Mathematics in Catalonia: 1996-2002*

Julià Cufí[1], Gerard Gómez[2], Gregori Guasp[1], Agustí Reventós[1] and Oriol Serra[3]

1. Introduction

The aim of this article is to present the main conclusions of the report on research in Catalonia for the area of mathematics. The report was published in 2005 by the Institute for Catalan Studies.

This is a report of the scientific activity in Catalonia in the field of mathematics during the period 1996-2002. It deals with two aspects of mathematics research. First, it provides an analysis of the country's research potential, as defined by its universities and other centers of investigation, their staff, as well as the economic resources that they obtain for research. Second, it offers an assessment of the scientific productivity of researchers from these institutions, as measured by analyzing, both quantitatively and qualitatively, articles published in specialized mathematics journals and doctoral theses submitted to universities.

The data from our study are often compared with those from the report on research in mathematics corresponding to the period 1990-1996. A summary of that information and the conclusions drawn from that earlier report can be found in the article by Joan Girbau "Mathematics in Catalonia" [*Contributions to Science, 2(1):111-121 (2001)*].

2. Universities and their human resources

In Catalonia, research in mathematics is mostly carried out at universities. In this section, we provide quantitative information about the mathematicians working at these institutions. However, only mathematicians working in the Mathematics departments have been considered; thus, mathematicians that carry out their research in other departments, such as Economics and Computer Science, are not included in this study. However, their productivity is discussed in the data reported in the section "Scientific productivity".

Table 1 presents the figures concerning the staff at catalan universities. The data correspond to the academic year 2001-2002, which is the last year of the period analyzed.

During the period 1996-2002, there was an increase of 15% in the number of teaching and research staff employed in the Mathematics departments of Catalan universities. This total increase, which was not uniform for all categories, shows that there has not been stagnation during this period; rather, the number of fellowship holders at the University of Barcelona, the Autonomous University of Barcelona, and the Polytechnical University of Catalonia has increased significantly.

Table 1. Permanent teaching staff, term-contract teaching staff, and fellowship holders.

University	Permanent teaching staff	Term-contract teaching staff	Fellowship holders	Total
Autonomous University of Barcelona	55	48	10	113
University of Barcelona	79	30	15	124
University of Girona	14	9	2	25
University of Lleida	17	10	–	27
Polytechnical University of Catalonia	193	79	22	294
University Pompeu Fabra	16	8	–	24
University Rovira Virgili	14	–	3	17
Total	388	184	52	624

1. Universitat Autònoma de Barcelona
2. Universitat de Barcelona
3. Universitat Politècnica de Catalunya

3. Scientific productivity

3.1. Doctoral theses

Table 2 shows the number of doctoral theses on mathematics submitted to Catalan universities between the academic year 1995-96 and the academic year 2001-02. There was a remarkable increase (ca. 37%) in the number of theses submitted during the more recent period compared to the period 1990-1996. The increase in the number of fellowship holders (158%) during this time most likely accounted for the increase in the number of theses.

Despite this increase, the rate of theses supervised by permanent teaching staff was 0.45, which is markedly lower than during the period 1990-1996, indicating a decrease in productivity in relation to the potential of Catalan universities.

Table 2. Doctoral theses submitted to each university during the period 1995-2002.

University	Doctoral theses submitted
Autonomous University of Barcelona	32
University of Barcelona	46
University of Girona	1
University of Lleida	0
Polytechnical University of Catalonia	78
University Pompeu Fabra	5
University Rovira Virgili	0
Total	162

3.2. Scientific publications

Scientific productivity in the field of mathematics in Catalonia during the period 1996-2002 is analyzed from two points of view. First, the evolution of productivity of Catalan mathematicians is compared with that worldwide. Second, productivity in Catalonia is compared with that of countries having the highest productivity in mathematics. Catalan productivity is compared with worldwide productivity, first of all, by taking into account, for each year of the period analyzed (Table 3), all papers published in mathematics. After that the data are evaluated following the UNESCO codes (Table 4) for the classification of subfields in mathematics. All the studies carried out include only work that was reviewed in the journal *Mathematical Reviews* during the period 1996-2002 and which have been published in journals, congress proceedings, or books. Note that, after a manuscript is sent for publication, it takes an average of 2-3 years for it to be listed in *Mathematical Reviews*. The papers that enter in the account of catalan productivity are those having at least one author from a Catalan institution.

