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Topic (iii): Innovation

Riding the big data wave to streamline acquiring and managing data

Invited Paper

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I.   Introduction

1.   Society is in the middle of a revolution. Just as the early 19th century was marked by the industrial revolution, so too will the early 21st century be recognised as a significant period of transition for society – the "information revolution".

2.   The early 19th century is seen as a revolution because improvements in one field of endeavour – in this case the development of the steam-powered engine and other development of powered machinery – had spill on effects that impacted significantly on society's working life, culture, and standards of living. The early 21st century is marked by substantial change in information technology and consequently in the production, management and use of information. There is every indication that the changes will be just as profound, and will have significant and lasting societal and cultural impacts.

3.   These significant changes have begun, but are still in progress. Currently society is in the middle of a data deluge. There has been immense growth in the amount of data that is being produced, transmitted and stored. This sudden explosion in data is every bit as powerful as the invention of the steam-powered engine 300 years ago. The challenge for society is to harness this new resource and use it to substantially improve the way we do business, live and prosper as a society.

4.   The Australian Bureau of Statistics (ABS) is Australia's national statistical agency, and has a proud tradition of over 100 years of service to the production of official statistics in Australia. In common with other national and international statistical institutions, the ABS is in the business of information. As part of the information industry the ABS has to respond to the rapid changes in the environment to ensure Australians reap the benefits of the many opportunities available.

5.   There are some key changes in society that are particularly relevant to national statistical organisations.

- Rapid growth in uptake of IT devices. Digital devices are always with us.
- Constant production of digital data in every aspect of our lives. Purchases are conducted electronically. People keep electronic diaries and make electronic appointments. Communication and collaborative work is conducted using email, social media and mobile devices. Instruments and appliances generate large streams of data.
- People expect convenience. We have come to expect instant response, quick transactions and efficient processes.
- People are harder to contact using traditional methods. It is more difficult to establish phone contact and people have less tolerance for intrusive calls. Greater security makes it harder to get to the front door of many dwellings, and we are less likely to find someone at home when we do get to the front door.
- More and more data is available as a by-product of government, industry and personal activities and many innovative applications which use this data are appearing.

