Relationship between Internationalization and Quality of University Research

Pilar APARICIO-CHUECA[1]
Xavier TRIADO-IVERN
Frederic MARIMON

Abstract

This paper has twofold aim: (i) profiling the "research groups" at the University of Barcelona (UB) in order to identify the key success factors of the groups that could be labeled as "Excellent"; (ii) and assessing the relationship between the quality of the research and the internationalization degree of the group.

A factor analysis determines the dimensions that characterize the research groups. A cluster analysis determines the profiles of these groups. Finally, a regression finds the relation between the quality of their scientific production and the internationalization.

Three cluster types or styles were identified. One of the clusters stood out by virtue of the impact of its publications and in terms of the general quality of its output. These "excellent" groups attain high degree of both at the same time: quality in their research and international collaboration. This article is one of the first to assess the impact of international collaboration in the scientific production of the universities.

Keywords: *team working, team effectiveness, high-level research, universities research organization*

JEL classification: I23, I20

Introduction

The evaluation of scientific activity and productivity of researchers is a matter of interest from different perspectives: funding research, advancement and recognition among the activities of research, policy research and decision making which allows implementation, strategic planning of university activity, wage bargaining in cases where it is done directly between the researcher and the contracting organization, the provision of university teaching posts and promotion as well as scholarships, among others (Paez and Salgado, 2009).

[1] **Pilar APARICIO-CHUECA,** Faculty of Economics and Business, University of Barcelona, Diagonal 690, Barcelona 08034, Spain, Telephone: +34 934 021 963, Fax: +34 934 024 580, Email: pilaraparicio@ub.edu

Xavier TRIADO-IVERN, Faculty of Economics and Business, University of Barcelona, Diagonal 690, Barcelona 08034, Spain, Telephone: +34 934 021 963, Fax: +34 934 024 580, Email: xtriado@ub.edu

Frederic MARIMON, Social Science Faculty,, Universitat Internacional de Catalunya, C/Immaculada, 22, Barcelona 08017, Spain, Telephone: +34 934 021 963, Fax: +34 932 541 850, Email: fmarimon@cir.uic.es

This paper focuses on analyzing the role and effectiveness of research groups and research universities. The growing interest in academic research in the universities can be seen in all areas of knowledge, and it appears to stem from the increased number of specialised publications and the emergence of impact as a factor for measuring the quality of research. The shift also reflects a change in the role of the university. In addition to creating accreditation agencies or bodies to ensure the quality of research, the university can also foster research in groups or teams by changing the conditions for advancement and the incentives that prevail within the university system.

As a result, there arises a paradox. While university policies and planning are devised to promote the potentialities and synergies of teamworking, the system of advancement largely centres on individual achievement. To what extent are these two aims compatible? On the other hand, is it a good strategy for these research groups establishing international alliances in order to perform an excellent research? In other words: is it true that international groups achieve better standards in its research?

One of the challenges in summarising the literature on teams remains the difficulty of identifying the variables that have an influence on team output in organisations. The literature on the subject is extensive, and a number of models from diverse perspectives have been put forward to analyse the relationship among the distinct variables and output (Gladstein, 1984; McGrath, 1986; Campion et al., 1993; Devine et al., 1999; Bunderson, 2003; Gibson & Vermeulen, 2003; Kozlowshi and Bell, 2003; Salas et al., 2004; Horwitz, 2005; Rey et al, 2008).

Salas et al. (2004) has, for the most part, grouped and classified the models under two overarching theoretical frameworks. The first group takes a functional perspective (Hollingshead et al., 2004, Wittenmaum et al., 2004) and the theoretical model is the IPO (input-process-output) model of team productivity (Hackman et al., 1976; Hackman, 1990; Wittenmaum et al., 2004). The second group is based on the models of Campion and his collaborators (Campion el at, 1996). They define five broad categories of variables affecting team results: job design, interdependence, group composition or heterogeneity, context and, lastly, process.

