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Topic (i): Sharing of software and components

**COLLABORATION AND SHARING STATISTICAL SOFTWARE, COMPONENTS, PROCESSES
AND CAPABILITY –
EXPERIENCES AND ASPIRATIONS AT THE AUSTRALIAN BUREAU OF STATISTICS**

Invited Paper

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I. INTRODUCTION

1. National Statistics Offices (NSOs) often have the same or similar mission, business models, statistical architecture, components and obligations. In common with MSIS, the Australian Bureau of Statistics (ABS) recognises that there are many statistical infrastructure components and approaches available in other NSOs and elsewhere that may be relevant to ABS business. NSOs have a long history of sharing methods, frameworks, processes, experiences and technology. Through a number of Australian National Statistical Service collaborations, the ABS has learnt lessons about what is required for effective collaboration and sharing of statistical business infrastructure. Stronger central ICT governance in Australia is also stimulating the development of models for cooperation and ICT reuse, particularly given a financially constrained environment. This paper will share those experiences, ABS aspirations for purposeful collaboration and some thoughts on how this could be achieved.

II. BACKGROUND

2. Since the 1980s, the ABS has used an evolutionary (rather than revolutionary) approach to supporting statistical processes using ICT. Important elements of the approach have been:

- ABS Senior management guides investment and priorities for enhancement of business process and use of ICT;
- Business change drives technology change and business areas own the development of their process improvement and ICT work program and funding;
- Business, methodology and ICT work in partnership to deliver the outputs and outcomes sought by the ABS;
- Cost recovery ensures business areas understand the cost of ICT and make business decisions about the level of investment required;

- Central and transparent ICT budgets are developed to ensure cost effective use of ICT; and
- A program of improvement to the ICT environment supports enhanced personal and workgroup productivity, strong knowledge management and collaboration inside and outside the organisation.

3. In the past decade, there have been two major re-engineering programs - the Business Statistics Innovation Program and the Integrated System for Household Surveys Program. During the same period, several important components have been developed, including an input data warehouse for economic data, a new business register, a significantly enhanced website, an e-Census solution and a Computer Assisted Interviewing system for home-based interviewers.

4. Like many organisations, ABS has a defined Enterprise Architecture. The Architecture includes Objectives and Principles, Business Drivers, a Business Process Taxonomy, IT Governance Framework, Application Architecture, IT Infrastructure, Technologies and Tool sets, Commercial Systems and Tools, Data Management Architecture and Components and Services Interfaces. Over many years the ABS and other National Statistics organisations have shared methods, frameworks, processes, experiences and technology. ABS has adopted a small number of statistical software components from other NSOs as part of our Enterprise Architecture over time, including TPL (US Bureau of Labor Statistics), Blaise (Statistics Netherlands), INFOS (Statistics New Zealand), Data Ferrett (US Bureau of the Census) and Tau-Argus (pilot use - Statistics Netherlands). Usually, the opportunity to share software has emerged from discussions with other NSOs about the successful development of a software component rather than from an explicit plan to share. There have also been many visits and discussions about ABS developed components, but ABS developed software has often been difficult to share because of dependencies on our standard commercial software choices (which include ORACLE, Lotus Notes Domino, SAS and SuperStar Suite).

III. DRIVERS FOR CHANGE

5. Our reinvestment approach has worked well in the past and we have been able to achieve significant business and technology change. However, the incremental approach, and integration over time of many different statistical software components into our architecture, has resulted in a complex processing model with elements from different eras and design philosophies. This has been manageable to date, but there are a number of reasons this model will not support us well for the future.

A. Australia's National Statistical Service (NSS)

6. ABS is leading a National Statistical Service (NSS) [1], a community of government agencies, led by the ABS as Australia's national statistical organisation, building a rich statistical picture for a better informed Australia. The NSS is:

- the sum of an agreed set of statistical frameworks, principles, policies and data resources developed by, or available to, government agencies and instrumentalities within Australia that are used, or could be used, to produce official statistics, together with the skills and capabilities of the people involved;
- underpinned by a set of shared values and associated behaviours that shape and sustain the integrity and objectivity of official statistics and provide governments, markets, businesses and communities with confidence to trust, both as providers and users, the official statistics produced within the NSS.