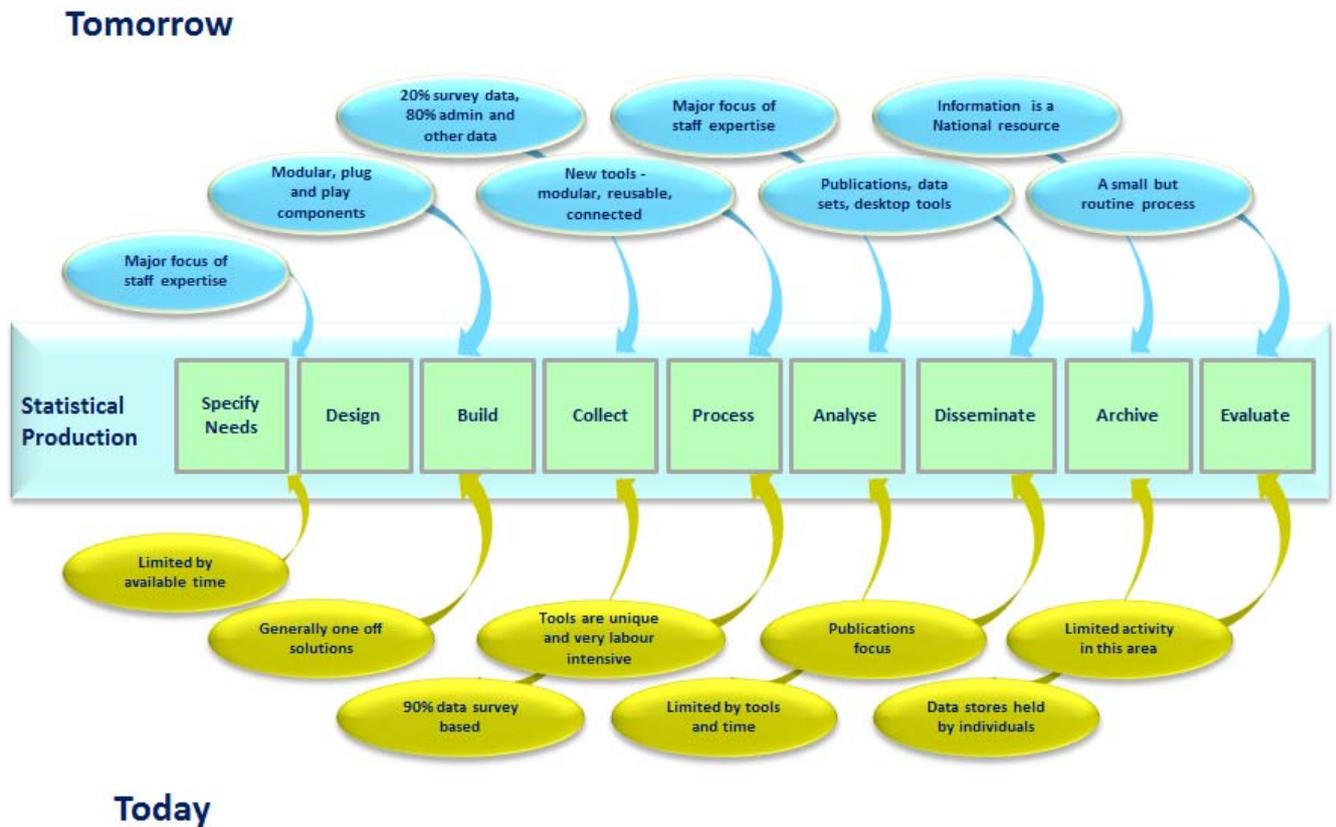## The changing environment
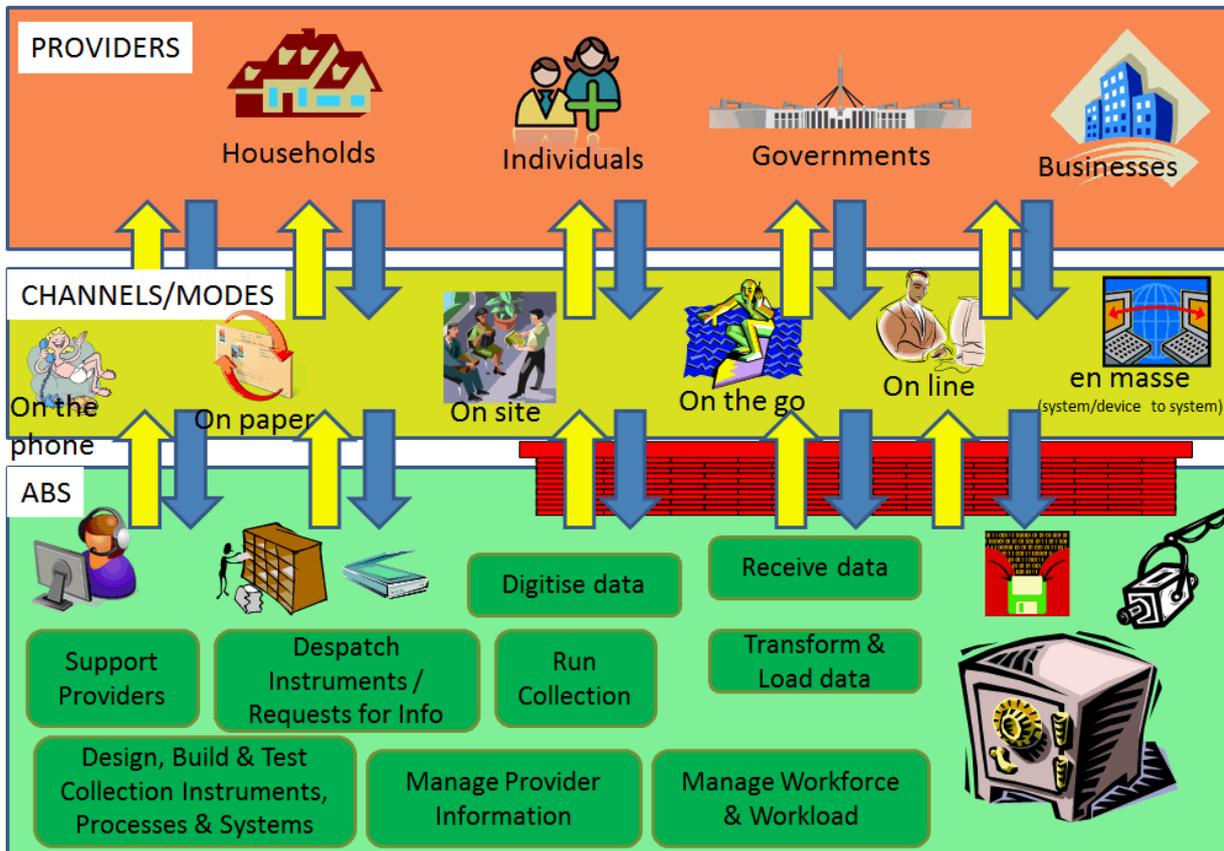
II.   The challenge for producers of statistics

6.   The challenges presented by the information revolution have some similarities to the challenges presented by the industrial revolution. Organisations like the ABS have to move further away from a cottage industry model of production, where individual artisans produce very personalised and tailored products. They need to continue a transition towards efficient, high volume models of production where a large range of products can be produced using standardised production processes, while still allowing for customised products to be aimed at market segments with specialised needs.

