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HOW TO OVERCOME THE GAP BETWEEN THE AVAILABLE STATISTICAL METHODS AND THEIR EFFECTIVE USE BY RESEARCHERS IN SOCIAL SCIENCES. A FEW THOUGHTS ABOUT THE EXPERIENCE IN THE PRESTA PROGRAMME

PRESTA is a training programme in applied statistics for teachers and researchers in South American universities, sponsored by the European Union, which started in 1994. It was intended to make a convergent presentation of "exploratory data analysis" (in the Anglo-Saxon tradition) and " data analysis" (in the French tradition) to a "critical mass" of users. The seminars organised in its first quinquennium were attended by 2,500 researchers and teachers from about 300 universities. Working in the field, we soon realised the importance of the distance between the currently available statistical methods and their effective and potential uses. Therefore, the research programme is focused on the pedagogical contents and the institutional components of this "gap". In this paper, we summarise our experience with regard to the main factors that led to this situation and the strategies developed to solve it.

1. INTRODUCTION

Since the eighties, the Data Processing Methodology Laboratory of the Université Libre de Bruxelles, Belgium, in collaboration with other European universities, has been holding statistical methods seminars at the main public universities in Argentina, Bolivia, Chile and Paraguay. These seminars have basically covered statistical methodology and associated data processing technology, applied to sampling surveys in socio-economic studies.

In 1993, this experience led us to propose a different type of international co-operation with South American universities in the field of training researchers in statistical methods: The "Programme de Récherche et d'Enseignement en Statistique Appliquée" (PRESTA – Programme of Research and Training in Applied Statistics). This initiative got immediate support from other European higher education institutions and the sponsorship of the European Union.

We first present the outline of the "diagnosis" on which the PRESTA programme was based (Section 2) and then we summarise its method of operation and main achievements (Section 3). In the last two sections, we present a critical reflection about the gap observed between statistical methods currently available and their effective use in social research. Section 4 deals with the course's content and the didactic approaches experienced in the seminars organised. Since the experience was carried out on a large regional scale, we took into consideration the social and institutional dynamics that determined the persistence of such gap, which is analysed in Section 5.

2. SOCIO-ECONOMIC RESEARCH IN SOUTH AMERICA SINCE THE EARLY NINETIES

The co-operation experience with Latin America made it possible to observe, throughout more than a decade, the gradual development of a certain mismatch between the growing number of studies that request the use of statistical methods and the availability of professionals to carry them out.

2.1. EXPANSION OF THE DEMAND FOR STUDIES

The increasing demand for socio-economic studies in Latin America during the Eighties should be examined in the context of the economical and social transition that the majority of the Latin American countries were undergoing. In fact, the return to constitutional regimes was accompanied by governmental budgetary adjustment policies. Imposed by the burden of their foreign debts, these policies had considerable social, economic and political effects, since they mainly relied on large-scale privatisation plans for national companies and decentralisation of the power, without decentralising their financial resources, and preparing the human resources to take over their new responsibilities.

In this context, Latin American countries had to reorganise simultaneously their local government, regional government and the government of large cities. These countries once again established regional economic agreements, which intended to create new economic areas (Mercosur Agreement, Pacto Andino). These new forms of government naturally needed new studies to understand and define their policy. As a result, there was a widespread demand for statistical information, which could not be fulfilled by the former official statistical systems, and help from universities and the private sector was requested. This caused a proliferation of local and regional sources of statistical information, without any apparent effort to agree on methodology. Consequently, statistical data lost credibility, which lead to an increasing demand for additional studies.

Such expansion of demand would not have been possible without the great number of microcomputers available, which reduced considerably the costs of data storing and processing. Therefore, public administrations were able to create a large number of databases at low cost, sometimes without taking into account ethical considerations. The commercial distribution of statistics programs made it seem easy to exploit the information stored in these databases. New software and computer equipment was acquired and the budget that should have been partially devoted to training professionals was limited to "black box" training in the use of statistical software.

The confusion, maintained by commercial companies between (lack of) statistical knowledge and knowledge of the *modus operandi* of statistical software, enabled a false alternative to be strengthened, or even legitimised, in academic areas: "Pure statistics" versus "applied statistics". In addition, the statistics training of the "users" was dependent on the statistical software available, which was created for a different socio-cultural context and to meet the requirements of the dominant economic markets.

2.2. RESEARCHERS' PROBLEMS IN HANDLING THE NEW REQUESTS

The training of senior staff responsible for carrying out these studies highlighted the deficiencies of higher education structures, which were unable to steer the process of technological innovation needed in all fields related to the systematic observation of collective phenomena [(1)]. Local higher education groups could not participate in this

process, due, especially, to the deteriorated condition of the main public universities, after a long period of authoritarian regimes. Public universities had to adapt to constitutional regimes while becoming "mass" universities, and being subjected to a reduction in funding. This justified the opening of higher education to the market, and the attempts to privatise the existing public institutions, which lead to a quick proliferation of higher education institutions, in a general context of scarcity of qualified lecturers. This shortage, combined with the mechanisms for evaluating the institutions, led to the creation of many specialised courses, which did not meet the need for training teaching staff. The classical choices of training abroad were not appropriate to meet the needs on this scale.