This paper marks fourth phase of a study that begun in 2005 and builds on papers read at earlier conferences (Triadó and Aparicio, 2005, 2006). The first question was to clarify whether the research groups of a very big university[2] – University of Barcelona– were teams or work groups[3]. The second question was to

---

[2] This university -for 2010- have 109 million euros in research income, 348 research groups with classified as 243 consolidated research groups for the local goverment, 625 active research projects, 979 research grantholdersand 50 research institutes and centres.

[3] In a work group, each member pursues individual goals and any output or result is a product of the individual's effort, as is any measure of efficiency or effectiveness. This description fits the university's approach to how research groups function. We think that individual measurement of effectiveness and/or efficiency—researchers are judged and assessed based on their individual progress—is precisely one of the determinant factors in judging whether a research group can be classified *a priori* as a group, and not a team.

determine how to characterize the various groups, identifying their defining variables and analyzing correlation patterns. We adopted the IPO model, built on three premises: work groups pursue defined objectives; group behavior varies in quality and quantity and that variation can be measured; and there are both internal and external factors influencing process behavior and output. The findings showed that the groups are not small, but rather exceed twenty researchers. On average, they generally include two chaired professors, five professors and seven visiting researchers. It appears that the presence of a person from Administration and Services Staff (A&SS), normally technical expert, boosted group productivity, and the most productive groups had at least one in their ranks.

The second phase of the broader work set out to identify whether the need to collaborate with colleagues was the same in all areas of knowledge. It focused on identifying which variables are directly related to the output of research groups. The conclusions were clear in demonstrating that researchers in the sciences showed greater potential for publication than did their counterparts in the humanities. When quantifying the quality of each group's scientific output, the impact of other factors was also apparent, including research momentum (work published by the same group in previous years), assessment and impact of the research, and group size.

In the third phase (Marimon et al., 2010), excellent research groups were identified. Their profile was analyzed to see whether any conclusions could be drawn regarding key success factors. We showed the group characteristics that lead to a cluster of excellence and ensure greater success in research, backed up by publication in prestigious journals[4].

This article discusses fourth and last stage of the study that analyzes the relationship between quality and production of research universities with the internationalization of the members of the research groups of the universities recognized by the world ranking.

1. Methodology

1.1. Methodology and database

The study makes use of a database on the research groups formally constituted by the University of Barcelona. A portion of the data, the most quantitative part, has been provided thanks to assistance from the UB's Office of Research and its GREC system[5], while the more qualitative information comes from a questionnaire devised by the authors and aimed at the directors of the research groups. The sample universe was made up of the 348 research groups at

---

[4] It is a matter for future study in another area to establish any relationships between a scholar's quality of research and quality of teaching, in the context of new graduate and postgraduate programs within the EHEA (European Higher Education Area) framework.

[5] GREC is a Research Management application developed at the University of Barcelona and currently in use at several research institutions and bodies.

the University of Barcelona (RGUB), which are spread across twenty faculties and involve a total of 4,730 researchers (table 1).

Table 1. Study Fact Sheet

CHARACTERISTICS	POPULATION
Universe	348 Research Groups at University of Barcelona (RGUB)
Selected Sample	169 Research Groups Sample selection was determined by which research groups responded to the questionnaire.
Time Period	Winter 2005 and Autumn 2006
Data Studied	1994-2010

Source: Own elaboration

Based on the classification of research groups proposed by Marimon et al (2010), we analyzed the relationship for each cluster of research groups between their recognition and their level of internationalization.

Among the variables chosen to identify the cluster (table 2) were added to analyze the internationalization variables, such as "Researchers visiting staff and A & SS" and the presence of international researchers in the group.