Table 4 shows the distribution of papers published around the world and in Catalonia, in accordance with the UNESCO codes. The differences that can be seen between the totals in Table 3 and those in Table 4, both in Catalonia and around the world, are due to the fact that many articles in *Mathematical Reviews* correspond to what could be called border fields in mathematics, such as physics and economics, and thus have UNESCO codes different from those we have considered.

The total number of publications during the period 1996-2002 in Catalonia is 2584, compared to 472633 worldwide. Catalan productivity in mathematics represents 0.5% of global production, a percentage higher than during the previous period (0.4%). In addition, compared with the period 1990-1996, the number of publications in the world has increased by a factor of 1.28, while in Catalonia it has increased by a factor of 1.71.

Table 3. Total number of mathematics publications in Catalonia and around the world.

1996	1997	1998	1999	2000	2001	2002	1996-2002
Catalonia							
293	321	397	395	384	383	411	2584
World							
63064	66590	67886	70025	70217	69170	65681	472633

Table 4. Partial distribution of mathematics publications around the world and in Catalonia according to UNESCO codes.

Area and UNESCO code	World	%	Catalonia	%
Logic (1101-1104)	11627	3.16	132	6.45
Algebra (1201)	34374	9.34	149	7.28
Analysis (1202)	92179	25.05	501	24.46
Computer Science (1203)	23344	6.35	225	10.99
Geometry (1204)	32285	8.78	176	8.59
Number Theory (1205)	14505	3.94	58	2.83
Numerical Analysis (1206)	22228	6.04	50	2.44
Operative Research (1207)	6560	1.78	12	0.59
Probabilities (1208)	16702	4.54	125	6.10
Statistics (1209)	23100	6.28	87	4.25
Topology (1210)	15553	4.23	65	3.17
Total	292457	100.0	1580	100.0

Analysis of the distribution according to classification of the works in the different fields, as defined by the UNESCO codes, shows that the relative volume of Catalan production is comparable to that worldwide in all eleven areas considered, except Logic, Numerical Analysis, and Operative Research. In the category Logic, the percentage of Catalan productivity is almost twice as high as the global one, while in Numerical Analysis and Operative Research it is less than half of total global production.

Productivity in mathematics in Catalonia was compared with that in countries having the highest levels of productivity, defined as those countries with more than 2000 publications reviewed in *Mathematical Reviews* during period 1996-2002. The list of Table 5 comprises 33 countries, almost all of them considered in the 1990-96 study. Most of the countries with a high degree of development appears in this list.

In table 5, the 2002 population is given in millions of persons and the 2002 GDP in dollars per inhabitant. "Publications" is the sum of articles, proceedings and books. The data from the 33 countries are sorted according to the figures for the column "Number of publications by million inhabitants ", i.e., from the highest to the lowest. An analysis of these figures (and those corresponding to the previous period) shows that mathematical production in Catalonia in 1996-2002 relative to population increased, compared to the period 1990-1996, by a factor of 1.66.

Note that Israel ranks first, far ahead of the other countries, while other mathematically productive countries, such as Japan or Russia, occupy lower positions. Catalonia ranks 15, which is the same position that it occupied during the previous period, and it has surpassed other countries, including the United States, Germany, the United Kingdom, and Italy.

The relationship between GDP and publications by million inhabitants is heterogeneous. For some countries this relation tends to be linear. However, in the majority of countries, the number of articles per million inhabitants is higher than would be expected if the relationship was directly proportional.

3.3. Analysis of the quality of publications

In the previous section, we considered all articles on mathematics published in Catalonia and worldwide, taking into account only the quantity, not the quality of these articles. We now turn our attention to the quality of the work produced. One indicator of the quality of a scientific article is its citation index, which is based on the number of citations by other authors over a given period of time. However, in our opinion, this index, which may be adequated for many scientific disciplines, should not be so good for mathematics. We believe that there is no direct rela-

Table 5. List of countries arranged by total mathematics papers/population rate.