The pedagogical content and forms for the statistics training of professionals in social sciences were poorly suited to the labour market requirements and changes. In sections 4 and 5, we analyse the conditions for these transitions.

2.3. THE INITIAL COOPERATIVE STRATEGY IN THE PRESTA PROGRAMME

The aforementioned facts made us consider that the co-operation between European and Latin American universities should not be restricted to sporadic organisation of post-graduate courses. Therefore, a co-operative strategy in five stages was devised to avoid the main factors that prevented the local supply of trained senior staff, while creating a lasting and autonomous local system for statistical training. In 1994 a five-year programme of inter-university co-operation sponsored by the European Union was started with the following aims:

a) To promote co-operation between European and South American universities in the field of statistical methods applied to the social sciences, by developing:

- The training of South American university lecturers on recent statistical methods useful for social sciences;
- The technical and scientific contribution to "distance statistics training" and the European specialists support to stimulate the dissemination of this activity in other universities in the region;
- The dissemination of scientific reference documentation in Spanish and Portuguese, accessible to all Latin American researchers;
- A network of European and South American university laboratories, joining forces on applied and/or basic research projects, including quantitative research methods in social sciences.

b) To promote co-operation among various South American universities, and among universities and the national public institutions responsible for socio-economic research or action, by encouraging:

- The organisation of regional seminars for training researchers and senior staff in the field of recent statistical methods used in the social sciences;
- The development of regional "distance education" services of applied statistics in social sciences;
- The development of joint research with the methodological support of European laboratories.

3. ACTIVITIES CARRIED OUT BY THE PRESTA PROGRAMME: OPERATING METHODS AND RESULTS

The PRESTA Programme was conceived over a central question: How the demand for updating the knowledge of statistical techniques and methods for South American "users" (real or potential) could be adequately met?

3.1. TRAINING TRAINERS

We had to devise a process that was sustainable and extensive enough for training local lecturers who could gradually take over the teaching responsibility in the planned training of a "critical mass" of South American professionals [(2)]. This was necessary since the voluntary participation of European lecturers was limited by their institutional responsibilities.

During the first four stages, eight "Training Trainers" sessions and eight "Pedagogical Workshops"[(3)] were carried out. We also ensured the participation of local lecturers in the various "thematic seminars" held. The *Latin American Applied Statistical Workshop* was an effective complement to the process of training local lecturers. 344 people took part in these training activities, which corresponded to 250 lecturers from 10 South American countries. In the first stage of the programme, 90 of these lecturers took part in the teaching team and were responsible for training researchers, at least once. There are many testimonies from colleagues and academic staff of participant institutions about the considerable impact from the "Training Trainers" sessions. Many lecturers have incorporated the content acquired during the training into their teaching. Consequently, a great number of Social Science Faculties have been able to adapt their curricula to reflect new content, due to the availability of trained lecturers.

Content of training courses

The innovative character of the content of the "Training Trainers" activities was widely recognised. However, the conventional training of the Latin American teaching staff imposed certain limitations that will be discussed in section 3.2 and that determined the orientation of the course's content, which was based on the educational requirements presented in section 4.

Training modalities

The local lecturers liked many aspects of the training offered, which were different from their conventional training. They appreciated the organisation of intensive training cycles, which were organised in two full-time 10-day sessions with an inter-session period where participants had to carry out a personal, guided application. They also valued the scientific documentation they were able to access throughout this training.

The organisation of "pedagogical workshops" was also highly appreciated. In Latin America, no previous similar experiences, where lecturers collectively reflect about the best way of teaching statistical methods to professionals, had been organised.

The PRESTA network and "horizontal" co-operation tools

The programme gradually developed tools for "horizontal" co-operation and training. The participation in the "Training Trainers" cycles was deliberately limited to two lecturers from each institution. This served to establish genuine inter-institutional training groups, and to encourage representation from a large number of institutions in

all the training courses. In this way, we created favourable conditions for the collaborative work of lecturers from different countries, and for the co-operation of lecturers from large universities and other not so well known institutions. This was one of the key factors for the operation of the PRESTA network.

In time, the PRESTA electronic list(4) became a forum for exchanging and communicating scientific and technical information between lecturers and Latin American institutions. Organising the PRESTA network in four zones, which cover the 10 countries taking part in this programme, facilitated the development of these "horizontal" co-operative links. These zones were established according to pre-existing inter-university networks, so that the programme action could complement or reinforce existing links between institutions in the same or different countries.