7. The objectives of the NSS are to:

- deliver a high quality, up-to-date, comprehensive, coherent statistical picture of the economy, society and the environment to assist and encourage informed decision making, research and discussion within governments and the wider community;
- provide a world class official statistical service that retains the confidence and trust of the Australian society as both providers to, and users of, the resultant official statistics;
- maximise the use for official statistical purposes of data available within government administrative systems by government agencies and instrumentalities;
- minimise the burden of statistical reporting at all levels of the Australian community;

- document and retain as an enduring national resource key statistical outputs and their underlying data sources.

8. As we have progressed the NSS, the importance of statistics for strategic decision making has been recognised by more policy makers within the Australian Government. For example, the Council of Australian Governments (the peak forum for Federal and State government co-ordination in Australia) has identified a number of key issues for Australia and ABS is participating in providing statistics to support government information requirements for these issues. At the same time, regional governments and others are seeking greater detail for particular geographical areas. ABS needs the ability to rapidly create and process new statistical collections to deliver statistics within shortened time frames and it is difficult to use our current processes or combine our technology components quickly and efficiently to meet these needs.

9. Conceptually, the NSS requires shared values, content, infrastructure (including technology infrastructure) and capability. Although much can be achieved without shared technology, the use of common technical components has the potential to support many of the goals of the NSS. Most of the existing ABS statistical technology infrastructure is designed for use within the ABS. Although the functions could be used in other organisations, there are technical, organisational and cultural barriers to this use. The NSS requires a common but flexible architecture and a rich tool set for the community of agencies and organisations and in the longer term, we aspire to use much of the same technology inside the ABS and with NSS partners.

B. New data sources, processing techniques and dissemination approaches

10. Through the NSS and through changes in society's use of technology, new data sources and data services are becoming available which may be usefully integrated into ABS processes and outputs (for example spatial data services). More and more data suppliers and consumers (individuals, business, non-government organisations and government agencies) expect to deal with ABS electronically. As more of our statistical capability becomes dependent on connections to external systems, the risk profile and service demands are changing.

11. Budget pressures drive an expectation from our Government that organisations such as the ABS will continue to find operational efficiencies. Our research and methodology programs have explored a number of promising processing techniques, such as standards based statistical metadata management, machine learning and semantic web approaches which have the potential to drive productivity savings for the organisation. We are also investigating the need for process metrics to determine which areas of our operation might be usefully optimised.

12. The ABS Website is a critical service for the dissemination of ABS statistical releases and the demand for ABS publications has increased significantly in past years. The ABS website has been operational for over 10 years and has evolved as the demand for services has increased. Whilst the website is running successfully today, it uses an aging set of processes and software and has grown significantly more complex, making it increasingly difficult to maintain or enhance. In addition to improving the end-user services of the Web site, there is also demand for system-to-system services which would require more extensive development. These could include Web services for data and 'core' statistical processes to allow others to innovate with statistical data and processing infrastructure in their own Web sites. We may also like to provide community and social computing services for easy, thematic access to quantitative data via Windows Mobile, Symbian and iPhone devices and possibly reference links via Twitter, Facebook and MySpace etc.

13. Other trends which are driving change for the ABS include the substitution of purpose-built collection instruments (e.g. survey forms) with more 'administrative' data and the associated distributed data warehousing and metadata implications; the need for work practices and systems which allow re-purposing of already collected data to produce new statistical outputs in much shorter time-frames; support for collecting data to managed quality levels rather than planned processing cycle times; and support for (external) end-user data linking and merging of output data for complex research.

14. Overall, our ability to invest in statistical infrastructure has been limited, leading to slow progress in these areas. Our strategic directions have recognised that these capabilities are needed for effective, responsive and productive statistical systems for the future, but funding constraints have resulted in a small number of pragmatic projects that realise local but not strategic benefits to the organisation and difficulty in achieving the critical mass, coherent architecture, and reuse required to support the ABS needs in the future. Although we

could choose to develop some of these supporting technologies wholly within the organisation, we believe there are significant benefits in collaborating on development efforts in these areas.

