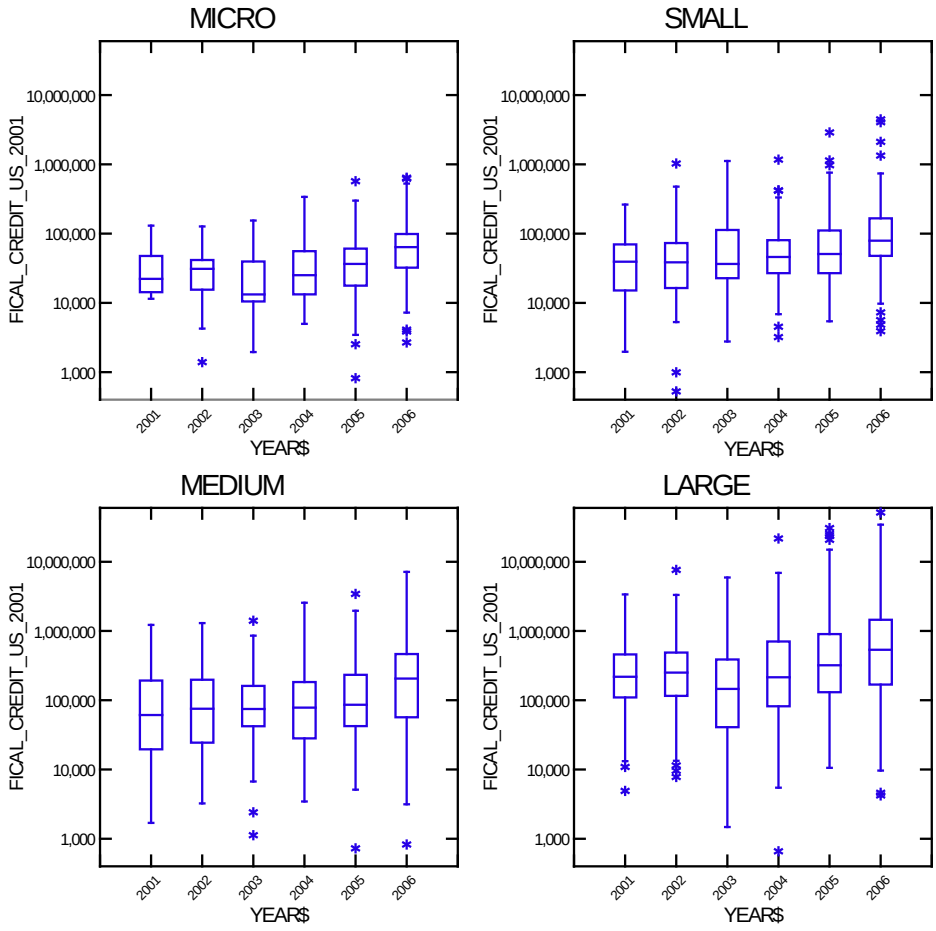


Table 3 Main general results of the programme, 2001-2006

	Large			Medium			Small			Micro			Total		
	Number of firms	Number of projects	Fiscal credit (Millions USD)	Number of firms	Number of projects	Fiscal credit (Millions USD)	Number of firms	Number of projects	Fiscal credit (Millions USD)	Number of firms	Number of projects	Fiscal credit (Millions USD)	Firms	Projects	Fiscal credit (Millions USD)
2001	54	281	$ 26.06	58	177	$ 9.93	21	32	$ 1.11	9	16	$ 0.35	142	506	$ 37.45
2002	71	421	$ 38.16	75	271	$ 12.10	38	82	$ 3.47	21	50	$ 0.87	205	824	$ 54.60
2003	98	498	$ 40.84	79	230	$ 11.91	44	113	$ 4.95	14	31	$ 0.46	235	872	$ 58.17
2004	134	763	$ 108.79	121	351	$ 20.39	55	111	$ 5.26	47	84	$ 2.09	357	1309	$ 136.54
2005	204	1216	$ 259.54	196	516	$ 40.27	112	211	$ 15.85	96	140	$ 5.64	608	2083	$ 321.30
2006	194	1059	$ 336.28	148	351	$ 63.95	83	131	$ 22.33	58	76	$ 5.84	483	1617	$ 428.40
Total	755	4238	$ 809.68	677	1896	$ 158.55	353	680	$ 52.97	245	397	$ 15.26	2030	7211	$ 1,036.46
Total %	37.19	58.77	78.12	33.35	26.29	15.30	17.39	9.43	5.11	12.07	5.51	1.47	100	100	100