	Country	2002 Population	2002 GDP	Art.	Publications	Publications/population
1	Israel	6	16710	6828	8344	1284.83
2	Switzerland	7	38930	3425	4298	594.67
3	Canada	31	22300	13627	16324	519.64
4	France	59	22010	23779	29878	502.64
5	Singapore	4	20690	1863	2072	497.60
6	Finland	5	23510	2004	2516	483.94
7	Denmark	5	30290	2003	2572	478.67
8	Belgium	10	23250	3985	4823	467.34
9	Austria	8	23390	2866	3716	456.46
10	Sweden	9	24820	3246	4024	450.92
11	The Netherlands	16	23960	5555	7164	443.76
12	Australia	20	19740	7337	8590	438.69
13	Czech Republic	10	5560	3404	4224	413.72
14	Hungary	10	5280	3573	4153	408.52
15	Catalonia	6	20458	2057	2525	388.10
16	Germany	82	22570	24290	31969	387.53
17	United Kingdom	59	25250	18668	22715	385.93
18	Italy	58	18960	18365	21920	378.46
19	USA	288	35060	79824	97432	337.87
20	Spain[a]	34	16475	9195	11158	327.79
21	Bulgaria	8	1790	2072	2511	319.14
22	Greece	11	11660	2864	3138	295.18
23	Poland	39	4570	8810	10299	266.63
24	Rumania	22	1850	5238	5943	265.85
25	Japan	127	33550	22902	26251	206.47
26	Russia	144	2140	22211	25764	178.83
27	Ukraine	49	770	6697	7632	156.66
28	Korea	48	9930	6189	6555	137.59
29	Brazil	174	2850	4923	5482	35.50
30	China	1281	940	43087	44839	35.00
31	Turkey	70	2500	2202	2348	33.54
32	Mexico	101	5910	2283	2873	28.44
33	India	1048	480	9406	10400	9.92

a. Without Catalonia.

tionship between the quality and significance that an article may have for the development of mathematics and its low term citation frequency. Thus, we have chosen to use an indirect measure of the quality of an article: the level of prestige of the journal in which it is published. Needless to say, any approach to measuring a journal's prestige can be objectionable, but our aim is to obtain data that allow comparisons with other countries to be established, rather simply reflecting the level of excellence of Catalan productivity in any field, and using as many approaches as possible.

We have defined "prestigious journals" as those with the highest impact factor among those with an index of persistence greater than 10 years. We then added to this group a limited number of specialized journals in particular areas to ensure that all areas were represented. The total number of articles published worldwide in the journals listed below (referred to as outstanding articles), over the period 1996-2002, amounts to 6.16% of the total number of articles published in all journals reviewed in *Mathematical Reviews* over the same period.

List of prestigious journals:

- *Acta Mathematica*
- *Advances in Applied Probability*
- *Advances in Mathematics*
- *American Journal of Mathematics*
- *Annals de l'Institut Fourier*
- *Annals of Mathematics*
- *Annales Scientifiques de l'École Normale Supérieur*
- *Archive for Rational Mechanics and Analysis*
- *Arkiv för Mathematik*
- *Artificial Intelligence*
- *Biometrika*
- *Bulletin of the American Mathematical Society*
- *Celestial Mechanics and Dynamical Astronomy*
- *Combinatorica*
- *Commentari Mathematici Helvetici*
- *Communications on Pure and Applied Mathematics*
- *Duke Mathematical Journal*
- *Econometrica*
- *Ergodic Theory and Dynamical Systems*
- *Indiana University Mathematical Journal*
- *Inventiones Mathematicae*
- *Journal d'Analyse Mathématique*
- *Journal de Mathématiques Pures et Appliquées*
- *Journal für die Reine und Angewandte Mathematik*
- *Journal of Algebra*
- *Journal of Differential Equations*
- *Journal of Differential Geometry*
- *Journal of Functional Analysis*
- *Journal of Mathematical Analysis and Applications*
- *Journal of Mathematical Biology*
- *Journal of Number Theory*
- *Journal of the American Mathematical Society*
- *Journal of the American Statistical Association*
- *Journal of the Royal Statistic Society*
- *Mathematics of Computation*