The establishment in 1998 of the PRESTA Programme International Co-ordination Committee, with representatives from each zone, fostered the operation of a co-ordinating structure closer to the beneficiary institutions and individuals. Consequently, the committee was better suited to manage the needs, and to co-ordinate the human resources involved in the programme.

3.2. TRAINING A "CRITICAL MASS" OF PROFESSIONALS

The demand formulated by the beneficiaries of the co-operative programme and their geographical and institutional dispersion required a structure for continuing education, at the post-graduate level, which included all the higher education institutions, was adapted to local needs and conditions, and, at the same time was flexible enough to change in form and content as the needs and conditions evolved.

The training of the final beneficiaries of the programme was mainly carried out by 66 training modules or "local seminars"(5) and 19 "thematic seminars". This action continued through continuing training seminars on research methods, set up by the programme reference centres. The training of local researchers was intensified through technical and methodological assistance to their work and research projects.

Carrying out such a high volume of courses by teams of two or three lecturers required the organisation of 10,600 lecturer/hours, 67% of which took place during the last two stages of the programme, mainly by local lecturers. The 2,550 participants in these activities corresponded to about 2,300 South American professionals, including a great number of sociologists, economists, demographers, psychosociologists, historians, geographers and statisticians(6).

The final aims of the programme also required the training of groups with a large inter-institutional membership, which lead to a rapid growth in the number of beneficiary institutions. Over 800 institutions were represented in these training seminars, half of which were research units from the main Universities of ten South American countries. The other half included public research institutions, national or regional government research departments, large municipal administrations, official statistics offices, and NGOs (Non Govermental Organisations) research centres or similar organisations.

All these seminars were aimed to facilitate training to the entire target group of the programme in each country concerned. The achievement of this coverage objective was due to the constant efforts made to launch the training activities, by moving them as far as possible from the major urban centres to locations in the interior of the beneficiary countries(7).

Content of training courses for professionals

The first aspect that attracted the participants' and managers' of local institutions attention was the fitting of training content to the local needs and reality.

We had observed that the training of statisticians and professional "users" was almost exclusively limited to an approach to statistical instruments oriented towards "confirmation" or modelling of the observed phenomena. Particularly in the training of "users", an inappropriate separation between the "quantitative" and "qualitative" methodology was maintained. This purely academic hiatus even acquired a certain reality quantum among students, as it was combined with a radical separation between training in statistical methods and the introduction to research methodology. As a consequence, the training provided was inadequately oriented towards the analysis and solution of specific problems. Our courses were, therefore, deliberately focused on an exploratory approach to statistical methods, by presenting a series of tools directly linked to research.

Traditional teaching of statistics emphasised the algebraic presentation of methods, without explaining the conceptual and practical links between them and their practical application in research. This training, incorrectly considered as "theoretical" basic training in statistics, was moreover received at very different levels by the professionals of the various countries concerned. There were considerable differences in statistical expertise between professionals of different disciplines, and between researchers in the same discipline trained in different institutions, even within each country. The training groups were therefore very heterogeneous from the viewpoint of their formal statistics knowledge and this heterogeneity could have been an insurmountable handicap, had it not been incorporated as a *de facto* reality into the conception of the pedagogical process adopted in the training. This is the reason why we refined the instruments for distributing these seminars, and we adjusted the criteria for the selection of the candidates, giving a greater weight to their experience in using quantitative research methods as compared to their previous training in statistics.

This approach avoided the pitfall of a theoretical training with contents unsuited to the beneficiaries' expectations, and requiring the use of their deficient knowledge base. At the same time, we also avoided reducing the professionals' training in applied statistics to the popularisation of specific techniques and software.

Training professionals modalities

The post-graduate training available in these countries usually extended the conventional curricula for training professionals to specialised master degrees or doctorates. Post-graduate training had been organised into long courses, with contents unsuited to the requirements and development in science and technology. Consequently, the professionals' demand for updating their statistics knowledge was not covered.

Our strategy for permanent training in statistics proved to be well suited to the local conditions. The option of creating local teaching teams within the PRESTA network zones, while seeking the participation of local institutions in the preparation of each seminar, enabled to gather and mobilise the human and material resources available to serve a sector of the target population of the programme who lived in places rarely reached by international scientific co-operation programmes. This also served to experiment, on a vast regional scale, the integration of new educational technologies and the specialised human resources locally available for improving the training of local professionals. The training system created was well adapted to the beneficiaries' expectations. Focusing on a pedagogical process at a higher education level, it benefited from the multidisciplinary nature of groups, and even from their heterogeneity, to

favour peer training and to lead to a collective acquisition of the skills.

An initial period devoted to balance the participant's knowledge, served to review the basic concepts, and to create a "common language" in these multidisciplinary groups. Local seminars were extended by (8) short consolidation courses, devised to help the participants to gradually move towards using the methods taught on real data from their own research. The lecturers provided methodological assistance parallel to the seminars, and at the end of the course, a session was devoted to presenting and criticising some participants' research work. These sessions also served to make this ongoing work more widely known, and to establish collaborative links between local researchers.