Table 4 Top 15 firms (FC amount), 2001-2006

Year	Firm ID	Firm sector	Firm size	State	N of projects	Fiscal credit (mill USD)	% from total FC	Cumulative % (total FC)	Cumulative % (N of firms)
2006	1	Automobile industry	Large	Distrito Federal	51	51.40	4.96	4.96	0.05
2006	2	Automobile industry	Large	Distrito Federal	4	34.38	3.32	8.28	0.10
2005	1	Automobile industry	Large	Distrito Federal	71	30.67	2.96	11.24	0.15
2005	3	Automobile industry	Large	Distrito Federal	2	25.42	2.45	13.69	0.20
2005	4	Automobile industry	Large	Distrito Federal	3	23.74	2.29	15.98	0.25
2004	5	Automobile industry	Large	Puebla	4	21.72	2.10	18.07	0.30
2005	5	Automobile industry	Large	Puebla	11	20.80	2.01	20.08	0.34
2006	6	Food and beverages	Large	Nuevo León	9	20.29	1.96	22.04	0.39
2005	2	Automobile industry	Large	Distrito Federal	5	14.96	1.44	23.48	0.44
2006	5	Automobile industry	Large	Puebla	9	14.66	1.41	24.90	0.49
2006	7	Steel industry	Large	Nuevo León	42	8.75	0.84	25.74	0.54
2006	8	Domestic appliances	Large	Distrito Federal	1	8.59	0.83	26.57	0.59
2006	9	Aerospace	Large	Baja California	2	8.04	0.78	27.35	0.64
2006	10	Machinery and equipment	Large	Nuevo León	4	7.90	0.76	28.11	0.69
2002	11	Steel industry	Large	Veracruz	2	7.64	0.74	28.84	0.74
2006	12	Chemical industry	Medium	Estado de México	1	7.14	0.69	29.53	0.79
2004	1	Automobile industry	Large	Distrito Federal	43	6.91	0.67	30.20	0.84
2006	13	Agriculture (poultry)	Large	Guanajuato	5	6.48	0.62	30.82	0.89
2005	14	Automobile industry	Large	Guanajuato	5	6.32	0.61	31.43	0.94
2006	15	Communications	Large	Distrito Federal	11	6.14	0.59	32.03	0.99
Total					285	331.95	32.03	32.03	0.99

Figure 4 Growth rate of new firms, 2001–2006

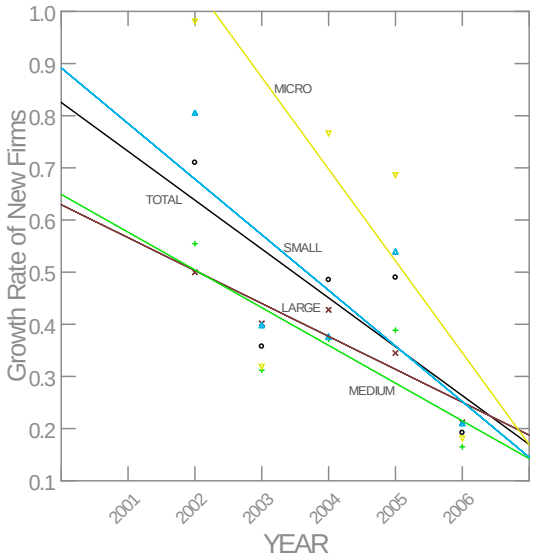


Figure 5 Participation index by state

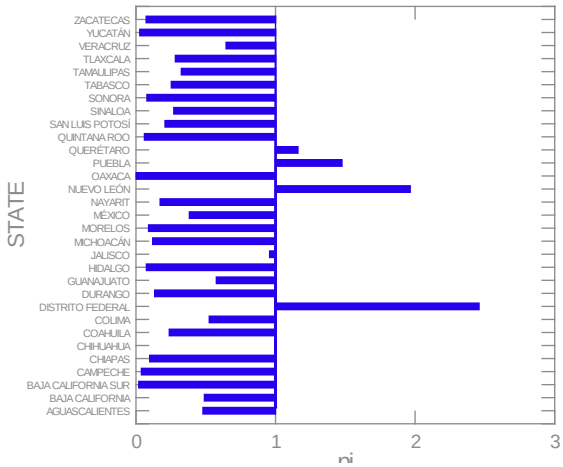


Table 5 Fiscal credits granted by state and group (USD)

	GROUP 1	GROUP 2
AGUASCALIENTES		9,417,815.90
BAJA CALIFORNIA		16,587,159.68
BAJA CALIFORNIA SUR		23,561.83
CAMPECHE		31,040.81
CHIAPAS		315,585.33
CHIHUAHUA		43,419,220.77
COAHUILA		15,438,218.54
COLIMA		692,071.21
DISTRITO FEDERAL	435,712,144.70	
DURANGO		1,659,188.20
ESTADO DE MÉXICO		63,398,841.17
GUANAJUATO		30,295,499.94
HIDALGO		1,311,316.19
JALISCO		64,696,640.70
MICHOACÁN		1,776,470.64
MORELOS		1,276,782.36
NAYARIT		371,806.45
NUEVO LEÓN	194,440,439.98	
OAXACA		13,282.34
PUEBLA		73,312,403.58
QUERÉTARO		34,720,433.07
QUINTANA ROO		121,137.44
SAN LUIS POTOSÍ		4,757,196.10
SINALOA		2,106,712.09
SONORA		1,876,895.51
TABASCO		753,830.76
TAMAULIPAS		11,255,673.21
TLAXCALA		2,217,209.20
VERACRUZ		24,040,996.63
YUCATÁN		273,348.32
ZACATECAS		147,141.97
TOTAL	630,152,585.68	406,307,481.94