Table 2. Description of biodemographic variables, task variables and organizational variables

Biodemographic variables

Age (*average group age*)	Youth in the team can tend to facilitate communication by virtue of similar mindsets or knowledge levels (Tsui et al., 1992), and this could lead to lower membership turnover. Groups with the youngest researchers should be expected to be most aggressive in producing output and, as a result, groups of below-average age ought to achieve higher levels of output (Hambrick, 1994).
Sex; *race/ethnicity; culture or nationality*	Following the literature, the second demographic variable to study is gender and its effects on teams (Rogelberg and Rummery, 1996).
Group size	Size is another variable characterising groups. (Dennis and Valacich, 1994). Two variables measured size: the first is the absolute *number of group members* and second is the *number of full-time equivalents* (FTEs) that make up each RGUB.
Group composition	In addition to the two group size variables, the composition of the group was also analysed: *number of chaired professors*, *number of professors, contracted teaching staff, visiting researchers and A&SS staff*. Also important is the presence of *international researchers* in the group as well as researchers from other areas, who bring an interdisciplinary approach.
	Another important aspect of group composition is the *number of doctoral theses* and *research grants*.

Task attributes variables

Research area	This variable contributes information on the number and quality of the group's *outputs*. Research groups were divided into two overarching groups, based on their proximity to the *sciences or the humanities*. Those two classical divisions—sciences and humanities—were used to assess the impact of area of knowledge on the research groups. The type of investigations (theoretical, empirical, o mixed) carried on in each group. Other variable that was asked to the main investigator was his/her own opinion about the kind of their developed researh: theoretical, empirical, o mixed
Research momentum or historical output levels	This refers to the number of earlier studies. It acts as a momentum or experience variable (Guzzo et al., 1986) and reflects the learning curve of the groups that are most productive and have the greatest imapct. With more projects and papers in hand, groups boost their ability to achieve greater successes in future.
Total *number and percentage of civil servants in group*	This variable analyses group composition. The literature on the matter is limited, because civil servants are widespread in Spanish organisations.

Organisational variables

Structure	These variables contribute information on group structure and organisation. The identified variables include written *rules and regulations in a group*, the *presence of subgroups* and their stability, the formality or *informality of communications*, the *existence of internal coordinators* or other similar figures …
Group administration and updating tasks	This set of variables analyses how current the group's data are and how committed the group is to keep the information up to date. It reflects the quality of the update process used for GREC data.

Production variable

Total output between 2004-2005	Total output have been measured as a total of book chapters, doctoral thesis, papers, or papers acepted in congreses in the years 2004 and 2005.
Productivity	This variable provides information about the average production of each component of the team.
Qualitative assessment of output (04-05)	This is a measurement of the quality of the output. It is the number of articles published in SCI (Institute for Scientific Information) journals.
Individual Qualitative assessment (04-05)	With this information we want identify the average output quality for each researcher.
Impact factor of output (04-05)	This variable is gathering information about impact of output, without any consideration about how many researchers are in each group.
Individual impact factor	This variable is gathering information about impact of papers and output for each individual researcher.
Impact/output ratio	These variables give a measurement of the output impact.

Source: Own elaboration

The implication of internationalization is analyze, through regressions and statistical tests (Marimon et al., 2010) is shown the relationship between quality and quantity of production of research groups from universities, related to the level of internationalization members.

1.2. Objectives and hypotheses

This work focuses on identifying international research networks as a strategy for improving their quality. The data analyzed comes from a particular case: the research groups at the University of Barcelona. The aim of this paper is to demonstrate that excellent research groups, both in quality of outputs such as quantity, have a high component of internationalization. Internationalization is revealed as a key variable to consider the quality of research.

The objective of this research is based on one assumption*: Research groups classified as excellent groups have overcome an external accreditation that confirms it.*

In the assessment of Research Group conducted by the accrediting agency AQU[6] in 2009, al the seventeen groups identified as "excellent" by Marimon et al, (2010) have exceeded external accreditation and have been awarded public funding to boost their production and quality. Therefore it is recognized that the starting point of this paper is right, since the object of analysis Research Group is ranked as excellent. Therefore, two hypotheses are drawn:

Hypothesis 1: focus groups with a higher level of internationalization get more quality in their outputs.

This hypothesis seeks to confirm the relationship between the level of positive internationalization research group and the quality of its outputs.