C. Whole of Government Drivers

15. A third reason for changing our approach is that the Australian Government has been actively promoting standardised information sharing, common systems architectures, improved whole-of-government governance and ICT asset reuse at an inter-agency level. This work is led by the Australian Government Information Management Office (AGIMO). ABS is represented on a number of Whole of Australian Government committees, including a Business Process Transformation Committee (BPTC) and a Chief Information Officers Committee (CIOC). The BPTC is a senior government committee which seeks reform and use of standard business processes across Australian Government Agencies to improve the quality, consistency and efficiency of service delivery to citizens. The CIOC supports business process transformation and seeks to implement common technology approaches across government. Some of the related activities are described below.

16. AGIMO has established an Australian Government Architecture [2], which has reference models for Government Performance, Business, Services, Data and Technology. The Architecture is designed to cover all government services and the draft Business Reference model now includes a "place holder" related to statistical services. ABS is working to ensure that each reference model layer includes the requirements related to statistics. There may be an opportunity to align and incorporate all or part of the Generic Statistical Business Process Model into the Australian Government Architecture.

17. A recent review of Australian Government ICT ("Review of the Australian Government's Use of Information and Communication Technology" by Sir Peter Gershon CBE FREng) [3], is leading to stronger central governance of ICT and ICT related architecture. We expect an increasing requirement to factor in change to comply with emerging government legislation or standards, including architecture standards. One of the recommendations of the review was to benchmark the costs of ICT across major government agencies and the results of these benchmarks are being used to identify and share good practice across Australian Government agencies. The review also focussed on the barriers to change posed by legacy ICT, and there is an intention to actively manage the replacement of legacy systems.

18. As well, work is underway on how to safely and effectively share information between government agencies to support the delivery of government services to the Australian community, whilst complying with legislation and privacy requirements. A "National Government Information Sharing Strategy" has been developed which identifies the principles, practices, tools and requirements for information sharing across all levels of Australian Government. The principles are: providing leadership, demonstrating value, acting collaboratively, establishing clear governance, establishing custodianship guidelines, building for interoperability, using standards-based information, promoting information re-use and ensuring information privacy and security. Sharing and reuse of technology is also a common theme in these collaborations.

19. A further initiative is that AGIMO has recently released Draft Australian Government Principles for the Reuse of Software and Other ICT Assets for comment by Australian Government agencies.

20. Many MSIS members will identify with these types of initiatives within their own national, European and UN contexts. Seeking commonality across NSOs is an important pursuit for international statistical interoperability.

IV. RECENT EXPERIENCE WITH COLLABORATION

A. Examples of recent collaborations

21. The reasons outlined in the previous section have led us to actively seek opportunities to collaborate with other organisations in the production and use of statistical architecture, processes and technology. Most notable of these have been:

- development of a pilot "National Data Network"
- creation of a Children and Youth Statistical Portal to provide access to information from a variety of sources and agencies,

- creation of a Victorian (state government) Child and Adolescent Monitoring System which draws together information from a number of agencies on indicators related to the well-being of children and adolescents,
- contribution to enhancements of the US Bureau of Census DataFerret dissemination product,
- development of Creative Commons software for electronic digital rights management 'water-marking',
- participation in a "standardised business reporting" project which aims to reduce the burden placed on business in reporting to government, and
- cooperation with the (Australian) Commonwealth Spatial Data Integration project

22. The ABS has identified some important lessons about how to collaborate and share software successfully from being active participants in these activities. Some of the lessons learnt are outlined below.

B. Lessons Learnt

23. Executive level champions and engagement in each involved organisation is essential to ensure that the solution is a good fit with organisational priorities, to provide cross agency governance and direction, to commit and sustain resourcing at required levels and if necessary to cease or redirect the development if the approach is not working.

24. Effort must be directed towards clearly defining the business problem, objectives, expected costs, benefits, risks and issues so that potential participants can accurately assess their interest and likely commitment. It is important to identify genuine 'mutual value' propositions for collaboration as soon as possible. Organisations have different priorities, political drivers, legislation, capabilities and resource constraints and potentially different levels of buy-in to particular sharing projects. It should be recognised that there are a number of points of entry and exit for collaborating organisations: at inception, at conceptual design stage, at pilot stage, at full development, upon success or when change/replacement of current infrastructure is required.