In addition to the concentration in large firms, the programme has been also regionally concentrated. We carried out a cluster analysis of the standardized database, using as column variables the number of projects submitted and the resources allocated to them and as raw variables the states where the firms are located. The analysis yielded only two groups, the first integrated by the Federal District (DF, capital of the country) and the northern state of Nuevo Leon (NL); the second group was integrated by the remaining 29 states whose firms have participated in the programme. The firms from the first group received during the period 60.85% (630.1 millions USD) of the fiscal credits, while the firms of the second group received 39.2% (406.3 millions USD) of them (see Table 4).[15]

[15] It has to be noted that some large firms, especially from the automobile industry which as mentioned above is one

To have some elements of comparison, we generated a 'participation index' (*pi*), such that:

$$pi = \frac{\text{states' firms share of fiscal incentives (\%)}}{\text{states' industry contribution to the GDP (\%)}}$$

Therefore, a balanced relationship between industrial activity in the states of the country and their firms' participation in the fiscal incentives to R&D programme should be around one. As can be appreciated in Figure 5, only three states have *pi*s close to one (two of them <1), three of them are quite larger (>1.5, especially DF and NL) and the remaining 25 states are rather smaller (<0.5). Thus, we can infer that the high concentration in only two states is more related to the design, characteristics and promotion of the programme rather than to the levels of industrial activity.[16]

3.2. Detailed analysis of projects, 2006

3.2.1. General aspects

Table 5 shows general information about the programme in 2006, including data on the total number of applications, technology investment (of approved projects), the fiscal credit requested by firms, percentages of granted fiscal credit and support as well as rejection of firms and projects. It can be observed that, similarly to what was shown in the previous section, large firms are favoured with regard to the rest of the other firm sizes (greater support and less rejection proportions).[17]

Table 6 General information about de Fiscal Incentives programme, 2006 (millions USD)

FIRM SIZE	APPLICATIONS FIRMS	APPLICATIONS PROJECTS	TECHNOLOGY INVESTMENT	REQUESTED FC	ELIGIBLE FC	FC GRANTED	% GRANTED†	% SUPPORT‡	% REJECTION* FIRMS	% REJECTION* PROJECTS
MICRO	128	178	$ 42.73	$ 12.74	$ 8.68	$ 5.84	13.67%	67.32%	54.69%	57.30%
SMALL	156	286	$ 199.10	$ 59.66	$ 34.91	$ 22.33	11.21%	63.95%	46.79%	54.20%
MEDIUM	277	784	$ 632.32	$ 189.68	$ 117.38	$ 63.95	10.11%	54.48%	46.57%	55.23%
LARGE	326	1907	$ 2,107.85	$ 632.32	$ 414.05	$ 336.28	15.95%	81.22%	40.49%	44.47%
TOTAL	887	3155	$ 2,982.01	$ 894.40	$ 575.02	$ 428.40	14.37%	74.50%	45.55%	48.75%

Source: own elaboration from CONACYT's database and a provisional evaluation document (CONACYT, 2007)

† *(FC granted) / (technology investment)*

‡ *(FC granted) / (eligible FC)*

* *[(approved cases) / applications]* − 1 see Table 2 for the number of approved projects and firms.

of the chief beneficiaries of the programme, have their corporate offices in DF, and these were responsible of submitting the projects, even though in some cases the projects were implemented in plants outside DF. However, CONACYT's database does not specify these cases.

[16] Our *pi* obviously cannot reflect industrial and technological complexity of the firms, and this could be a factor influencing the firms' participation in the fiscal incentives programme. Nevertheless, as we will see in the next section, the projects submitted to the programme are not characterised by high levels of technological complexity.

[17] We only have figures concerning total applications and approved projects, but not qualitative information about the reasons for rejecting projects.

