EVALUATION OF BIODIVERSITY RESEARCH PROGRAM

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Abstract

There is a growing importance of the evaluation of science, technology and innovation programs regarding the management processes. Different methods have been developed in order to identify their results and impacts. This paper presents the evaluation of the program on Biodiversity of the State of São Paulo (SSP) – Biota/FAPESP. The program is financed by the Foundation for Research Support of the SSP and aims to identify and characterize the biodiversity of the SSP defining the mechanisms for its conservation, economic potential and sustainable use. The indicators used in this assessment resulted from the decomposition method (or TIM, Themes – Indicators – Metrics) developed by GEOPI Laboratory of Studies on the Organization of Research and Innovation (University of Campinas, Brazil). Those indicators were turned into a web questionnaire sent to coordinators responsible for the projects covered by the Biota. 71% of target universe responded the questionnaires. Preliminary analyses point out that the organization of the research under a scientific program has enhanced the impacts generated by the researches, especially the ones related to public policies and innovation. The most important impacts were observed on biodiversity conservation.

Introduction

Scientific research can have a significant influence on public policy for sustainable development. With regard to conservation and sustainable use of biodiversity, in particular, there is a pressing need to establish mechanisms that decelerate biodiversity loss. The current rate of extinction is estimated to be 1,000 times higher than the natural rate. If this tendency does not change, areas amounting to 1.3 billion hectares worldwide, or one and a half times the size of the United States, could lose all their original biodiversity by 2050 (Parker & Cranford, 2010). Moreover, biodiversity loss is estimated to cost over US$750 billion per year in lost environmental services. Such services, which are vital to any economy and to human well-being, include climate regulation, rainfall, watershed protection, crop pollination, and subsistence for local and indigenous communities, among others (Parker & Cranford, 2010).

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Sustainable development is viable only when innovation drives for sustainability in the economic activity. It is therefore important that research expand the knowledge base, point to adequate techniques for biodiversity management, and provide guidelines on biodiversity use without jeopardizing future life. Hence, it is straightforward the need to promote or support scientific research with the aim of generating, organizing and publishing knowledge and information.

Since the 1992 Convention on Biological Diversity there has been a significant increase in research on biodiversity worldwide and in particular in Brazil (MCT, 2010; Scarano, 2007; Dirzo & Loreau, 2005; Lewinsohn & Prado, 2002). However, this research is still being interpreted in a limited manner, and the scientific community in the field of biodiversity is fragmented into several subdisciplines (Carneiro et al, 2008; Castro & Pereira, 2007; Sutherland, 2004; Ehrenfeld, 2000). In light of these problems, there is a need for more technology and innovation to enable more efficient multiple uses of biodiversity with a balance between conservation and development (Dirzo & Loreau, 2005). Impact assessment of biodiversity research programs, in the context of science, technology and innovation (ST&I) programs, can play a key role by indicating the real impact of biodiversity research on innovation, public policy, and education and training, among others. When a program of this kind is assessed, information is produced together with a value judgment on its effects, thus updating knowledge on the activity and topic concerned. Further action will be taken in response to this new information, and so the cycle continues. From this perspective, impact assessment performs a decisive role by indicating the ways in which programs can be continuously improved and, going beyond, by generating a learning experience with regard to the process. This underscores the responsibility to evaluate the impact of such programs.

Identifying the impact of ST&I entails retracing the paths followed by the activities concerned as well as the new avenues they have made possible. Thus the scene with which the researcher is faced is one of a large tangle of paths without clear-cut limits or borders to facilitate their isolation. Untangling these paths in time, and discerning their different causes, is a challenging task, and indeed is not always feasible. Part of the difficulty can be attributed to three conditions for most ST&I assessment exercises: (i) uncertainty, given that the definition of both scientific progress and its social appropriation is inherently imprecise; (ii) multidimensional relationships of cause and effect, hindering definitive causal attributions in impact assessment studies; and (iii) the lag between knowledge production and its impact on society. These three conditions overlap and also reinforce each other, constituting a systemic barrier to the interpretation of impact assessment studies.

The above conditions apply to the assessment of biodiversity treatment programs such as the case study discussed in this paper. An additional difficulty in this case is the fuzziness of the scope of such programs, one of which is to build knowledge of biodiversity by mapping the species in a specific area, for example. Moreover, sustainable use is not an objective concept and is hard to verify.