25. A phased approach to achieving the outcomes is useful as collaborative efforts can be time-consuming and harder than originally envisaged. It is important to explore the expectations of each involved organisation and agree the inputs that each organisation is willing to contribute. There are a wide variety of useful contributions including advice and feedback on proposals, participation in governance, stakeholder representation, project management leadership, statistical and technical expertise, requirements definition, design, development resources, content creation (including data or metadata), active testing and reporting, hosting of facilities, migration services, provision of local support, capable staff (physical or virtual), on-going support and enhancement and/or funding. All of the phases of the project need to be supported, not just the initial development.

26. Demonstration or "proof-of-concept" prototypes are useful but time and resource expenditure for these should be limited. Before proceeding to full development a business case should be prepared. The Australian Government uses both an ICT Business Case Guide [4] and a Gateway Review process for major projects which includes some useful advice for any projects [5].

27. In recent times, the Australian Government has used a "Lead Agency" approach where particular organisations are assigned leading roles in collaborations. There can be multiple Lead Agencies in one program, however, the responsibilities are clearly defined and acceptance of a Lead Agency role represents a commitment to deliver on those responsibilities for a project. In a number of instances, ABS has taken a Lead Agency role in the development of metadata and data sharing principles and processes. Contributing staff to the other involved agencies allows direct liaison and resolution of potential conflicting business or technical priorities and has the secondary benefit of staff development.

28. There is a need to work towards common business models and lexicon, and to decide which things need to be standardised and, importantly, which things do not. ABS is not seeking to achieve complete standardisation of all aspects of our architecture with other NSOs. However, we have recognised the importance of ensuring that the ABS Enterprise Architecture fits together with the Australian Government Architecture and is consistent with the Generic Statistical Business Process Model. If NSOs can agree on

statistical architecture, there is an opportunity to jointly influence governments about the role and practice of national statistics and to reduce the work required by each individual NSO.

29. Our dependence on technology owned and operated by others is increasing, creating new risks from both a business and technology perspective. Our collaboration models need to include mechanisms to identify and manage these risks and we need to ensure that ABS data continues to be protected to the confidentiality and security standards required by ABS legislation.

30. Existing technology architectures in organisations can be a strong barrier to effective collaboration. The architecture chosen needs to accommodate different technical choices and work effectively with tools already used within organisations. It is important to engage with CIOs and technical staff early to explore and remove technical barriers. Technical staff in organisations may justifiably resist the incorporation of new technology components as these often result in increased effort, cost and complexity. Mandated government standards for technology such as software choice, security and accessibility must be accommodated. Organisations which have outsourced technology services may have additional barriers, particularly as they do not necessarily have direct control over technology choices. Most CIOs have a strong interest in the level of ongoing support that can be expected to accompany a software component. The specifics of system resource hosting, moderation, governance and access to resources should be defined at an early stage to address this interest.

31. Opportunities arise at the point when an organisation needs to replace existing technology or approaches and an organisation's commitment may increase over time as the need to replace components arrives and success in other organisations is proven. It also needs to be recognised that a component viewed as of central importance by one organisation may be only of minor interest to another, although this may vary over time.

32. There is a need to be alert to emerging frameworks, infrastructure, applications and components. Existing or emerging solutions in related disciplines and fields, whether government, commercial and/or open source may be useful alternatives to the proposed development.

33. We have recognised that often multiple solutions exist for each functional area. This competition has the potential to drive significant improvements and can be accommodated if there are standard integration points and service definitions. ABS supports the use of SDMX and DDI working together, as a standard means of representing aggregate data and microdata with associated metadata and relating these to metadata frameworks such as the Metanet Reference Model [6]. Generalised services can make use of content structured in these ways. At the same time, it is recognised that other formats (eg XBRL or local "proprietary" formats) may still be appropriate for specific purposes. The objective is to define a standards based "backbone", and apply it as widely as practicable either through direct use or through automated (mono or bi directional, as appropriate) mappings/transforms to optimal "local" formats. Founding shared solutions on open standards may not always be the most cost effective approach in the short term, especially if the collaboration partners share common commercial, enterprise level platforms (eg SAS, Oracle), but it must be done.

34. It is useful to consider what is required for success as both a consumer and a provider of services. For example, ABS is seeking to both use geospatial software developed by another government agency and contribute data to the initiative. Also, we have been involved in the development of Creative Commons licensing software and are considering it for use in licensing our own data. (Some aspects of the ABS Website already incorporate Creative Commons use.)

