

**Collaborations Between Business/Industry/Government: Lessons Learned**  
**Cynthia Z.F. Clark and James Mark Harris**  
**National Agricultural Statistics Service/USDA**  
**1400 Independence Ave. S.W., Washington, D.C. 20250-2000**

**Abstract.** A research program in any official statistics office requires statistical and survey expertise. There are a number of different models for obtaining appropriate intellectual resources. The paper will discuss collaborations of government agencies producing official statistics with academics, survey, and private sector organizations. It will highlight benefits that arise by bringing together individuals focusing on theory with institutions that are implementing survey and statistical applications within their programs. These benefits come to all participants in the collaborations.

**Key Words:** Contract Services, Cooperative Research Agreements, Academic Fellowship Programs, Non-governmental Research Organizations.

Official statistical offices almost always have a staff of researchers who focus their attention on solving important questions relating to the statistical and survey methodology challenges that the organization is facing. There are many instances where this staff may not be able to address all of the needs that the organization faces. Impediments may include shortage of staff, lack of expertise in a particular area, or new challenges not previously faced by the organization or its researchers. The use of external resources – such as survey organizations or academic researchers – is often a mechanism that official statistical offices employ to address these challenges. This paper discusses mechanisms that official organizations have utilized to augment internal research capacity – using outside resources – along with benefits accruing to both the official statistical offices and the external researchers or organizations.

## **1. Contract Services**

One of the most straightforward approaches to obtaining resources not available at an official statistics office is to contract for expertise on a specific problem. This approach generally begins with a statement of desired work made available to possible contractors – either academic researchers, private survey organizations, or international organizations such as the World Bank or International Monetary Fund. This work is generally done off-site with limited contact between the researcher and the staff of the official statistics office, with the possible exception of contract management.

Over the years such contracts have been the most frequently used approach of official statistics offices. This procedure has the advantage of delivering a research product to the organization. This approach has been used extensively by the Census Bureau and by many European statistical offices. The contract services type of arrangement is beneficial to the official statistics office because the office has expertise in contracting services and because the office receives a solution relating to a specific research topic, generally with minimum staff commitment.

The U.K. Office for National Statistics (ONS) has had a five-year contract with the University of Southampton that has been renewed several times. This contract provides an exception to the

usual contract mode of operation – wherein there is limited interaction between the staff of the national statistical office and the contracting organization. This contract is a substantial one that ONS uses to designate work on identified problems to be done by academics on the faculty of the University of Southampton’s Department of Social Statistics. Additionally, the University of Southampton has an academic researcher in their department who manages the contract and is frequently on-site at ONS for consultation work, and who often addresses problems that had not been identified in advance. This mechanism has been very successful in providing, on a timely basis, academic consultation and research necessary for ONS programs. This model could be pursued by any official statistics office relating to a university in their country. The ONS contract has also been successful, over time, in developing the academic expertise of faculty in the Department of Social Statistics so that they are currently well known as having expertise in survey statistics. This developed expertise was one of the components that led to the successful implementation of a master’s degree program in official statistics at the University of Southampton (jointly supported by ONS).

### **1.1 Indefinite Task Order Contracts**

One modification of the contracting process has been to use indefinite task order contracts. Such contracts seek to identify several private survey organizations that can conduct research on behalf of a statistical organization. Statistical expertise and research experience is sought in identified fields – such as survey methods, survey estimation, survey analysis – without identifying a specific problem. Once several organizations have been selected through this mechanism, a specific research problem can be competed among the organizations or simply provided to the organization that is deemed to have the best capability for addressing the problem. A frequent component of these contractual arrangements may involve academics who subcontract with the selected private survey organizations. This mechanism was successfully developed by the Census Bureau and used extensively for research related to the 2000 and 2010 censuses of population and housing. More recently other U.S. organizations have utilized this contracting mechanism.

The indefinite task order contract benefits the official statistical office by bringing in academic experts at points where knowledge is currently not available to the official statistics office or where development of a new statistical or survey methodology is needed. It also has the advantage of facilitating new research needs in a timely manner. An additional benefit of this contractual arrangement is the potential supply of university-trained employees to which the official statistical office thus obtains access.

### **1.2 Cooperative Research Agreements**

The National Agricultural Statistics Service utilizes a variant of the indefinite task order contracting approach that provides additional flexibility. Agencies in the USDA can engage in cooperative research agreements – which function much like contracts but without the contracting competition process – with U.S. land grant universities primarily. These agreements must provide mutual benefits to both the agency and the cooperator, and some cost sharing is also required.