The aims of this paper are to identify the results and impacts related to the innovation dimension in the Biota Program and thus relate the influence of the Program over these results – which is here called *causality attribution*. Results are understood as products that were expected by the Project, and impacts would be the effects of these results. Innovation can be here understood in a broad way as the use of program or project results in production, marketing or public policy.

The program in question is Biota/FAPESP. The program was created in 1999 by FAPESP, the São Paulo State Research Development Agency (Brazil). Its main aims are to inventory and characterize biodiversity in São Paulo State, to define its economic potential, and to propose mechanisms for its conservation and sustainable use (Biota, 2011). Biota is one of the most relevant biodiversity programs in Brazil due to its pioneering and also for its

continuous format and resources invested. The program has also inspired similar efforts at home and abroad In the first ten years since the program's inception, annual investment in projects covering a wide array of knowledge areas averaged US$2.5 million (Joly et al., 2010)..

Methods

Results and impact indicators of Biota/FAPESP were identified using the decomposition method (or TIM, Themes – Indicators – Metrics) developed by GEOPI[‡] to evaluate scientific and technological research programs.[§] Its dimensions necessarily reflect the objectives of the programs assessed, comprising the following stages: an analysis of the program's objectives; decomposition of the objectives into keywords or key terms; conversion of these terms into assessment themes; identification of indicators to qualify and measure the assessment themes; validation of these indicators by a group of experts. Once the indicators were validated by the experts, an online questionnaire was produced covering the following themes: project profile, knowledge advancement, innovation, training and dissemination, and project management. In this paper are only presented the results and impacts of the innovation dimension. Project's coordinators were asked to state whether each indicator had changed since the start of the project, and if so how much. They were also asked to gauge the extent to which the program influenced such changes. Thus a ponderation is added over the interpretation of program's results and impacts, which minimizes the simplistic relations of cause and effect. This is a typical *Aditionallity Method* associated to *Causality Atribution.* The sample comprised 56 projects completed between the program's inception in 1999 and 2009.

Results

Thirty-seven respondents, or 66% of the total, reported that their project had generated a technological result of some kind. The number of such results cited totaled 85. The influence of the program on the production of these results averaged more than 91% (that means a high causality grade between the technological results and the Biota Program).

Respondents were also asked to classify results by type (Figure 1).

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[§] SALLES-FILHO *et al*, 2010; SALLES-FILHO *et al*, 2011.