Table 7 Top ten projects of 2006

Sub–sector	Firm size	State	Fiscal credit (millions USD)	% of the total FC assigned to the sample	Technological area	Type of project	Scope 1	Scope 2	Collaboration	Expected impacts
Automobile industry	Large	DISTRITO FEDERAL	30.87	18.53	Engineering	Infrastructure	na	na	no	employment
Automobile industry	Large	PUEBLA	6.75	4.05	Administration	Procedures and operations	Incremental	New to firm	no	not mentioned
Automobile industry	Large	DISTRITO FEDERAL	5.62	3.37	Engineering	Process innovation	Incremental	New to firm	no	employment, ecology, exports
Communications	Medium	DISTRITO FEDERAL	5.15	3.09	ICT	Product innovation	Incremental	New to firm	no	not mentioned
Chemical industry	Medium	TAMAULIPAS	4.74	2.85	Chemical	Process innovation	Incremental	New to firm	no	patenting, employment, exports
Food and beverages industry	Large	ESTADO DE MEXICO	4.37	2.63	Engineering	Procedures and operations	Incremental	New to firm	no	employment, patenting, ecology
Infrastructure	Small	DISTRITO FEDERAL	4.07	2.45	Engineering	Infrastructure	na	na	no	not mentioned
Food and beverages industry	Large	GUANAJUATO	3.43	2.06	Engineering	Infrastructure	na	na	no	not mentioned
Communications	Large	DISTRITO FEDERAL	3.38	2.03	ICT	Applied research	na	na	no	not mentioned
Automobile industry	Large	NUEVO LEON	3.15	1.89	ICT	Product innovation	Incremental	New to firm	no	employment, patenting
			71.54	42.95						

Table 6 shows the top ten projects, considering the amount of fiscal credit granted. The same situation observed in the general study, in which a few number of firms and projects receive a large amount of the total fiscal credits granted is also present here, and only these projects amount to 43% of the budget assigned to the sample. Again, it is clearly perceptible the concentration in large firms,[18] with pre–eminence of the automobile and communications industries. These ten projects help to understand some of the distortions observed in the sample with regard to activities different from I+R&D and that will be discussed below, especially those concerning infrastructure and procedures and operations projects.

From the total of projects in our sample, the larger number corresponded to the industrial sector, secondly to services and finally to agriculture (86, 10 and 4% respectively). It is important to mention that 30% of the micro–firms' projects, were in the latter sector. The technological areas in which the majority of the projects are concentrated include engineering (42%), pharmaceuticals (16%), chemical (14%), and information technologies (ICT, 12%). It has to be noted that all of the pharmaceutical projects of large firms were either minor product innovations or clinical trials.[19] Similarly, all the projects of ICT, corresponded to basic software applications that in strict sense should not be considered as the result of R&D activities.[20] These latter were considered in our analysis as product, incremental and new to the firm innovations.

There is in the sample an important percentage of projects which are different from innovation or R&D activities[21] (13%) and the ratio between these and I+R&D projects is very similar for the different firm sizes (0.14 ± 0.02) with the exception of medium firms (0.26). Nevertheless, the fiscal credits assigned to the former type of projects amounts to 42% of the total (large firms have assigned 35% of the total fiscal credits to this type of projects).

Among I+R&D activities there is a predominance of product and process innovations in relatively similar proportions for all groups. The approved fiscal credits are also proportional with regard to the number of projects. On the other hand, among the activities which are different from I+R&D, there is a large number of infrastructure projects (particularly the building of industrial plants and establishing R&D centres or laboratories),[22] and the huge amount of fiscal credits assigned to non–I+R&D activities is undoubtedly attributable to this type of investments. Another type of project receiving quite favourable treatment, particularly in the amounts of fiscal credit granted, corresponds to the implementation of procedures and operations (though it is difficult to imagine why this kind of activities reach 13.4 millions USD).

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[18] The inclusion of a small firm in this group is probably attributable to an error of classification in the CONACYT database.

[19] Not all the abstracts included sufficient information relative to the stage of the clinical trials. However, these were classified as experimental development.

[20] See Frascati Manual, OECD (2002).

[21] See the comments about definitions in section 3.

[22] The latter is included among the eligible costs in the programme; notwithstanding, we cannot consider it as I+R&D activities.

Table 8 Degree of novelty or innovation of the projects by firm size, 2006

	MICRO			SMALL			MEDIUM			LARGE			Total			
	N	%	FC (mill USD)	N	%	FC (mill USD)	N	%	FC (mill USD)	N	%	FC (mill USD)	N	%	FC (mill USD)	% FC
HIGH INNOVATION	2	0.34	0.63	0	0	0.00	1	0.17	0.05	0	0	0.00	3	0.51	0.68	0.41
MEDIUM INNOVATION	3	0.51	0.24	5	0.84	0.87	8	1.35	0.69	11	1.86	4.11	27	4.56	5.91	3.55
LOW INNOVATION	38	6.42	3.11	78	13.18	11.87	168	28.38	31.69	229	38.68	66.16	513	86.66	112.82	67.74
NO INNOVATION	0	0	0.00	0	0	0.00	7	1.18	0.66	42	7.09	46.49	49	8.28	47.14	28.31
Total	43	7.26	3.98	83	14.02	12.74	184	31.08	33.09	282	47.64	116.75	592	100	166.56	100.00