The training system was equally effective in encouraging local development of other training courses. It was evident that to provide specialised training to South American professionals, local and thematic seminars had to be linked, and the creation of permanent research methods seminars with consolidation courses had to be encouraged. The rapid development of training activities in the beneficiary countries showed the enthusiastic reception to the initiative, and justified the co-operative strategy adopted, which would not have been possible without the voluntary unpaid contribution of many European and South American lecturers, who devoted a great deal of time and hard work to preparing, organising and performing the programme activities.

4. MAIN PEDAGOGICAL RESEARCH CARRIED OUT IN THE PRESTA PROGRAMME

Working in the field soon made us realise the importance of the "distance" between the statistical methods available and their use in social research in Latin America. Therefore, appropriate instruments were gradually devised to reduce the effects of the determinant factors for this situation, at least those that could be affected by inter-university co-operation. The programme research activity took a critical look at "statistics teaching" offered to "users" in socio-economic research. The main components of this analysis are presented in this section.

From certain attitudes towards statistics among professionals, a lack of knowledge in the programme beneficiaries about statistics as a set of instruments to observe collective phenomena was noticed. The statistical training of these professionals maintained a parallelism between the teaching of statistical methods and the teaching of the research methods specific to each discipline. It was expected that future professionals have sufficient maturity and wisdom to produce, individually and spontaneously, an operational synthesis of the content of these two areas of learning, while the lecturers themselves only very rarely tried to produce such a synthesis.

The training of "users" was based on too strong a use of the *notion of measurement* neglecting the *concept of classification*. This meant that the professionals acquired a misconception of data, which was an obstacle to their understanding of the recoding of variables. They were not conscious that the measurement scale of an observed phenomenon is not intrinsic to the data, but a "language" chosen by the researcher to describe a collective phenomenon. By forgetting the concept of comparison, the training provided to future researchers produced a loss of sense of the concept of information produced by the observation of collective phenomena.

The training of professionals devoted little attention to those statistical-methodological aspects that enable us to evaluate the coherence between the research theoretical framework and the consequent technical choices. Some examples are the

strategies for managing uncertainty and error, the choice of an appropriate representation space based on the creative recoding of the observational data; the choice of weightings and even of substitution rates implicitly adopted by the majority of multivariate methods; or the choice of properties in any aggregate function.

These deficiencies in training resulted in the users' great difficulties in choosing from the vast array of tools available, and in justifying the appropriate statistical method to deal with a research problem. It was often observed that researchers were inclined to "delegate" these operational choices to the statistician, or they even were forced to "blindly" use the default options of statistical software. The observation of these deficiencies in the researchers' *modus operandi* led to concentrate the didactic effort on the two areas that will be presented below.

Making the use of descriptive methods a crucial feature of statistical knowledge

The content of training courses for trainers and the majority of local and thematic seminars was based on the convergent presentation of methods specific to the Anglo-american "exploratory data analysis" and to the "data analysis" French school. This group of methods formed the "toolkit" that should be available to researchers and lecturers working in non-experimental statistics (human and social sciences, economics, public health, environmental sciences, agronomy, etc.) to be able to meet the requirements of local demand for socio-economic studies.

The methods, which were unfamiliar to the South American scientific community, were presented as "tools" for building representations of complex phenomena, which demanded, first of all, an exploratory approach to reach a comprehension of the same, before any attempt to "freeze" them into a pseudo-explanation model. Unidimensional and multidimensional exploratory statistics are often perceived, in academic circles, as a mere group of foundation concepts for statistical modelling and inference. However, by guiding the training provided by the programme towards local professionals' greater ability to solve specific research problems, this conventional academic hierarchy could be contradicted.

In presenting these methods, the emphasis was placed on the analysis of a group of observations rather than on the relationship of a group of variables. This shift in emphasis contributed to the development of a great capacity among the researchers to use statistical methods for building synthetic representations of their subject of study, and to consider these representations as "tools" for understanding the phenomena observed.

Didactic strategy: giving priority to comprehension of the methodology

The second key area of specific didactic research was based on the purpose of the seminars organised by the programme to train social science researchers, i.e. to train "users" of statistical methods, rather than statistical researchers, who are supposed to develop new methods. That is why the presentation of the rational basis and operating principles of the methods should be oriented towards understanding the instrument methodology. A deductive presentation, with a pronounced mathematical formalisation, would have been an obstacle rather than an aid to understanding the research instruments, and we decided to rely, as much as possible, on the language and concepts of Euclidean geometry. This strategy made it possible to base teaching on an intuitive perception of the properties of representation spaces, which facilitated the understanding of essential concepts to social science researchers, without sacrificing rigor and operational understanding. This also contradicted the belief that "users" cannot acquire sufficient understanding of the rational basis of these methods, due to their

ignorance of the formal language of linear algebra.