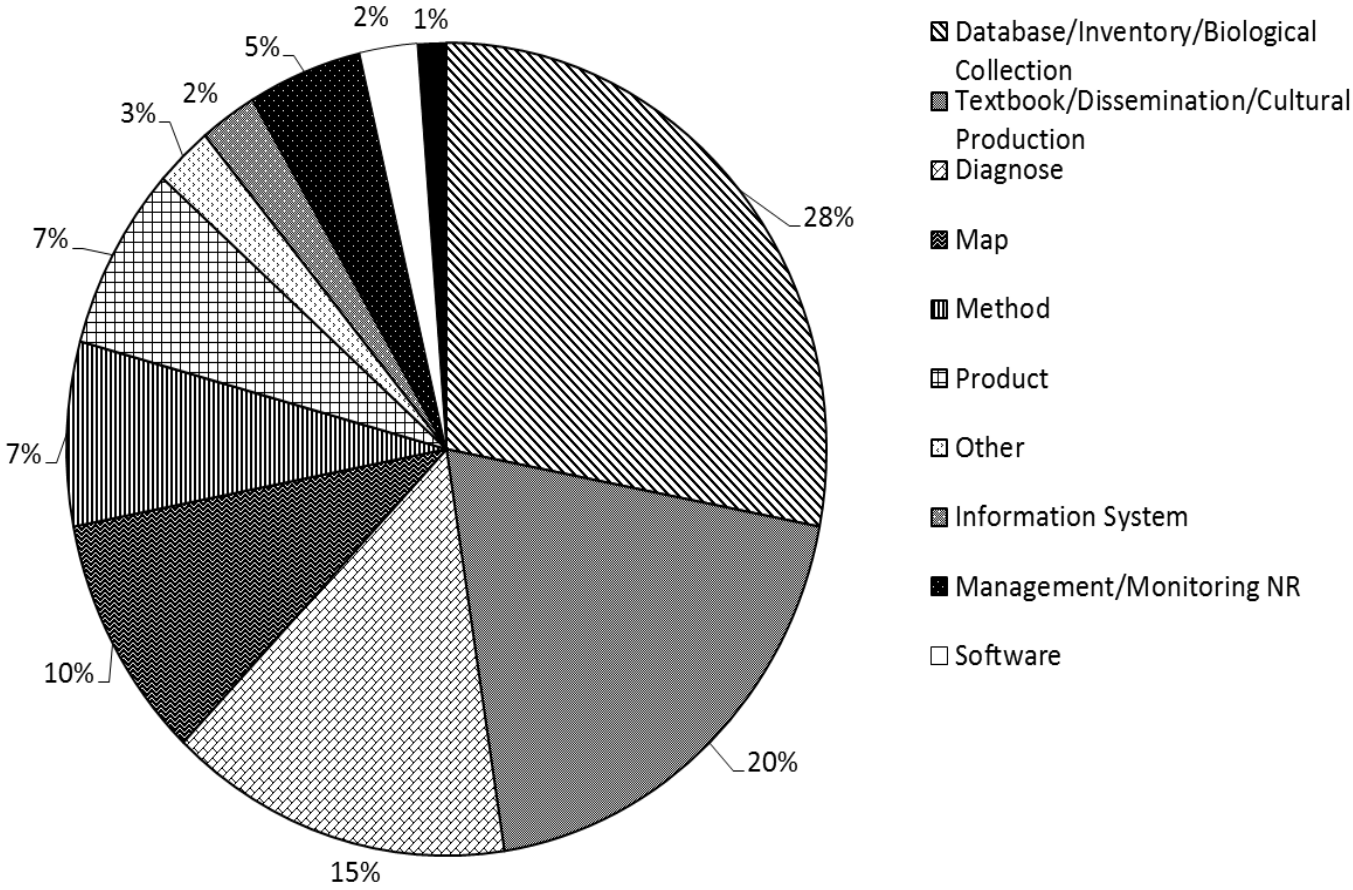

Figure 1. Classification of results by type of result (n=85)

Thirty-nine, or 45% of the total were converted into innovations, in the sense that the result is being used productively, commercially or in public policy. Thus it can be concluded that the Biota/FAPESP Program achieved an average of 0.7 innovations per project[**]. This number has to be carefully considered because it does not represent new products and processes (just two patents were filed related to technological results), but mainly new data and information used in biodiversity conservation. The most cited results were related to database, inventory and biological collections, followed by textbooks, dissemination and cultural production. These were also the results that were most adopted by third party members. The production of database, inventory and biological collections reflected strong encouragement of activities relating to biodiversity characterization in the initial phase of the program. Regarding the purpose of the results that were adopted and thus are considered innovations, the most frequent categories were (i) zoning ordinance or management (40%) (ii)

[**] This rate was obtained by dividing the number of results that turned into innovations by the number of projects that compose the sample analyzed in the present evaluation.

dissemination and support to education; (iii) technological development; (iv) cultural deployments; (v) economic alternatives; and (vi) industrial application.
Public Administration is the greater adopter of the Biota's results 20 results is being used somehow to support public policies. Non-profit organization was the second category that most adopted the results generated by the research projects. Enterprise entities still has a weak link with de program.

Conclusions

After ten years of existence, the Biota/FAPESP Program has begun to have a significant impact on innovation. In its initial phase the program's main mission was characterization of biodiversity. This entailed basic research, whose findings served as input for the formulation of public policy. The program furnished input for four decrees issued by the São Paulo State Government and eleven resolutions issued by different departments of the state government (Joly et al., 2010), all of them directly related to biodiversity conservation in São Paulo. However the results regarding the sustainable use of natural resources, specially those related to bioactive substances from biological diversity, patents and enterprise partnerships are not significant, that the Program has to amplify its scope in order to foster what we could call more "hard innovation" from the sustainable use of biodiversity, which is one of the objectives of the Biota.

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