- *Mathematische Annalen*
- *Mathematische Zeitschrift*
- *Nonlinearity*
- *Proceedings of the London Mathematical Society*
- *SIAM Journal on Applied Mathematics*
- *SIAM Journal on Control and Optimization*
- *SIAM Journal on Discrete Mathematics*
- *SIAM Journal on Numerical Analysis*
- *Studies in Applied Mathematics*
- *The Annals of Probability*
- *The Annals of Statistics*
- *Topology*
- *Transactions of the American Mathematical Society*

On this basis, we have counted the number of outstanding articles published in any of the journals listed above by authors in the 33 countries listed in Table 5. The results are shown in Table 6, in which the countries have been sorted according to the ratio of number of outstanding articles by million inhabitants. In Table 7 the countries are sorted according to the percentage of articles published in the above list of prestigious journals compared with the total number of articles published.

Table 6. List of countries by number of outstanding articles/million inhabitants.

	Country	Population	Outstanding articles	Outstanding articles /population
1	Israel	6.5	854	131.38
2	France	59.4	3179	53.52
3	Switzerland	7.2	352	48.89
4	Canada	31.4	1351	43.03
5	Denmark	5.4	222	41.11
6	Catalonia	6.5	254	39.08
7	Sweden	8.9	343	38.54
8	USA	288.4	11020	38.21
9	Australia	19.6	679	34.64
10	United Kingdom	58.9	2004	34.02
11	Finland	5.2	167	32.12
12	Singapore	4.2	133	31.67
13	Germany	82.5	2584	31.32
14	Belgium	10.3	297	28.83
15	The Netherlands	16.1	456	28.32
16	Austria	8.1	225	27.78
17	Spain[a]	34.0	915	26.91
18	Italy	57.9	1377	23.78
19	Hungary	10.2	213	20.88
20	Greece	10.6	215	20.28
21	Czech R.	10.2	172	16.86
22	Poland	38.6	440	11.40
23	Japan	127.1	1396	10.98
24	Bulgaria	7.9	80	10.13
25	Rumania	22.4	169	7.54
26	Korea	47.6	328	6.89
27	Russia	144.1	489	3.39
28	Brazil	174.5	448	2.57
29	Ukraine	48.7	123	2.53
30	Mexico	100.9	135	1.34
31	China	1281.0	1613	1.26
32	Turkey	69.6	64	0.92
33	India	1048.3	361	0.34

a. Without Catalonia.

Table 7. List of countries ordered by outstanding articles/total articles (%).

	Country	Outstanding articles/total articles		Country	Outstanding articles/total articles
1	USA	13.80	18	Italy	7.50
2	France	13.37	19	Belgium	7.45
3	Israel	12.50	20	Singapore	7.14
4	Catalonia	12.34	21	Japan	6.10
5	Denmark	11.08	22	Hungary	5.96
6	United Kingdom	10.73	23	Mexico	5.91
7	Germany	10.63	24	Korea	5.30
8	Sweden	10.57	25	Czech Republic	5.05
9	Switzerland	10.27	26	Poland	5.00
10	Spain[a]	9.95	27	Bulgaria	3.86
11	Canada	9.91	28	India	3.84
12	Australia	9.25	29	China	3.74
13	Brazil	9.10	30	Rumania	3.23
14	Finland	8.33	31	Turkey	2.91
15	The Netherlands	8.20	32	Russia	2.20
16	Austria	7.85	33	Ukraine	1.84
17	Greece	7.78			

a. Without Catalonia.

An analysis of the figures provided shows that 254 articles were published by Catalonia in prestigious journals during the period 1996-2002, indicating a 1.59-fold increase compared to the previous period. In the rest of the world, there was a 1.16-fold increase.

For Catalonia, the ratio "Number of outstanding articles by million inhabitants "(Table 6) increased from 19.18 (1990-1996) to 39.04 (1996-2002), thus moving from 14th to 6th place on the list. Note that this ratio may be influenced by the fact that the list of prestigious journals used in this study comprises a few more journals than the list used in the previous study (1990-1996). Catalonia has surpassed some European countries, including Germany, Sweden and the United Kingdom, which, like Catalonia, have not had large population changes. So, the rate of increase of outstanding articles in Catalonia was higher than in those three other countries.

From the data shown in Table 7, it can be seen that Catalonia ranks quite high in the list, in fourth place. The only surrounding European country that is ahead of Catalonia is France. For Catalonia, the ratio "Outstanding articles/total articles" increased by a factor of 1.22 compared to the previous period.