Table 9 Type of projects by degree of novelty or innovation, 2006

	HIGH INNOVATION			MEDIUM INNOVATION			LOW INNOVATION			NO INNOVATION			Total			
	N	%	FC (mill USD)	N	%	FC (mill USD)	N	%	FC (mill USD)	N	%	FC (mill USD)	N	%	FC (mill USD)	% FC
APPLIED RES	0	0	0.00	0	0	0.00	12	2.03	4.16	5	0.84	0.37	17	2.87	4.53	2.72
BASIC RES	0	0	0.00	0	0	0.00	1	0.17	0.10	3	0.51	0.07	4	0.68	0.16	0.10
EXP DEVPMNT	0	0	0.00	5	0.84	2.75	7	1.18	0.49	9	1.52	0.60	21	3.55	3.84	2.31
FEASIBILITY	0	0	0.00	0	0	0.00	1	0.17	0.00	0	0	0.00	1	0.17	0.00	0.00
INFRASTRUCTURE	0	0	0.00	0	0	0.00	31	5.24	10.80	25	4.22	44.55	56	9.46	55.35	33.23
ORG SYSTEM	0	0	0.00	0	0	0.00	2	0.34	0.24	0	0	0.00	2	0.34	0.24	0.14
PROCED & OPS	0	0	0.00	0	0	0.00	11	1.86	12.52	4	0.68	0.86	15	2.53	13.38	8.03
PROCESS	1	0.17	0.05	4	0.68	1.01	80	13.51	30.24	0	0	0.00	85	14.36	31.30	18.79
PROD & PRCSS	1	0.17	0.62	4	0.68	0.53	72	12.16	10.48	0	0	0.00	77	13.01	11.63	6.98
PRODUCT	1	0.17	0.01	14	2.36	1.62	295	49.83	43.70	0	0	0.00	310	52.36	45.33	27.22
TRAINING	0	0	0.00	0	0	0.00	1	0.17	0.10	3	0.51	0.70	4	0.68	0.79	0.48
Total	3	0.51	0.68	27	4.56	5.91	513	86.66	112.82	49	8.28	47.14	592	100	166.56	100.00

3.2.2. Innovation–novelty levels

Table 7 shows basic data of the projects grouped by degree of novelty and firm size. The predominance of low innovation projects for all the groups can be observed, with large firms having a higher percent of these, followed by medium firms. It is also noteworthy that almost the majority of resources was granted to low and no innovation projects (68 and 28% of the FCs), although the latter represent a very small proportion of the projects (8.2%). It is also surprising that the few cases of high innovation were performed by micro and medium firms with quite a low level of resources, see also Figure 6, for a depiction of the distribution of FCs and how a few outlayer cases in the no–low range of innovation are granted higher amounts of fiscal credits.

Figure 6 Box plots of fiscal credits granted by degree of innovation and firm size (log scale)