Hypothesis 2: focus groups with a higher level of internationalization have higher production level.

In this second hypothesis seeks to identify the existence of a positive relationship between the level of internationalization of the research group and the quality of its outputs.

2. Results

2.1. Define of the research groups: dimensions and cluster

Based on the sample, a factor analysis was carried out to reduce the number of variables under study, where 169 groups proved to be useful and the 31 variables contributing data on them were reduced to four factors (table 3). The sampling adequacy of the KMO factor analysis was 0.706 and Bartlett's test of

---

[6] The purpose of the AQU Catalunya Strategic Plan for 2009-2012 is to enhance the running of the Agency in line with the objectives set out in the Catalan Universities Act/LUC and the European standards and recommendations, and to meet the growing demand for review and evaluation created by the setting up of the EHEA.

sphericity was significant at a level of .000. The method chosen to take the analysis forward was the principal components analysis with varimax rotation. Only four factors were extracted so as not to disperse the analysis too much, while capturing almost 70% of the variance.

Table 3. Description of factors

F1 Youth factor	Number of grant recipients, total grants received in the last two years, the presence of non-Spanish researchers and the number of A&SS staff connected to the research group.
F2 Size factor	Number of people linked to each research group, number of chaired professors and other professors and-historical output levels of the group to 2003
F3 Quality factor	The impact factor of each individual group member and of the overall output in the period 2004-2005, the qualitative assessment of output in the same period, and the ratio of impact to output.
F4 Output factor	Output of selected groups, irrespective of quality, both on an individual level (each member's productivity) and on the group level (total group output for the period 2004-05). It also includes the sum total of doctoral theses defended in the period under analysis.

Source: Own elaboration

Using cluster analysis, the research groups were put into internally homogenous groups with statistically significant differences between them. The analysis of the conglomerates of k-means yielded three clusters. Applying the appropriate tests, it could be seen that the four factors were statistically distinct and that the means of each cluster, by factor, are as shown in Table 4.

Table 4. Analysis of cluster averages by factor

Cluster		F1 Youth	F2 Size	F3 Quality	F4 Output
1 Standard	Mean	-.23	-.30	-.192	-.41
	Std. Deviation	.869	.764	.533	.601
	N.	107			
2 Productive	Mean	.53	.68	-.40	.93
	Std. Deviation	1.075	1.190	.637	1.150
	N.	45			
3 Excellent	Mean	.04	.10	2.28	.15
	Std. Deviation	1.063	.892	1.126	.901
	N.	17			

Source: Own elaboration.

Table 5 shows that the "standard" clusters do not stand out either in terms of quality or quantity of output. This is the most numerous clusters and includes 107 groups, or 63% of the sample. The research groups in this cluster may be characterized as smaller and contain a greater percentage of civil servants in their ranks. They have the lowest overall levels of output, productivity and quality. They also have fewer grants and doctoral theses in the last two years than the other groups do.

The productive cluster brings together UB research groups that place concern on their volume of output, although output volume could also be attributed to group size. This cluster contains 45 research groups whose levels of individual and overall output are the most significant, leaving aside the quality of their output.

The third and final cluster (Cluster 3) is made up of the groups designated "Excellent" research groups. They stand out both because of the quality of their publications and in terms of the qualitative assessment and impact of their publications. This cluster contains 17 groups, representing 10% of the sample. In the final section of the paper, more detailed attention will be given to the Excellent cluster in order to make some interesting comparisons.