3.4. Analysis of the degree of collaboration in scientific publications

When analyzing the state of the art of mathematics research in Catalonia, we felt it was important to also consider both the number of articles written in collaboration with mathematicians from outside Catalonia and with which countries this kind of collaboration most frequently occurred. The results of this type of analysis may be interpreted in several ways. Some readers may think that collaborating with foreign colleagues means that the capabilities of mathematicians of any country are limited and help is needed from outside sources. Alternatively, a high collaboration index can be viewed as corresponding to a high level of mathematical capabilities, which allows interactions in various mathematics-related subjects and with different research groups from around the world. Regardless of the interpretation and subsequent conclusion, analysis of the degree of collaboration provides further insight into the state of mathematics research in Catalonia.

Table 8 lists the 15 countries that collaborated most frequently with Catalonia in publishing mathematics articles. The data reflect the degree of collaboration between the countries in absolute numbers. Most of the collaborations were with mathematicians in

Table 8. Number of articles written in collaboration

	USA	Spain	France	UK	Italy	Germany	Canada	The Netherlands	Mexico	Argentina	Japan	China	Russia	Belgium	Catalonia
USA		692	2281	2507	1642	2812	2739	846	235	148	1039	1773	893	470	221
Spain	692		337	260	282	211	116	101	96	93	39	77	150	216	214
France	2281	337		532	916	884	496	200	89	49	269	167	606	256	136
UK	2507	260	532		490	810	480	261	61	20	213	339	365	161	87
Italy	1642	282	916	490		677	290	185	34	43	169	120	512	146	70
Germany	2812	211	884	810	677		499	401	97	25	350	408	984	183	67
Canada	2739	116	496	480	290	499		169	51	16	228	601	204	80	47
The Netherlands	846	101	200	261	185	401	169		5	7	84	78	116	143	33
Mexico	235	96	89	61	34	97	51	5		5	72	14	106	9	33
Argentina	148	93	49	20	43	25	16	7	5		3	1	1	9	33
Japan	1039	39	269	213	169	350	228	84	72	3		371	193	47	30
China	1773	77	167	339	120	408	601	78	14	1	371		64	54	27
Russia	893	150	606	365	512	984	204	116	106	1	193	64		62	27
Belgium	470	216	256	161	146	183	80	143	9	9	47	54	62		21
Catalonia	221	214	136	87	70	67	47	33	33	33	30	27	27	21	

Table 9. Funding

	1996	1997	1998	1999	2000	2001	2002	Total
Catalan Government	223,641	330,166	476,607	394,258	596,485	890,247	561,403	3,472,808
Projects Spanish Ministry Education and Culture	493,974	607,851	377,927	614,377	801,832	952,552	1,366,702	5,215,215
European Union	851,495	419,661	385,726	342,062	589,333	529,365	823,216	3,940,858

the United States, Canada, and European countries close to Catalonia. Nonetheless, Catalan mathematicians collaborated more often with colleagues in Mexico, Argentina, Japan or China than with those in countries such as Belgium or Scandinavia.

4. Funding and infrastructure

In analyzing the sources that fund mathematics research, the cost of maintaining infrastructure, including buildings, libraries, computer equipment, and lecture rooms, should be taken into account. There are also personnel costs, that is, the salaries of everyone working in mathematics research at any institution in Catalonia. Besides this direct grants for research, which fund many research groups, finance research projects, the organization of congresses, fellowships for visiting foreign researchers, scholarships for training researchers, etc. In the following, we refer mostly to direct grants for research and less frequently to bibliographic support and computer equipment.

There are essentially three sources of subsidies for Catalonian mathematics research: the Catalan Government, the Spanish Government, and the European Union. Table 9 summarizes the funding by theses three sources during the period 1996-2002.

The Catalan Government has established several diverse programs to fund research groups, projects, and individual researchers. Among these programs, the one set up to fund "consolidated research groups" in Catalonia stands out since it aims to strengthen research groups by requiring that projects be cofunded by the group. At the end of the period 1996-2002, there were 18 consolidated groups in mathematics in Catalonia, comprising 263 researchers from Catalan universities, a number that represents 60% of the potential mathematics researchers in Catalonia. These groups received a total amount of 1,089,567 Euros during that time.