35. Internal stakeholders who will employ the outputs from the collaboration must be engaged throughout the collaboration as active participants, rather than passive 'watchers'. The deliverables, time and cost parameters must be clear. However, all participants should be prepared to be flexible as new external factors and internal re-prioritisation may occur.

36. It is useful for collaborating organisations to include reuse as a key component of their ICT asset management strategy/enterprise architecture. Intellectual Property arrangements should allow the asset to be used by other participating statistical organisations. Information about the reusable asset, including implementation requirements, should be available to other co-operating organisations. Organisations reusing a collaboratively produced asset can be expected to contribute to maintaining the ongoing reusability of the asset.

37. Governance arrangements for a collaboration project should be explicit, open, transparent and sustainable and include a clear definition of accountabilities and should be supported by an express agreement between parties, normally in the form of a memorandum of understanding. The expectation that exact alignment of functionality and business objectives for all collaboration partners is unrealistic, and should be recognised in the arrangements.

38. While good organisation and planning are necessary elements of successful collaborations, ABS experiences have demonstrated the value of personal relationships between professional staff in collaborating organisations; these relationships can sometimes foster and sustain quality work when process and governance has been less effective. Supporting a means to create these relationships between capable and motivated staff is essential, as they can also create enthusiasm and produce innovation beyond planned results.

V. ASPIRATIONS FOR FUTURE COLLABORATION

39. As outlined in this paper, the ABS commitment to lead a NSS, changes in expectations of data providers and users of our statistics, the drive from government to share ICT approaches and technology, our limited ability to fund all of the technology investments needed for the future and encouragement from the success of a number of open source projects have led us to actively seek opportunities to share technology with other organisations. We see very strong opportunities flowing from effective collaboration between NSOs.

40. There are many areas of statistical processing where ABS is looking to use existing statistical components from other NSOs, partner in collaborative development or lead developments. One of our key requirements is a "standards enabled active shared metadata environment" to support the rapid assembly of statistical components for the delivery of statistics. We are seeking a standard which allows us to incorporate "plug and play" components across all parts of the statistical process. Other components of particular interest at the current time include tools for metadata definition, automated and computer assisted coding, output editing, business rules processing, confidentiality approaches, time series processing, data visualisation techniques, a wide variety of web based services, analysis tools and process metrics approaches.

41. In summary, we are looking for an architecture and approach that:

- leverages what is already available;
- uses open standards and/or open source approaches and forums which encourage sharing such as sourceforge (www.sourceforge.net);
- provides the ability to adapt to new components and capability as they surface (both in the NSO community and in the broader environment);
- encourages recognition by NSO technology areas of the shared statistical frameworks, any investigations or stocktakes conducted by NSOs, and lessons learnt about what has worked (or not);
- allows cooperative planning for new developments in different organisations, including shared research and definition of requirements, an understanding of the investment priorities and strengths of different NSOs;
- supports collaboration across the life cycle of components (design, construction, use, enhancement, retirement);
- establishes common or compatible governance mechanisms and operating frameworks including the ability to "bid for work" on projects; and
- encourages opportunities for the technical staff of NSOs to meet and provides mechanisms to share staff through exchanges or through direct contribution on open source style developments.

Successful collaboration has the potential to:

- support a more top-down, faster pace of process and system change (agile approach);
- develop a common but flexible architecture and a rich tool set, allowing extensions by partners without modifying the 'core' product;

- support easier implementation of statistical frameworks through the use of a more common technical base;
- use “pooled” resources to provide higher quality and more flexible components with a better support base;
- create shared business cases for the development of statistical infrastructure, contributing to the overall strength of national and international statistics systems through coherence and common values;
- achieve savings in ICT across government and across NSOs;
- share important expertise and build international capability; and
- position the collaborating organisations well for the future.

42. In recent years, the ABS has gained experience in collaborating with a number of organisations. ABS has recognised that there are many potential benefits from successful collaboration and we seek to further build our contribution to the work of NSOs and important forums such as MSIS. Our recent experiences have provided practical knowledge about what is required for success and by sharing this knowledge and by understanding the knowledge and experiences of others, we hope to support effective progress in meeting our future challenges.

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