Table 5: Cluster profiles

	Cluster 1 Standard	Cluster 2 Productive	Cluster 3 Excellent
Number of people in group	10.65	19.80	17.24
Percentage of men	39.33	41.82	42.50
Number of chaired professors	0.88	1.76	1.71
Number of other professors	2.94	5.29	2.12
Grant recipients	2.08	4.53	3.82
A&SS group members	0.34	0.73	1.00
Average group age	42.17	41.94	41.37
Contract academic staff	2.23	3.62	3.24
Visiting researchers	2.18	3.87	5.35
Total full-time equivalents	6.44	11.05	7.38
Total output between 2004 and 2005	33.83	101.04	73.24
Momentum: total output to 2003	343.75	783.18	824.59
Qualitative assessment of output (04-05)	5.40	11.76	35.82
Impact factor of output (04-05)	13.46	26.26	126.29
Individual impact factor	2.14	2.21	18.07
Impact/output ratio	0.55	0.27	1.91
Percentage of civil servants	40.90	39.65	24.59
Productivity	5.82	11.34	10.63
Specialisation	0.45	0.37	0.70
Sum total of grants in last two years	5.52	11.68	13.11
Sum total of doctoral theses defended	8.06	17.64	8.47
Presence of non-Spanish researchers	0.55	0.77	0.64

Source: Own elaboration.

In order to study the relative positions of the three clusters in terms of the four factors obtained in the factor analysis, each cluster has been plotted on axes representing the intensities of the factors. The clusters are represented as bubbles, and the size of each bubble is proportional to the number of research groups contained in it. In other words, the largest bubble corresponds to Cluster 1 (with 107 groups), while the smallest bubble represents the least numerous cluster, which is made up of the Excellent groups and only contains 17 in total. The *Excellent*

bubble is further differentiated by appearing darker. The *Excellent* cluster stands out in terms of the quality of its output, whereas it is located in an intermediate position between the other two clusters in terms of the other factors.

The positioning map graphically supports the summary conclusion that quality of output is the factor that differentiates the *Excellent* cluster. As a result, quantity of output, group size and group youth are not explanatory factors.

We also observe that the groups classified as excellent are those with a higher level of internationalization, both the number of visiting researchers in each group and the number foreign researchers.

2.2. Impact of internationalization in the quality of the research

It has been published an online map of the internationalization of the University of Barcelona, where it can be found all the institutions with which the UB is linked through agreements or joint projects. The map contains 1.748 projects financed by 1.013 agreements with international organizations of 82 different states, so it reflects one of the most important dimensions of international research at this university. The map is created on the basis of Google Maps, including general agreements, framework agreements, specific, mobility, European projects and cooperation, etc.

The map, drawn in a way that is easy to see, shows in small-scale conventions grouped by states. In each state, there is a circle that is proportional to the number of agreements, and also provides information for each of the agreements, grouped by institutions. When extending the scale of the map, the conventions are represented according to the institution with which they are signed.

The analysis of the research of the catalane universities provides clues to claim that internationalization and quality research are correlated. Figure 1 shows the internationalization degree of the universities (in the horizontal axis)¸ the excellence of its research (vertical axis) and the total amount of scientific production (size of the bubble). The University of Barcelona is plotted in dark.

Figure 1. Positioning catalane universities in quality research measured in normalized impact and internationalization
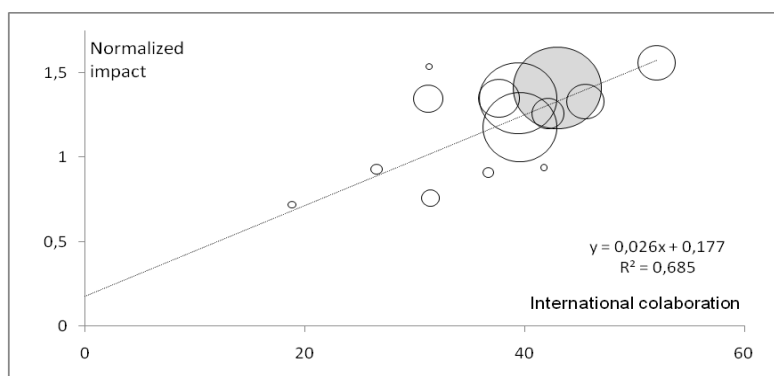
Source: Own elaboration, from Scimago Institutions Rankings (SIR) World Report 2010 data.