Computing developments, which have facilitated graphical representation, reinforced this didactic choice by incorporating several dynamic geometrical representations, data and methods into the courses. This didactic approach also offered a communication code that transcended the disciplines and specialisation of the researchers.

5. INSTITUTIONAL ASPECTS OF THE DISTANCE BETWEEN STATISTICAL METHODS AND THEIR EFFECTIVE USE

The scale of the task of disseminating knowledge enabled the identification of some institutional dynamics that contributed to maintain, or even to reinforce a certain "statistical cultural vacuum" among the professionals responsible for carrying out research studies in a broad sector of Latin America. It was impossible to develop a training structure while ignoring the institutional constrains that inhibited the dissemination of knowledge, and which encouraged an inappropriate "praxis". In fact, four main dynamics were identified.

5.1. DIFFUSSION OF SCIENTIFIC KNOWLEDGE

The university publishers, who assured the functioning of traditional ways to disseminate scientific and technical knowledge, were reduced to adapting to market forces, which cannot assure an adequate dissemination of updated documentation to the scientific community. When ad hoc mechanisms for access to documentation disappear, two undesirable and complementary effects occur: On one hand, certain scientific traditions (or schools) get a dominant position due to the mere fact of having access to the publishers controlling the distribution channels and the scientific publishing market; On the other hand, when the dissemination of scientific documentation is limited, the scientific community develops a dependent behaviour with regard to knowledge (which had become rare in the local environment), leading to strategies of individual and passive appropriation of this knowledge. These symptoms were observed in the Latin American University milieu, although the effects of this disappearance were even more harmful in non-university environments.

That is why all the programme activities encouraged the dissemination of updated scientific and pedagogical documentation among South American professionals. It was mostly translated into Spanish and Portuguese, and consisted of lecture notes, guides to solving the application tasks, user manuals for computer programs, books and scientific papers. In addition, "student kits" were also distributed for the main computer programs used in the courses. An essential part of the lecture and guided study notes and the reference bibliography in the local seminars, were made available to the scientific community through the Programme's web site, in a series of Acrobat® documents.

A minimum document base was created in the scientific libraries of each local institution that hosted a seminar and a larger one in the reference centres responsible for facilitating the access to documentation to the PRESTA network members. The journal *"Metodológica"* was another distribution channel for specialised scientific documentation. This journal publishes papers on methods and techniques for quantitative research in the social science from European and Latin American researchers in a variety of fields.

5.2. THE DIVISION OF TASKS ADOPTED IN THE RESEARCH TEAMS

The weak penetration of a "statistics culture" and the absence of university extension programmes that could relate the “users” and the university statisticians encouraged the adoption of an absurd division of tasks between the various professionals involved in the elaboration of the socio-economic studies. In this work, the "field staff" were the least-experienced professionals, responsible for the observation stage, consisting not only of gathering and preparing the observational data, but also of designing the survey questionnaire.

The "statistician" was not responsible for bringing the tools that would objectively process the information produced by the "field staff" into these research systems, but his job was just to "demonstrate" the scientific validity of the system, by contributing to the definition of the representative sample size, and by ensuring the "processing" of the "responses" obtained. The statistical data analysis was carried out without any reference to the conditions and objectives of the observation. and the "statistician" was often asked to identify "significant" relationships and "interesting models" based on the observational data. Finally, at the end of these disconnected operations, a third participant, the "specialist", was brought into operation to interpret the statistical results and write the final report. This breakdown of tasks between three participants in the research leads to the denaturing of the collective and multidisciplinary practice of research, and disqualified all the professionals involved.

We could not envisage organising the training of researchers without addressing this unhealthy traditional division of tasks within research, and therefore all the programme activities aimed to transfer the experience and knowledge required to organise multidisciplinary research teams. We collaborated directly on the development of local teams of joint research projects in various fields, facilitated meetings between research teams, and contributed with methodological and organisational experience to prepare joint and multidisciplinary research projects in various fields.

5.3. POST-GRADUATE TRAINING (MASTERS AND DOCTORATE)

Faced with the shortage of human resources specialised in applied statistics, the Latin American universities had developed a number of post-graduate courses "in statistics". This considerable effort had a number of disadvantages.

First, this specialised training offer was not included in a human resources policy of this sector, in agreement with each country's specific requirements. The courses were often isolated initiatives of higher education institutions, which led to very local recruitment of students who continued their studies in this way. It is interesting to note that the demand for such training courses was well below that for PRESTA training activities. The mismatch between offer and demand for this training is produced by the lack of sufficient integration of the specialised human resources available at a regional level.