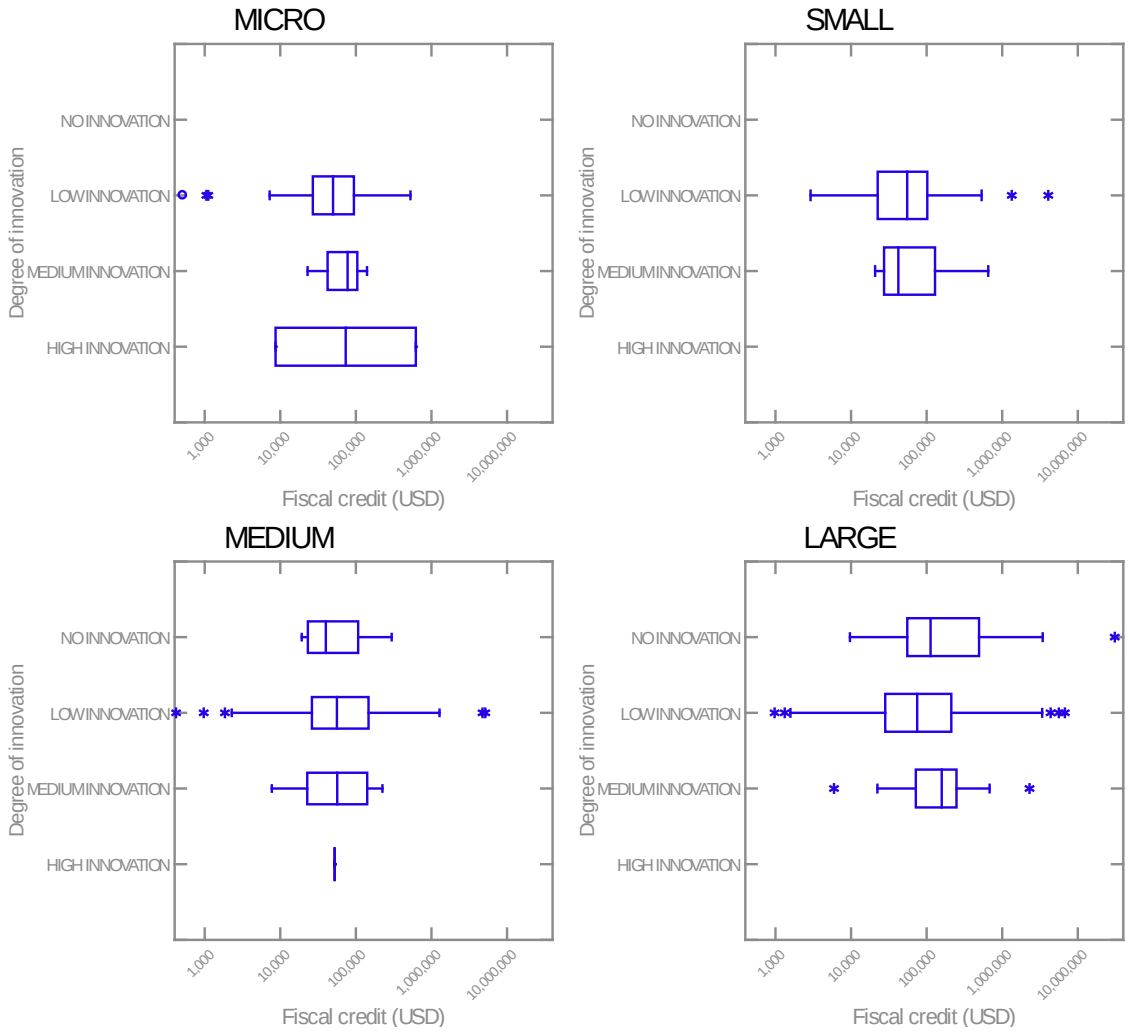
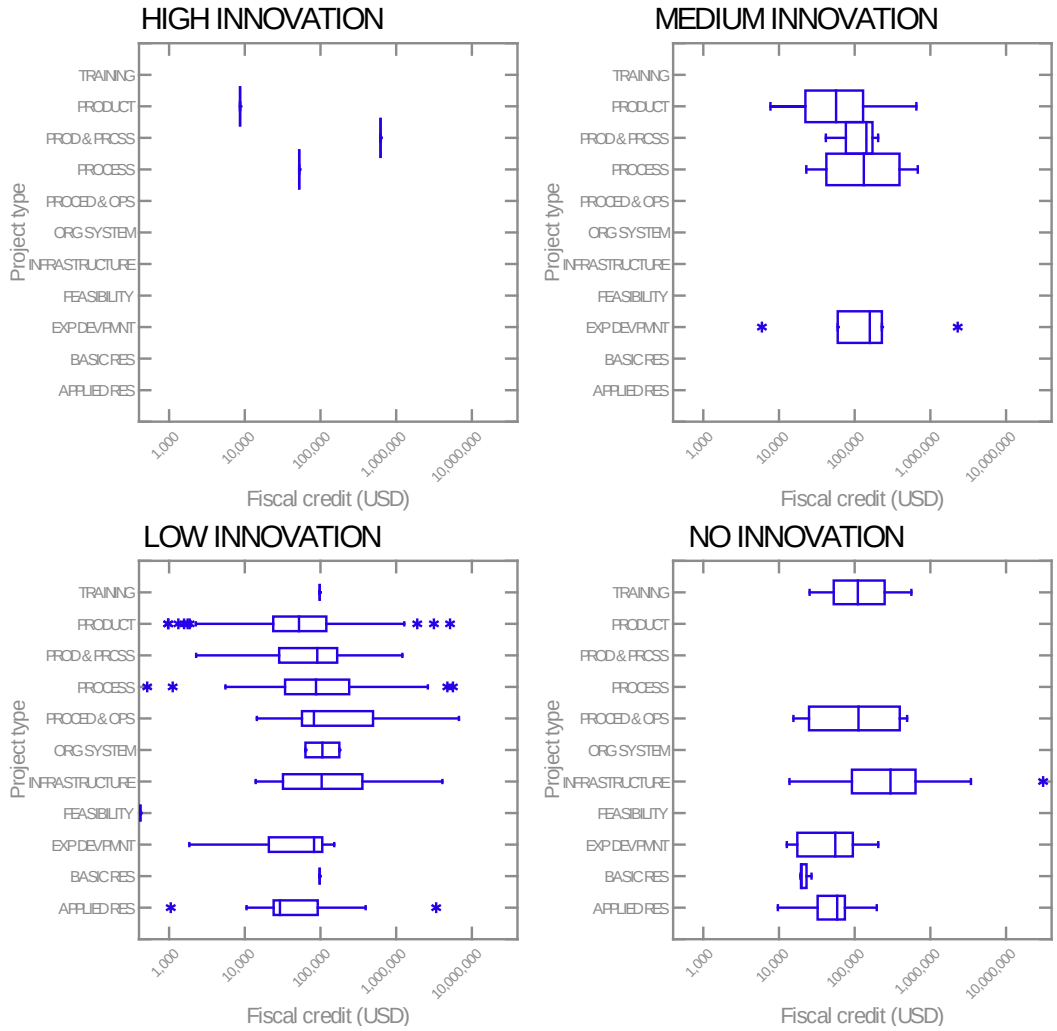