This arouses a new hypothesis. Are also the excellent groups in the University of Barcelona the more internationals? Two Mann-Whitney tests were conducted. The first concludes that the presence on international researchers does not impact on the quality factor (significance .930), while the second concludes that those groups with international researchers are more productive (significance .011). In this way the first hypothesis of the study is not confirmed and the second is confirmed.

Nevertheless, the excellent groups have 5.35 visiting researchers on average (while the standard groups 2.18 and the productive 3.87). The *Excellent* gropes also have more presence of non-Spanish researchers (o.64) than the standard groups (0.55), albeit the productive have 0.77.

3. Profile of excellent cluster and discussion

One factor they all Excellent groups have in common is that they belong to faculties in experimental areas linked to the sciences. This fact reaffirms the conclusion drawn back in phase two of the larger study (Triadó and Aparicio, 2006), namely that the research groups most closely tied to the sciences achieved a higher rate of publication and could reach a higher level of excellence than research groups in the humanities. As these groups were created in 1993 on average, they may be said to have established a certain "track record in research". After all, they average fifteen years' experience in doing research.

Excellent research groups appear to demonstrate a high level of quality in their output both at a group level and at an individual level.

Regarding to the group composition, Excellent groups have an average of 17.24 members, and it is equivalent to 7.38 full-time. It is remarkable the presence of 5.35 visiting researches on average, as well as 3.82 grant recipients and one person providing administrative support.

In addition to any broader application of benchmarking afforded by the Excellent cluster profile above, Table 6 presents a comparison between the UB's Excellent research groups and the other UB groups divided by area of knowledge, in the widest sense. The groupings fall into human sciences; law, economics and social sciences; experimental sciences and mathematics; health sciences; and education sciences. The purpose of the comparison is firstly to analyze the composition of the research groups by area and then draw attention to the differences that now exist between the research groups in each area and the best-in-class groups.

Table 6. Group profiles, by area

	Excellent Groups	Human Sciences groups	Law, Economics and Social Sciences groups	Experimental Sciences and Maths groups	Health Sciences groups	Education Sciences groups
Visiting researchers	5.35	2.83	1.53	3.23	6.04	1.83
Number of non-Spanish researchers	0.64	1.33	1.65	1.27	1.38	1.48
Average group age	41.37	45.86	43.69	39.06	42.87	46.57
Grant holders	3.82	1.68	1.14	4.48	2.94	1.63
A&SS team members	1	0.26	0.1	1.1	0.7	0.17
Sum total of grants received in last 2 years	13.11	6.45	3.61	10.64	10.29	4.38
Percentage of civil servants	24.59%	42.09	54.87	30.76	27.29	53.91
Number of people in group	17.24	10.75	11.73	16.48	16.55	11.94
Total full-time equivalents	7.42	6.08	8.07	8.77	6.70	7.57
Momentum: total output to 2003	824.59	119.31	150.08	151.6	153.53	167.13
Qualitative assessment of output (04-05)	35.82	0.26	2.43	15.97	16.85	3.69
Impact factor of output (04-05)	126.29	0.26	1.37	44.37	57.96	5.48
Total output between 2004 and 2005	73.24	40.72	57.18	50.98	42.21	72.42
Sum total of doctoral theses defended in last two years	8.47	11.32	7.09	11.68	8.97	14.35
Productivity	10.64	7.67	7.46	6.01	6.04	11.65

Source: Own elaboration.

The number of researchers in each RGUB varies between 10.75 and 17.24. The latter number is for Excellent groups, whose full-time equivalents are roughly 7.42±0.95. Another aspect of the composition of Excellent groups, as well as those in health sciences and mathematics, is that they have an A&SS person, while the

other areas have only about 0.2 A&SS. As for visiting researchers, there is a similar disparity, although it is less marked. Lastly, the number of grant recipients and civil servants in each group is notable. Excellent groups contain 24.6% civil servants, the lowest level across all groups, while the maximum number of 54.9% arises in law and social sciences. The number of grants received repeats a similar pattern. Excellent groups received thirteen grants in the years 2005-2006, which is the highest number, while the approximate breakdown for the other groups was, by area, four for law and social sciences, six in human and social sciences and ten in mathematics and health sciences[7].