A 1938 cooperative agreement with Iowa State College (now University) led to the development of the master sample of agriculture, a seminal contribution to the Bureau of Agricultural Economics (the predecessor of the National Agricultural Statistics Service) and to the Census Bureau. The area frame thus created was used for agricultural surveys, the agriculture census, and linkages with the population census. It is a model for the proposal in the United National Global Strategy for Agriculture and Rural Statistics. A similar agreement in 1956 led to the cooperative work of the Iowa State University Statistical Laboratory on the National Resources Inventory (NRI) with the USDA Soil Conservation Service (now the Natural Resources Conservation Service). The current NRI is a longitudinal survey of soil, water, and related environmental resources designed to assess conditions and trends on non-federal US lands.

This type of agreement epitomizes the cooperative working arrangement. These cooperative arrangements provide the official statistics office researchers with experience in working with academic researchers. Using these cooperative arrangements, official statistics office researchers strengthen their research skills and increase their knowledge base. In addition, the official office obtains or retains personnel who were directly involved in the project and on whom it can rely on for project implementation and for future research needs. Universities benefit by allowing academic researchers to engage in research that often produces published research papers, thus providing meaningful opportunities for students to participate in research projects.

## **2. Academic Fellowship Programs**

In 1977 the American Statistical Association collaborated with the National Science Foundation and the U.S. Census Bureau to develop the ASA/NSF/Census Bureau Fellows program. This program brought an academic to the Census Bureau to work on a problem – defined by the academic – that was of interest to the Census Bureau. The goal of the program was to bring senior statisticians, social scientists, and graduate students to the Census Bureau to do research with Census Bureau data and to interact with Census Bureau staff. Frequently the incentive for the researcher to work at the Census Bureau was to gain access to Census Bureau data and to work with that data on-site. The program often facilitated ongoing collaboration with the researchers and their graduate students, providing opportunities for the Census Bureau eventually to hire the graduate students. It also facilitated incorporation of problems and methodologies used in official statistics into the academic curriculum.

When the academic researcher relocated to the Census Bureau, the individual would conduct research on the problem and also learn about other current research problems at the Census Bureau. Often collaboration would result with researchers at the Census Bureau. The period of time for the fellowship varied – generally at least six months, but occasionally several years. Often, the period of work at the Census Bureau was split over several periods of time. The selection of projects was made by an external board chaired by ASA, composed academic researchers, NSF staff, and senior research managers at the Census Bureau. This program has been expanded to other U.S. statistical agencies, including the Bureau of Labor Statistics (BLS) in 1985 and the National Center for Education Statistics (NCES) in 1986. Several other U.S. statistical agencies have partnered with ASA, but do not receive NSF support in their programs. These agencies include the National Agricultural Statistics Service, the National Center for Health Statistics, and the Bureau of Economic Analysis. Each agency has customized how the

researchers work with their organization. The NSF/ASA program alone has had over 100 senior research fellows and 60 research associates in its history.

In 1991-1992, Brenda Cox, a researcher from Research Triangle Institute, served as an ASA/NASS Research Fellow, with a project to work on sample weighting and estimation issues. However, as a result of her interaction with NASS staff, she recognized a need for a broader sharing of statistical and methodological issues relevant to business censuses and surveys. She focused on that broader need and led a program committee that planned the first international conference on establishment surveys (ICES) in 1993. This effort has subsequently been continued through conferences in 2000 and 2007 with support from international professional associations and official statistics offices. The next conference will be held in 2012.

NASS most recently engaged Professor Partha Lahiri (JPSM, University of Maryland) in 2009 as an ASA/NASS Research Fellow to conduct research on small area estimation to produce county level crop estimates. Professor Lahiri's interest in the NASS estimation problem arose from three one day workshops in 2008 – 2009, held with three other external researchers to explore statistical methods for addressing the NASS estimation problem. He has been working with staff at NASS on this problem approximately one day a week over a two-year period. Logistically, this is facilitated by the fact that Professor Lahiri's academic location is in the same geographic area as the NASS office. This close proximity allows interaction with NASS staff and allows Dr. Lahiri access to otherwise unavailable official data.

In contrast to previous examples, the academic fellowship programs give flexibility to the outside researchers, allowing them to define the research. The researchers are able to work on topics within their research realm. The advantage to the organization has often been that its knowledge expands in areas, not seen as having immediate priority, which can, however (as the examples show), bestow long term benefit and even transform the agency's work.