In fact, these post-graduate courses are often set up with the academic staff available at the institution, and according to criteria of excellence which generally lead to reproduce the equivalent curricula offered by European or North American institutions. Thus, an abstract strategy of promoting high-quality scientific research absorbs the few resources available, in detriment of any complementary strategy based on the continuing education of working professionals. Therefore, the supply of training generated is qualitatively and quantitatively out of line with the requirements.

The passive repetition of foreign courses produces an impoverishment in the content

of these post-graduate courses. In addition, their content reproduced graduation courses at a more advanced level, which led to a lack of interest towards post-graduate courses among working professionals. Despite all, there is an interesting potential of specialised staff in Latin America, which would allow a programme of continuing education for active professionals. This would lay the foundation on which high-level scientific research could be built, and which would be managed by university laboratories, local research institutions or official statistics offices.

5.4. UNIVERSITY EXTENSION PROGRAMMES

With the disappearance of university extension policies and the impoverishment of specialised training in applied statistics, the university statistical laboratories have reduced their contacts with "users" and diverted the aims of the essential contacts between academic statisticians and the organisations performing socio-economic research. In fact, the university extension program has been reduced to "consultancy" assignments to a few specialists, ignoring, therefore, the importance of the transference of knowledge that the University is supposed to provide. That is the reason to attempt to revive the university extension tradition, by developing, through a specific experiment, the forms and content of a large two-way transfer of knowledge between a few groups of University statisticians and broad sectors of statistical methods users in research.

5.5. AN ACTIVE INSTITUTIONAL POLICY FOR PROMOTING HORIZONTAL RELATIONS

Being aware of these institutional dynamics, it was indispensable to carry out a practical experience of the training potential that could arise from strengthening the horizontal relations between local and regional higher education institutions. In fact, the local institutions responsible for organising the "Training Users" seminars had to set up contacts with all the study and research centres in their surrounding area. The training itself fostered the practice and development of exchanges within inter-institutional and multidisciplinary groups. This led to a greater collaboration between university and non-university centres, which went beyond the framework and even the content of the PRESTA Programme.

However, it was not enough to create meeting opportunities. It was still necessary to identify the concrete spheres of action and to provide active support to the participants willing to engage in new institutional practices capable of effectively neutralising the effects of the dynamics described above. Therefore, five active institutional policies[(10)] were carried out: promotion of "common academic areas"; use of new teaching technologies for continuing education of active professionals; development of reference centres as research and education units working for the benefit of various sectors of applied research; reinforcement of links between producers of official statistics and university statistics and promotion of the applied statistician professional profile. In the implementation of these policies, the programme attempted to act as a federative body, so as to support awareness-raising and active commitment by all the individuals and institutions concerned.

Promotion of "common academic areas"

The organisation of the PRESTA network enabled us to put into practice "common academic areas", a concept that was suggested by Rector Brovetto of the Universidad de la República Oriental del Uruguay, Secretary General of the "Grupo Montevideo".

Seminars were organised for training professionals several times in the network zones, where specialised human resources of various public universities in the zone (trained by the programme) were offered to train statistics "users" in universities, public administrations or research centres in a given town or region.

To reach this goal, scientific, technical and pedagogical training had to be provided to a sufficient number of local lecturers, and moreover, it was necessary to prepare appropriate didactic materials and to teach the appropriate forms of organised multidisciplinary and inter-institutional seminars. The establishment of the PRESTA International Co-ordination Committee served to disseminate the necessary organisational knowledge among local teaching staff. Many successful experiments of public higher education establishments in the region working in "common academic areas", aroused genuine interest among the local academic authorities, which realised that this experiment could be extended beyond the field of applied statistics.

New technologies in the training of professionals

From the very beginning of the programme, we considered the possibility of developing a "distance education" line of action for "training users" of statistics. However, when completing the "Training of Trainers" we realised the limitations and disadvantages of this technique in relation to our objective of large-scale dissemination of knowledge throughout the scientific community in the region.

In fact, this was an arduous task without "training effect" on the local teaching staff, apart from the small group of local colleagues in charge of the project. In addition, the training structure associated with "distance education" was not a proper network, but a series of "vertical relationships" between the training centre and the individual locations where participants were studying. We felt that this structure was inappropriate to reinforce the integrated strategy of "Training Trainers" that we adopted in parallel with "User Training". Finally, it seemed that the access to continuing training by local professionals was not due to their isolation, which would have justified the use of distance education. Apart from a few exceptional cases, the whole target population for the co-operative programme was working in institutions located in urban areas usually close to the university facilities.

It was, then, considered more appropriate to concentrate on the development of a training structure organised into networks and capable of being spread in the large urban centres, as well as in smaller university towns, so as to lead to the setting-up of continuing education institutions. From the second stage, priority was given to the development of simultaneous local seminars using videoconferencing systems that were installed since 1995-96 in a number of South American universities. In others universities, a partial access was made available through systems installed by large national or multinational companies operating in South American countries. In co-operation with the Universidade Federal de Santa Catarina, Brazil, we promoted the attractive educational properties of this new medium for the benefit of training.