The programme of the Spanish Government that much provides funding for mathematics research is the "Sectorial programme to promote general knowlege". While a few Spanish programs fund research in areas that we considered to be related, they have little impact on funding in the field of mathematics itself. Only a few of these programs, such as the "*Telematic Services and Applications*" and Space Research, finance work in mathematics, and most of the funding is indirect.

Even though mathematics is not a priority for the European Union, there are several programs that support research. These have been funded by the European Union with the goal of creating thematic networks that facilitate researcher mobility and aid in the organization of courses and congresses.

In Catalonia, during the period 1996-2002, research projects centered around mathematics received more than 10 million Euros. Regarding the sources of funding, only 13.8% came from the Catalan Government. The main source of funding is the Spanish Government, with 49.5%, followed by the European Union with 36.7%. Comparing these figures with those from the period 1990-1996, there was an increase of 4% in the funds from the Catalan Government, and a decrease of 5% in the funding received from Spanish Government, while the European Union's funding remained at the same level.

Funding provided for mathematics libraries is another area of consideration. The investment in books and journals at the mathematics library of the University of Barcelona during the period 1996-2002 amounted to 1,213,700 Euros. At the Department of Mathematics at the University Autonomous of Barcelona, 498,942 Euros were invested, while at the Statistics and Mathematics Faculty of the Polytechnical University of Catalonia this investment was 286,244 Euros.

Comparing these figures with those from the previous period, investments in books and journals at Catalan universities from 1996 to 2002 markedly increased. Nonetheless, both at the University of Barcelona and the University Autonomous of Barcelona, the number of journal subscriptions decreased. The Polytechnical University of Catalonia doubled its outlay for books and started investing in journals. The total investment in Catalonia in bibliographic material related to mathematics during the period 1996-2002 was almost 2 million Euros, an increase of more than 40% compared with the previous period. This amount was less than 20% of the total direct financial help received by research groups.

Together with books and journals, computer resources are among the most important forms of support required by researchers in mathematics. Without entering into a lengthy description of the types of computer equipment found in Catalan universities and other research centers, the equipment of the Dynamics Systems Group of the UB and UPC, which includes a HIDRA parallel computer (Beowulf computer) that provides service to a large number of users, should nonetheless be mentioned.

5. Other centers and institutions involved in mathematics research

As noted above, mathematics research in Catalonia is carried out essentially at universities, but there are other research centers that either do research in mathematics or are involved in mathematics-related collaborations in Catalonia. In this section, we will briefly describe these centers and institutions.

Center for Mathematics Research (CRM).

The CRM is a consortium between the Catalan Government and the Institute for Catalan Studies that invites distinguished

mathematicians from around the world to spend time as visiting researchers. It sponsors research programs and organizes thematic semesters, congresses, and seminars. The activities of the CRM are carried out in coordination with research groups from Catalan universities.

Mathematics Institute of the University of Barcelona (IMUB).

The IMUB is a research center linked to the University of Barcelona that is dedicated to research and basic training in all the fields of pure and applied mathematics. It develops and supports research in mathematics, including the organization of scientific activities such as advanced courses, workshops, conferences, and seminars.

Institute of Research on Artificial Intelligence (IIIA).

The IIIA is a center of the Spanish Scientific Research Council, located at the campus of the University Autonomous of Barcelona. Some of its scientific activity is directly devoted to mathematics but it is also involved with Information Technology, which also has an important mathematical component.

Catalan Society of Mathematics (SCM).

The SCM is a subsidiary of the Institute of Catalan Studies that promotes both theoretical and applied research in mathematics. It acts as a meeting point between mathematicians from the various Catalan universities and those working as mathematics teachers in high schools.

Institute of Spatial Studies of Catalonia (IEEC).

The IEEC is a private foundation that promotes activities, studies, and projects related to scientific research and space technology.

Statistics Institute of Catalonia (IDESCAT).

IDESCAT belongs to the Ministry of Economics and Finance of the Autonomous Government of Catalonia. Its objective is to promote research and development in the field of statistics.

Ferran Sunyer i Balaguer Foundation.