### **3. Other Academic Arrangements**

In the U.S., another mechanism that has been used to gain academic collaborators is the use of Intergovernmental Personnel Act agreements. This mechanism can usually be used to gain the services of academics at official government agencies for up to two years. Two examples follow of successful use of this mechanism at the Census Bureau:

Professor Seymour Sudman (University of Illinois at Carbondale) worked at the Census Bureau in 1998-1999 during his sabbatical year. He meant to conduct research in survey methodology for establishment surveys – a field that had not previously received much attention. He was receptive to work on a project of interest to the Census Bureau. Initial discussion led to support from both the Associate Director for Methodology and Standards and the Associate Director for Economic Programs for a large scale project in response issues relevant to large establishments. This project was led by Professor Sudman and an Economic Directorate Steering Committee. As part of the team, two junior researchers worked with Professor Sudman. The project was well received; results of the research were implemented, and further research has been conducted at the Census Bureau. A large body of professional papers resulted from this collaborative effort.

Pursuant to an Intergovernmental Personnel Act agreement, Professor Don Dillman worked with the Census Bureau in the 90s to develop user friendly census forms and effective data collection methods. In Professor Dillman's case the agreement was renewed for a second two-year term. In his time at the Census Bureau, Professor Dillman worked with a number of teams with research and operational participants. As a result of his extensive work at the Census Bureau, Professor Dillman revised his successful 1978 text, "Mail and Telephone Surveys: The Total Design Method" (first edition) in 2000 to "Mail and Internet Surveys: The Tailored Design Method" (second edition). The second edition includes a chapter specifically directed to government household and individual person surveys, but the entire textbook is relevant for government surveys.

In both of the cases cited, improvements to official statistics were implemented as a result of a key outside researcher, and the skill and ability of official statistical office staffs were enhanced.

#### **4. Other Institutional Arrangements**

NASS engaged with the National Institute of Statistical Science (NISS) in a two year project that initially involved the identification by NASS of four complex agricultural statistics problems that would be addressed by teams composed of academics, doctoral students, post-doctoral researchers, and NASS staff. NISS sought academics supervising doctoral students interested in one of the problems, hired a post doctoral candidate to work on each problem, and identified NASS staff to work on each problem. This ultimately resulted in procuring staff for three of the four problems where staff on each problem consisted of two academics, a post-doc, a graduate student, and several NASS staff. One of the projects involved a staff member from the Economic Research Service, a co-sponsor of the survey on which the research was focused.

The teams convened at NISS headquarters in Research Triangle Institute, North Carolina in June of 2009 and spent much of the summer working together there. When the academic year commenced the academics returned to their institutions with their graduate students; the post-doctoral researchers and the NASS staff came to the NASS site in Fairfax, Virginia. During that period the academics and the NISS cooperators mentored each project with weekly teleconference calls and occasional visits. The teams reconvened for the second summer working together at one site. The projects concluded at the completion of the 2010-2011 academic year.

The problems addressed were: (1) examining large differences between the census of agriculture and the annual June Area Survey in farm numbers; (2) investigating multivariate imputation procedures for the complex Agricultural Resource Management Survey (a joint survey program with the USDA Economic Research Service), whose microdata is used for extensive econometric models; and (3) developing crop yield models using farmer reports, crop measurement surveys (objective yield surveys), and other data as model covariates such as temperature, precipitation, planting dates, remote sensing information, and historic data. Significant progress was made on each research problem during the project. Twelve resulting presentations were made at the 2010 Joint Statistical Meetings and three will be presented in the 2011 JSM, in either invited or special topic contributed sessions, garnering much interest in the work and in the research model. Six journal articles have been or will be submitted as a result of these agreements. Additionally, six internal research reports have been produced under the NISS-NASS agreement.

This project has had broad impact at NASS, influencing the work of other researchers and statisticians in the agency. As managers looking at this model retrospectively, we see many of the same benefits realized from other collaborations. Specifically, the agency benefited from enhanced capacity to address top priority topic areas, from the availability of researchers knowledgeable in applicable technical areas, from the willingness of researchers to take their projects to organizational implementation, and from the general strengthening of staff research ability. The outside researchers, the post-docs, and the doctoral graduate students gained valuable real world experience under the supervision of the academics and in collaboration with agency staff.