In fact, the videoconferencing system brought the potential of full interactivity with simultaneous transmission of sound and pictures. It permitted simultaneous local seminars, connected over a network, with specific teaching support, which had unquestionable organisational and pedagogical advantages.

The organisation of simultaneous local seminars enabled the organisation of a higher modality of common academic areas. This could bring together the human resources of a large number of public institutions into the PRESTA network zone to assist a training activity that could accommodate several hundreds of local executives at the same time, organised into small groups scattered over a vast geographical area (for example, at the

level of the Brazilian states). Each group undergoing training attended a classic "local seminar", with theoretical courses provided by the videoconference network and guided work sessions, managed by the teaching teams, with a pooling of resources through the videoconference network. The interactivity allowed by this system enabled the "operation" of a single virtual lecture theatre, which vastly increased the number of exchanges between local researchers and teaching staff, while being geographically spread, and working in very remote institutions as regards the main university centres in the region.

From the pedagogical viewpoint, this medium enabled the use of dynamic images, and colour, which greatly improved the didactic capacity to present the rational basis for statistical methods, linked to their use in various research fields.

Development of Reference Centres

The gradual establishment of reference centres was one key feature for the "Training Trainers" network. The starting up of reference centres was subject to the dynamism of the sub-regional networks established, as the annual training plans were implemented. First, we tried to identify and train a sufficient number of motivated teaching staff to assist in the dissemination of knowledge proposed. We had in this way guaranteed the optimum convergence between these personal aims and the level of commitment by their university institutions. To achieve this goal, we carried out a broad dissemination of the didactical material for "Training Trainers" among local teaching and management staff. The selection of participants (maximum three candidates per institution) was carried out with personal criteria (candidate's qualification) and institutional criteria (reasons to participate, commitment to support the participation of lecturers in other activities proposed by the programme, etc.).

Through initiatives taken by small groups of motivated lecturers, some institutions were gradually involved in a wealth of exchanges with university and non-university institutions within the PRESTA network. We fostered the establishment of bilateral and multilateral agreements between these institutions. Where such agreements already existed, we contributed to increasing their dynamism by means of programme activities. In parallel, we increased the availability of scientific documentation in these groups, and wherever necessary, their computer and teaching equipment. We encouraged the involvement of other colleagues, and closely involved local lecturers in the preparation, organisation and co-ordination of the programme training activities.

This enabled us to meet a large number of lecturers, and we succeeded in identifying the local institutions that were prepared to fully participate in the programme co-operation by contributing with available human and material resources. This dynamic led to the establishment of reference centres with different institutional forms [(11)]. This strategy of development of reference centres allowed highly decentralised management of the majority of training seminars carried out, particularly during the fifth stage of the programme. It facilitated the mobilisation of initiatives and local resources, while making our training system more suitable to the requirements, via structures that were close to the beneficiaries, and better qualified to identify their training needs and interpret their requests.

Strengthening of links between "producers of statistics" and "statisticians"

The intensification of these links is an undeniable necessity, and not just in the Latin American context. We tried to achieve this goal throughout the five years of working on the programme. First of all, a small quota for participation in all the "Training Trainers" activities was reserved to the official statistics offices senior technical staff [(12)].

However, the training demand from this sector was mainly for local and thematic seminars in the four zones of the PRESTA network. The training departments of the main national statistical institutes requested the programme to help in the technical and methodological updating of their scientific personnel. However, we considered that this was beyond the limit of the co-operation programme and preferred to create the local conditions for the rapprochement between the staff members and university statisticians.

The training system spread out was able to bring about this rapprochement. That explains the many exchanges that have occurred among these research teams, and the enthusiastic participation of "producers" of official statistics in the training activities, as well as at the *First Latin American Applied Statistics Conference*.

Reinforcing the "applied" statistician's professional profile

One consequence of the dynamics described above, which are making the dissemination of statistics operational use difficult is the weak academic position of those statisticians interested in the ways of using these tools. To change this trend, we organised the *Annual Regional Conference on Applied Statistics* [(13)], according to the scientific colloquia standards, which has become a very effective way to stimulate the work of university and non-university research teams.

The preparation of this conference takes a year, through the monitoring of the reference centre research teams. This dynamised the exchanges within the four PRESTA network zones, and the local researchers have submitted over forty research projects to the organising committee, twelve of which were selected and presented. In organising this conference, we pursued a pedagogical objective while encouraging the collective reflection about the role of the "participants" and the structure of statistics applied to socio-economic studies in Latin America.