5. Discussion

The groups in the study are highly heterogenous and show broad differences across biodemographic, attribute and effectiveness variables. In our earlier papers (Triadó y Aparicio, 2005, 2006), three hypotheses were validated that form the basis of the current study:

a) There is a positive relationship between average group age and a group's productivity. Similarly, average group age is positively related to a group's historical levels of output. By contrast, lower average group age boosts the quality of a group's output.

b) There is a difference in the quality of publications between groups in the sciences and groups in the humanities. The faculties of Physics, Chemistry, Biology, Geology and Mathematics achieve the highest quantity and quality of output.

c) Lastly, there is a direct, positive relationship between group size and output, and there is also a relationship of the same sign between group size and quality (both in number of articles and their impact factor).

Based on a factor analysis of the 33 variables in the information matrix, four factors were identified as follows: factor 1 was the "youth or job stability" factor; factor 2 related to group size or stature; factor 3 pertained to the quality of group output; and factor 4 captured the quantity of group output. The subsequent cluster analysis produced three clusters of research groups: standard, productive and Excellent.

The cluster studied in the greatest detail contains the Excellent research groups, whose main features are:

a) Research in experimental areas linked to the sciences; this link is important.

b) Fifteen years of track record, on average.

c) Average group composition of 7.3 full-time equivalents and 17.24 group members (irrespective of level of dedication); 5.35 visiting researchers, 3.82 grant recipients, and an administrator; and a low percentage of civil servants, who make up only 24.59% of their ranks.

---

[7] The Excellent groups have been treated as a separate group and do not affect the averages of the five areas used in the analysis.

d) High quality of output at a group and at an individual level (they have a group impact factor of 126.29 over the last two years and average individual impact factor of 18.07).

The last issue analyzed allows us to claim that the internationalization does not implies achieving better standard of quality, although the excellent groups are those who receive more visiting professors. The prestige of these groups is attractive for international researchers and faculty members.

Bibliography

1. Bunderson. J.S., (2003). "Team member functional background and involvement in management teams: direct effects and moderating role of power centralization". *Academy of Management Journal*, 46 (4), 458–474.
2. Campion, M., Papper, E., Medsker, G., (1996). "Relations between work team characteristics and effectiveness: a replication and extension". *Personnel Psychology*, 49, 429-452.
3. Campion, M.A., Medesker, G.H., Higgs, C.A., (1993). "Relations between work group characteristics and effectiveness: Implications for designing effective work groups". *Personnel Psychology*, 46, 823-850.
4. Dennis, A.R., Valacich, J.S., (1994). "Group, sub-group, and nominal group idea generation: New rules for a new media". *Journal of Management*, 20(4), 737-756.
5. Devine, D.J., Clayton, L.D., Philips, J.L., Dunford, B.B. & Melner, S.B., (1999), "Teams in organizations: prevalence, characteristics, and effectiveness", *Small Group Research*, 30, 678-711.
6. Gibson, C, Vermeulen, F., (2003). "A healthy divide: subgroups as stimulus for team", *Administrative Science Quarterly*, 48 (2), 202-239.
7. Gladstein, D.L., (1984). "Groups in context: A model of task group effectiveness", *Administrative Science Quarterly*, 29, 499-517.
8. Guzzo, R.A., (1996). "Fundamental considerations about work groups". In M. A. West (Ed.), *Handbook of work group psychology* (pp. 3-21). San Francisco: Jossey-Bass.
9. Hackman J.R. Brousseau, K.R., Wiess J.A., (1976). "The interaction of task design and group performance strategies in determining group effectiveness", *Organizational Behavior and human performance*, 16, 350-365.
10. Hackman, J.R. (Ed.), (1990). *Groups that work (and those that don't).* San Francisco: Jossey-Bass.
11. Hambrick, D.C., (1994). "Top management groups: A conceptual integration and reconsideration of the 'team' label". In B. M. Staw, L. L. Cummings (Eds.), *Research in organizational behavior*, 16, pp. 171-213.
12. Hollingshead, A.B., Wittenbaum, G.M., Paulus, P.B., Hirokawa, R.Y., Ancona, D.G., Peterson, R.S. et al., (2004). "Understanding theory and research on groups from the functional perspective". In M. S. Poole & A.B. Hollingshead (Eds.), *Theories of small groups: An interdisciplinary perspective*. Thousand Oaks, CA: Sage.