This is a private foundation, sponsored by the Institute for Catalan Studies, that grants an annual award bearing the name of the Catalan mathematician Ferran Sunyer i Balaguer. The permanent award is given to a monograph on recent developments in any field of mathematics.

6. Edition of Scientific publications

One of Catalonia's contributions to the development of mathematics is the publication of several periodical journals of mathematics. For the period 1996-2002, these publications included:

Collectanea Mathematica.

This is the oldest Catalonian mathematics journal. Its publication, by the University of Barcelona, began in 1948. The journal is exchanged by the University of Barcelona Mathematical Library with several international journals.

Publicacions matemàtiques.

Published by the Department of Mathematics of the Autonomous University of Barcelona. Its publication began in 1976 and it has been in the ISI databases since 2002.

Qüestiió.

It is published by IDESCAT, sponsored by the University of Barcelona and the Polytechnical University of Catalonia. Since 2003 its name is "Statistics and operations research".

Mathware & Soft Computing.

This journal was created in 1994 and is published by the Mathematics and Computing Section of the School of Architecture of Barcelona, which publishes works in the fields of cognitive science and artificial intelligence.

Butlletí de la Societat Catalana de Matemàtiques.

This journal publishes, in Catalan, articles in any field of mathematics, that may be of interest to a large number of readers.

Qualitative Theory of Dynamical Systems.

The University of Lleida has published this journal since 2000. It consists of articles concerning the theory, methods, and applications of dynamic systems.

Book collections.

The CRM, by means of an agreement with the Birkhäuser publishing house, produces a collection of books based on the contents of the Advanced Courses organized by the CRM.

Publications of the CIMNE.

The International Center of Numerical Methods in Engineering, which is a consortium between the Catalan Government and the Polytechnical University of Catalonia, publishes "Archives of Computational Methods in Engineering" and "Revista Internacional de Métodos Numéricos para cálculo y diseño en ingeniería".

7. Conclusions

1. Among the Universities with mathematics programmes, prmanent teaching staff increased only at the Autonomous University of Barcelona, wich previously had the lowest rate of permanent teaching staff.

2. The number of permanent teaching staff has stabilized. While this can have a positive effect on research dynamics, there is also a negative effect on the incorporation of young researchers. New professional paths for mathematicians through connections between university and the industrial and business worlds should be developed.

3. The number of fellowship holders at the three universities with mathematics programs significantly increased compared with the previous period. This probably resulted in an increase in the number of doctoral theses in Catalonia. The number of doctoral theses submitted by visiting students also increased. However, the total number of theses

submitted was low when compared with the scientific potential of Catalan universities.

4. An analysis of mathematical productivity according to country showed that, in Mathematics research, Catalonia maintained or improved its position among the most advanced countries. It should be noted, however, that the most rapid increase in productivity occurred up until the mid-1990s. The numbers seem to point out that a steady state was subsequently reached and that mathematics research in Catalonia has now entered a period of maturity.

5. The most productive fields in mathematics around the world are also highly productive in Catalonia, except for Numerical Analysis and Partial Differential Equations, which need to be strongly promoted in the future.

6. The number of outstanding publications in relation to the size of the population in Catalonia and the country's position compared with surrounding European countries increased over the previous period.

7. Catalonian mathematicians frequently collaborated with mathematicians from other countries. More than 40% of the mathematics publications in Catalonia included authors from other countries, especially from the United States and surrounding European countries.

8. Catalonia should have more weight in the administration of resources dedicated to research. In the line to assisting research groups according to the quality of their productivity, the resources available for mathematics research should be increased, thereby promoting both scientific and technologic development. Catalonia has the appropriate conditions for making a qualitatively important advance in Mathematical research, provided that it receives the necessary financial support.

9. Although investments in mathematics libraries at Catalan universities increased in absolute numbers, the amount devoted to journals subscriptions remains insufficient due to large increases in subscription costs.

10. Despite the high level of mathematics research in Catalonia, its international recognition remains low. This may be probably due to the lack of a mathematical tradition. It is necessary to increase the presence of Catalan mathematicians on the committees of outstanding journals and in the decision-making groups of international institutions that formulate scientific policies. A major step to raise the prestige of Catalan mathematics would most certainly be to increase the quality of Catalan mathematics journals to the level of outstanding journals.