Table 8 shows a disaggregation of the projects by type and level of novelty. The majority of the projects correspond to product and process innovations and a combination of these two (52, 14 and 13%), usually associated with entrance to new markets and cost reduction. It is noticeable the reduced number of activities and budget devoted directly to basic and applied

research and experimental development (in total 7% of the projects and 5% of FCs),[23] although the promotion of these are supposedly the main objectives of the fiscal incentives programme. It is also evident that these types of projects are located in the no–low novelty range (see also Figure 7). On the other hand it is clearly perceived that projects also having no–low level of novelty and related to infrastructure (9.5%) and procedures and operations (2.5%) —both no–I+R&D activities, are granted with more than 41% of the total FCs of the sample.

Figure 7 Box plots of fiscal credits granted by type of project and degree of novelty (log scale)



3.2.3. Impacts and collaboration

All the projects' abstracts included economic impacts or benefits for the firm to be derived from the projects, usually associated to cost reduction and entrance into new markets as mentioned above, as can also be inferred by the types and scope of the projects (see section 4.2.2). After the analysis of the projects' information, we had the perception that given the nature of them —no–I+R&D activities, product and process improvement of low degree of

[23] Despite what is mentioned in note 19.

novelty and cost saving oriented, that in the majority of the cases[24] firms would have carried out them even in the absence of the fiscal incentives programme.

In general, the information included in the abstracts was not sufficiently complete, accurate and consistent to build a richer database for our analysis; there were for example duplications (different projects from the same firm repeated the figures for expected profits or the number of jobs created), contradictions regarding patents, and in many cases there was a complete lack of information.

The expected effects in addition to those of direct economic profit for the firm are very similar for the groups in nature and proportions (perhaps due to the need to fill an application form). These are in order of importance: employment, exports and patenting, ecological concerns and education and training of personnel. The majority of cases including employment referred to those posts created for the development of the projects (not necessarily permanent), and usually involved professional and postgraduate personnel.[25] The abstracts analysed did not permit to derive verifiable conclusions, particularly with regard to the patenting possibilities of the projects' results. Perhaps in the case of the orientation to export markets and ecological benefits, the reported effects were more consistent with the nature of the projects.

Notwithstanding collaboration with public research centres or higher education institutions is mentioned as an important project approval criterion in CONACYT's terms of reference and calls, none of the groups by firm size reached 10% (within the total number of submissions in each group) of projects that included any kind cooperation.

4. Conclusions and recommendations

Our results have shown that the application of the fiscal incentives to R&D programme, from 2001 to 2006, has had the following characteristics. Firstly, it has received an increasing governmental support in terms of the absolute budget ceiling devoted to the programme and consequently in the revenue losses due to the incentive. However, this support has only been for the benefit of large and medium firms, since the fiscal credits granted to micro– and small firms had decreasing trends. With regard to the growth of the scope of the programme, we have seen that despite its apparent success, in fact there is low incorporation of new firms into it, and therefore the benefits are seized by a small number of firms.

Secondly, related to the previous problems, a high concentration can be perceived in the incentives granted by firm size, industrial sector and region. Naturally, large firms, particularly from the automobile industry, have received greater benefits in terms of fiscal credits and these have been primarily allocated in the two states with higher industrial development.[26]

Thirdly, despite the orientation of the programme should be the promotion of scientific and technological development through R&D, the results of our detailed study showed that very

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[24] But particularly, large and medium firms.

[25] With the exception of some of the large infrastructure projects in the automobile industry which reported the creation of great amount of skilled labour posts.

[26] Though we have to take into account, as previously annotated (see note 15), that in some cases the corporate offices with address in one state submit the applications, but the actual implementation of the projects could take place in another state of the country.

little is achieved in this respect. Actually, there is almost null support to basic and applied research and the few projects in this area are of a low degree of novelty. Similarly, experimental development projects were very scarce and corresponded to non– or low innovativeness. It has been shown that the majority of the supported cases were minor product and process innovations, these latter usually associated to cost reduction; as well as diverse types of activities that cannot be considered I+R&D or the result of it. As a consequence, the promotion of collaboration between private firms and public research centres and higher education institutions —implying the subsequent support of basic and applied research, is almost non–existent.