13. Horwitz, Suing K., (2005). "The Compositional Impact of Team Diversity on Performance: Theoretical Considerations", *Human Resource Development Review*, 4(2), 219-245
14. Katzenbach, J.R., Smith, D.K., (1993). *The wisdom of teams: Creating the high-performance organization*. Boston: Harvard Business School Press.
15. Kozlowski, S.W.J. and Bell, B.S., (2003). "Work groups and teams in organizations", in Borman, W.C., Ilgen, D.R. & Klimoski, R.J. (Eds), *Industrial and Organizational Psychology*, 12, John Wiley & Sons, Hoboken, NJ, pp. 333-75.
16. Marimon, F., Aparicio, P., Triado, X., (2010), "Profile and performance of the university research groups". *International Journal of Management in Education*, 4, nº3, 279-297
17. McGrath, J.E., (1986). "Studying groups at work: Ten critical needs for theory and practice". In P.S. Goodman & Associates (Eds.), *Design effective work groups* (pp. 362-392). San Francisco: Jossey-Bass.
18. Páez, D., Salgado, J.F., (2009), "Indicadores de productividad científica.Implicaciones para la evaluación de la psicología española", *Boletín de Psicología*, No. 97, Noviembre 2009, 117-136.
19. Rey J., Martín M.J., Sebastián, J., (2008), "Estructura y dinámica de los grupos de investigación", *Arbor*, Vol. 184, N. 732. doi:10.3989/arbor.2008.i732.219.
20. Robbins, S., Coulter, M, (2005). *Administración.* 8th Ed. Mexico: Pearson, Prentice Hall, 369-390.
21. Rogelberg, S.G., Rummery, S.M., (1996). "Gender diversity, team decision quality, time on task, and interpersonal cohesion." *Small Group Research*, 27(1), 79-90.
22. Salas, E., Stagl, K.C. and Burke, C.S., (2004), "25 years of team effectiveness in organizations: research themes and emerging needs", in Cooper, C.L. & Robertson, I.T. (Eds), *International Review of Industrial and Organizational Psychology*, Vol. 19, John Wiley & Sons, Chichester, 47-91.
23. SC Imago Research Group, Copyright (2010). *Scimago Institutions Rankings (SIR) World Report 2010.* Data Source: Scopus® http://www.scimagolab.com :: http://www.scimagoir.com
24. Triadó, X.M., Aparicio, M.P., (2005). *Identificación de las características de los grupos de investigación de la Universidad de Barcelona. Un paso hacia el análisis de la eficacia de investigar en grupo.* Actas del XIX Congreso anual y XV Hispano-Francés. Vitoria.
25. Triadó, X.M., Aparicio, M.P., (2006). *Efecto de los atributos 'bio-sociales' y de 'tareas' sobre el output en los grupos de investigación. El caso de la Universidad de Barcelona.* Actas del XVI Congreso Nacional de Acede. Valencia.
26. Tsui, A.S., Egan, T.D., O'Reilly, C.A., III., (1992). "Being different: Relational demography and organizational attachment". *Administrative Science Quarterly*, 37, 549-579.
27. Wittenbaum, G.M., Hollingshead, A.B., Paulus, P.B., Hirokawa, R.Y., Ancona, D.H., Peterson, R.S., Jehn, K.A. & Yoon, K., (2004), "The functional perspective as a lens for understanding groups". *Small Group Research*, Vol. 35. 17-43.