Through the contacts with the research groups in all the PRESTA network zones, we identified complementary methodological contents to be presented in short courses. In addition, the work by local researchers was selected and grouped into common methodological spheres, which encouraged debate and collective criticism of these applications. The composition of the audience, as well as the choice of themes in the courses and in a closing Round Table discussion, stimulated important debates. A recurring theme in the reflections was the concern to identify, the main difficulties that are hampering Latin America in the development of synergies between university statisticians and statistical "users", while recognising the technical trends and current policies for change, with a strong regional integration of the national statistical systems.

6. CONCLUSION

The activity carried out by the PRESTA Programme laid the foundations for a training system of teaching staff in higher education establishments. Therefore, the main features of this system deserve to be highlighted. This system appropriately integrated two dimensions that are very often separated in the training of university lecturers. It combined the necessary scientific and technical updating of the teaching staff with essential critical reflections about the specific pedagogical requirements for scientific training of professionals. In addition, it was leaned towards the theoretical and practical teaching of statistical methods, giving a central role to the linkage between the rational basis of methods with the conditions and limitations of use of these scientific instruments throughout research in social sciences.

This system was structured as a network, covering all the beneficiary countries. This

allowed teams of teaching staff to be mobilised, to constitute "common academic areas", through which the "horizontal" co-operation links could be created and strengthened between higher education institutions in the region. Finally, this training structure brings together the conditions for sustainable growth. In fact, it mobilises local lecturers through the autonomous operation of reference centres, which enables the training initiated in the courses under the programme to be continued through a continuing education structure.

The experiment developed revived the university extension tradition in the major South American universities, and allowed them to rediscover the social and scientific importance of this university activity. It showed in very specific terms, in an important field and on a vast scale, the most appropriate way of meeting the demands addressed to the university to update knowledge. Our work provided the organisational and pedagogical knowledge necessary to produce and disseminate university extension work in applied statistics. Furthermore, the interest aroused by this initiative has also inspired the hope that it will generate similar initiatives in other scientific fields.

Summing up, the experience with the PRESTA Programme has led to a rediscovery of the importance of high-level, non-academic training, capable of linking updated scientific and technical knowledge to the solution of the major social and economic issues on which the local scientific community is working on.

NOTES

1. It is difficult to summarise the main reasons for this widespread deficiency in the training of Latin American professionals, without mentioning the substantial differences in the situations found (and which are still found) in the different countries of the region. We are aware that the "local analysis" of these reasons has to take into account the obvious differences between, for example, the statistics higher education structures in Brazil or Colombia and those in Paraguay or Bolivia (just to mention extreme situations).
2. We invite the reader to consult the detailed presentation of each "Training Trainers" activity on the PRESTA Programme's web site. (http://www.ulb.ac.be/assoc/PRESTA).
3. This corresponds to 944 hours of theoretical and practical courses by teams of six or more teaching staff. This volume of hours of courses required about 5,400 lecturer/hours, with European colleagues providing 2,970 hours, and local lecturers providing the remaining 2,430 hours.
4. The PRESTA list has been administered, since 1995, by the Universidad de Concepción, Chile.
5. On the PRESTA web site, we give a detailed presentation of the content and specific arrangements for "local seminars". In the first stage, we held 2 local seminars and 1 thematic seminar, while in the fifth stage of the programme, 26 local seminars and 7 thematic seminars were organised. This illustrates the way in which the multiplier effect anticipated from the "Training Trainers" activity was spread.
6. This group also included, lesser numbers of agricultural engineers, veterinary surgeons, town planners, public health specialists, lawyers, engineers, mathematicians, computer scientists, surveyors, food industry specialists, etc.
7. It was unknown in Latin America for a training programme to involve such a wide spectrum of the whole scientific community in the countries of the region.
8. Consolidation courses took 6 to 8 four-hour sessions at which participants carried out a series of specifically prepared and guided tasks in small working groups with the support of a local lecturer. That facilitated the emergence of continuing training groups, among peers, where researchers could raise methodological questions from their own research work.
9. The contractual arrangements for the research explicitly refer to the theme of the study and the number of surveys that must be carried out. Therefore, the sample size and the very

notion of representativeness are established before and regardless of any operational definition of the purpose of the study.

10. These policies, and the basic options of the PRESTA Programme were debated for the first time at the International Conference "Experiments and Prospects for the Teaching of Statistics: Challenges for the 21st Century". This conference was held in November 1999 in Florianópolis, Brazil, in co-operation with the Universidade Federal de Santa Catarina and the International Association for Statistical Education.
11. Some universities have created a multi-disciplinary Committee for applied statistics; others have set up an Applied Statistics Laboratory; and yet other institutions have entrusted these functions to a part of the scientific personnel in their statistics departments.
12. This has enabled statisticians who are working on the production of statistics relating to education, health, the environment, agricultural production, employment and other economic information to take part in the training courses.
13. The First Latin American Applied Statistics Conference was organised by the Universidade Federal de São Carlos, in November 1999 in Sao Carlos, Brazil.

APPENDIX: PRESENTATIONS OF PRESTA PROGRAMME

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