Finally, despite the complex and bureaucratic procedures involved in the application and evaluation of projects —which supposedly should guarantee their quality, relevance, and potential impacts, there seems that an important amount of fiscal credits have been granted by discretionary decisions, since many large projects do not comply with the programme's terms of reference, particularly with regard to their scientific and technological research content.

Synthesizing, the fiscal credits programme has neither been useful to allocate resources where they are more needed or promoting high level R&D activities and technology development. Given the nature and objectives of the projects submitted, as well as their low level of novelty and innovativeness, it could even be asserted that the majority of the firms would have invested in them without the existence of the incentives.

Therefore, it is not surprising that the future of the programme is presently uncertain. Recent modifications to fiscal laws, in effect since 2008, eliminate the possibility for firms to deduct R&D expenses, unless these receive a special treatment. And the poor results obtained by the programme with regard to its objectives, seems to be a factor hindering the decision of policy–makers to grant this special treatment.

Our point of view is that a badly designed and implemented policy instrument should not be considered a bad or useless policy instrument. This is to say that fiscal incentives have proven to be effective to promote R&D and innovation in many countries, but they require careful design and implementation, as well as permanent monitoring and evaluation. We argue that the failure of the fiscal incentives to R&D programme in Mexico is no attributable to the policy tool itself, but to problems of design and implementation and a lack of permanent evaluation and fine tuning. Thus, we think that instead of scrapping the programme, it should be thoroughly redesigned to effectively promote high quality research and innovation. Among the issues that need to be revised, we can mention the following.

It has been demonstrated during the operation of the programme, that a horizontal measure, giving the same treatment to all firm sizes, has not worked because large firms have largely better conditions not only to incur in R&D costs but to file the applications. Added to the flexibility in the interpretation of the operative rules and costs eligibility, the equal treatment has lead to an unequal distribution of fiscal credits. Therefore, the introduction of differentiated measures for large and micro– and SMEs is a must.

This differentiation could include the allowed fiscal credit percentages as well as eligibility criteria based on the type and scope of I+R&D activities. The current design of the programme

does not mention explicitly the term innovation,[27] nevertheless, given the structure and characteristics of Mexican industry, micro– and SMEs could greatly benefit from incentives to perform innovation activities.[28] On the other hand, it is evident that large firms do not need support to carry out standard innovative activities, since they perform them routinely, however, they could greatly benefit from targeted incentives to develop basic science and emerging technologies. Therefore, a possible differentiated programme could exclude large firms from receiving incentives to innovation while allowing the deduction of I+R&D expenses to micro– and SMES.

Special attention should also be devoted regarding the current regional concentration of the programme. There are undoubtedly many other regions of the country, apart from the centre and the north, where firms have sufficient capabilities to carry out I+R&D activities in high technology areas. However, the tax incentives scheme has been underutilized in the country, perhaps due to its complexity, lack of diffusion and deficient or non–existent coordination mechanisms with other innovation and research policy measures (see below).

We have seen that a complex, project based administrative procedure has not been effective to avoid the misuse of the programme, particularly in granting FCs to non–eligible costs and projects. This is perhaps due to the lack of definitions of R&D and innovation in the diverse documents concerning the rules of operation of the programme. Thus, despite there are clear descriptions of eligible and non–eligible expenses, standard and internationally recognised definitions, such as those of the *Frascati* and *Oslo* manuals, are not used. Instead, there are only vague references to "... research and technology development projects [...] oriented to the development of products, materials and/or production processes representing scientific or technological advance" these should "have direct benefits in Mexico, such as patents, technology licensing and job creation among others".[29]

In addition to the inclusion of standard definitions, evaluations of international experiences recommend to conform to basic principles for good policy design i.e., simplicity (transparency and accessibility), low administrative and compliance costs (for firms and administrations), reliability (allowing firms' advanced planning, independently of current profitability) and long term stability (of the rules).[30] It is our opinion that a careful evaluation and fine tune of the Mexican scheme should include the revision of its complexity, the usefulness of determining budget ceilings as well as its project based nature. Nevertheless, we highly recommend the analysis and adoption of the aforementioned basic principles.

Finally, as mentioned earlier, the programme should be formally and systematically evaluated and fine tuned to guarantee the achievement of its goals. It seems that only recently has CONACYT commissioned out several external ex–post evaluations of the scheme, however, this should have been a permanent formal practice throughout the application of the programme. It is also important to take into account that evaluations need to refer not only to the scheme itself, but to its interactions and synergy with other innovation policy measures such as those concerning intellectual property, regional development, R&D collaboration and direct funding of business and public R&D activities, in order to achieve an optimal policy mix.

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[27] With the exception of a technical manual for users.

[28] This time using the broad current definition of innovation (Oslo, 2005).

[29] DOF (2006b) p. 13.

[30] European Commission (2003), p. 33.

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