One additional feature that the project demonstrated to the agency was the possibility of conducting research via an outside data enclave hosted by the National Opinion Research Center (NORC). The NISS/NASS model moved the agency's research towards a virtual research team. That is: the institutional organization, NISS, brought together the personnel components of the diverse team. Allowing the diverse team from multiple locations controlled access to sensitive or protected data was another significant step towards creating the virtual research team. As the utilization of video conferencing and the data enclave technology become standard operating procedures, true virtual research teams can become a reality.

## **5. Summary**

Each official statistics office has organizational rules that dictate how outside resources can be engaged. In the examples cited above, gaining an outside perspective and developing staff are re-occurring themes. Staff greatly enjoy and benefit from the interaction with outside researchers, the satisfaction of being involved with solving significant problems of the organization, and the recognition of being placed on high profile teams. Organizations have a parallel benefit as collaborations contribute to the development of staff, to the solution of significant statistical and survey methodology problems, and to positive attention focused on the agency and its collaborators. Outside researchers often gain by expanding their research interests and by identifying new research topics for further collaboration with their students, other academics, or government staff. The collaboration often attracts new staff for the statistical offices. Combinations of the approaches discussed in this paper and the utilization of technology such as data enclaves and video conferencing should result in advancing research at official statistical offices.

## **References**

Clark, Cynthia and C. E. Hoy (1999). "Research in Official Statistics". International Statistical Review. Eurostat, Luxembourg, Belgium.

Dillman, Don A. (2000). "Mail and Internet Surveys: The Tailored Design Method". Second Edition, John Wiley & Sons, Inc., New York.

Fuller, Wayne A. (1990). "The Master Sample of Agriculture". Unpublished paper. Iowa State University.

Ghosh, Sujit, M. Robbins, J. Habiger, D. Miller. (2010). “Multivariate Imputation Methods for Agricultural Resource Management Survey (ARMS) Data”. Proceedings of the 2010 Joint Statistical Meetings, American Statistical Association, Vancouver, Canada.

Jessen, R. J. (1945). “The Master Sample of Agriculture, II: Design”. Journal of the American Statistical Association, Vol. 40, No. 229 (Mar 1945), pp. 46 – 56. American Statistical Association, Washington, D.C.

King, A.J. (1945). “The Master Sample of Agriculture, I: Development and Use”. Journal of the American Statistical Association, Vol. 40, No. 229 (Mar 1945), pp. 38 – 45. American Statistical Association, Washington, D.C.

Narine, Joyce (2010). “The American Statistical Association, National Science Foundation, and Federal Statistical Agency Fellowship Program”. Unpublished note. American Statistical Association, Washington, D.C.

Nusser, S. M. and J.J. Goebel (1997). “The National Resources Inventory: a Long-term Multi-resource Monitoring Programme”. Environmental and Ecological Statistics 4, pp 181 – 204.

Robbins, Michael, T. K. White (2011). “Farm Commodity Payments and Imputation in the Agricultural Resource Management Survey.” American Journal of Agricultural Economics, January 2011.

Sudman, S., D. K. Willimack, E. Nichols, and T. L. Mesenbourg, Jr. (2000). “Exploratory Research at the U.S. Census Bureau on the Survey Response Process in Large Companies”. Proceedings of the 2<sup>nd</sup> International Conference on Establishment Surveys, American Statistical Association, pp. 327 – 335.

Wang, Jianqiang (Jay), S. Holan, B. Nandram, W. Barboza, C. Toto, E. Anderson. (2011). “A Bayesian Approach to Estimating Agricultural Yield Based on Multiple Repeated Surveys”. Journal of Agricultural, Biological, and Environmental Statistics (to be published).

Wang, Jianqiang (Jay), B. Nandram, C. Toto, W. Barboza, E. Anderson. (2010). “Advancing Statistical Methodology for USDA Surveys and their Analysis”. Proceedings of the 2010 Joint Statistical Meetings, American Statistical Association, Vancouver, Canada.

Willimack, D.K., E. Nichols, and S. Sudman (2002). “Understanding Unit and Item Nonresponse in Business Surveys”. Chapter 14 in Survey Nonresponse, R. M. Groves et al., editors. Wiley, New York.

Young, L., D. Abreu, P. Arroway, A. Lamas, K. Lopiano. (2010). “Precise Estimates of the Number of Farms in the United States.” Proceedings of the 2010 Joint Statistical Meetings, American Statistical Association, Vancouver, Canada.