7.	To effectively 'industrialise' and modernise statistical production we need to change our way of doing business. The principles that will guide this are:

- Ride the big data wave - use existing data first, acquire existing data from others second and run new collections third
- Greater automation of processes
- Active use of paradata for real time tuning of processes (responsive design)
- Greater re-use of tools, modules and components
- "Plug and play" components
- International collaboration and adoption of internationally agreed standards and frameworks for statistical processes and statistical information management.

8.	What do these principles mean in practice for the way statistical production is conducted in a large national statistical agency? Some of the differences needed across the Generic Statistical Business Process Model (GSBPM) [1] are shown in the diagram below.

[1] http://www1.unece.org/stat/platform/display/metis/The+Generic+Statistical+Business+Process+Model

9.   We need to move from:

bespoke design	→	use of an information bank and modular design
built solutions	→	assembled solutions
designing specifically for a collection mode	→	source agnostic design
"designed in" quality	→	managed quality (working with existing data and varying levels of quality)
quantum approach of survey cycles with clear start and end points	→	using a continuous approach of on-going collection, processing and release
direct collection of data, supplemented with data from administrative sources	→	tapping into existing data, using direct collection to link sources and bridge gaps
individually crafted data structures	→	use of agreed standard approaches
management of data	→	management of data, metadata and paradata
a large field workforce	→	smaller field workforce with specialist interviewing skills
spending majority of effort in collection and processing	→	putting more emphasis on specifying needs, design and analyse
understanding user needs and designing collection instruments and methods	→	understanding data characteristics and negotiating solutions that bridge gaps between available data and user requirements

III.   Meeting the challenge - the ABS 2017 transformation program

10.   Responding to the challenge presented by the information revolution and the big data wave has triggered a significant transformation program within the ABS. A key aspect of our approach has been to think about how we could transform more rapidly and effectively with the involvement of other national and international statistical institutions, which face a similar future. Work began in early 2010 with a focus on the information management principles and standards that would be required to drive transformation. A description of the early thinking about this is provided in the paper "The case for an international statistical innovation program – transforming national and international statistical systems" [2].

11.   ABS and 5 other National Statistics Institutions (NSIs) - Statistics Canada, Statistics Norway, Statistics Sweden, Office of National Statistics United Kingdom and Statistics New Zealand - formed the Statistics Network [3] in 2010. In June 2010 an informal CSTAT group of Chief Statisticians / Director Generals from 6 countries agreed to sponsor the collaborative development of a number of Statistical Network projects. These projects were identified as important opportunities to promote collaboration to achieve mutual benefits across all participating NSIs. Collaboration with each other was seen as a practical opportunity to increase the pool of expertise, and where possible reduce the cost of re-development via genuinely co-designed and co-developed projects. This shared approach to design and development facilitates and relies upon the adoption of shared information management standards, common IT architectural approaches, and convergence of methods and business processes used by each NSI. A number of additional members have recently joined the network. Some of the key achievements of the network has been leadership in collaboration on the development of the Generic Statistical Information Model (GSIM) [4], and active collaboration on transformation related to web collection and innovation in dissemination.

12.   In 2010 the Bureau of the Conference of European Statisticians created the High-Level Group for Strategic Developments in Business Architecture in Statistics, comprising heads of several national and international statistical organizations, to reflect on and guide strategic developments in the ways in which official statistics are produced. The High-Level Group developed a vision paper[5] to provide the necessary coordination and strategic direction to the many international initiatives currently working on related topics, including the Statistical Network. In 2011, The High Level Group commissioned a workshop of the many groups interested in various aspects of business architecture for statistics. [6]

13.   Within the ABS, we recognised that the need to change was becoming urgent. Our existing model was not sustainable given a diminishing budget for on-going work, increased costs, increasing difficulty in maintaining response rates and increasing demand for statistical information. The ABS 2017 program was formed in November 2011 to rapidly progress a number of key changes in the way we collect, manage and deliver information and statistics

14.   ABS 2017 was formed with three key goals:

- Reduce the cost and time of doing business
- Grow the business through new statistical products and services, and
- Deliver the first digital Census (2016) [7] on time, budget, and quality

    while delivering on Business As Usual.

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2 http://www.unescap.org/stat/MSIS/egm-Jun2011/session-opening-ABS.pdf
3 http://www1.unece.org/stat/platform/display/msis/Statistical+Network
4 http://www1.unece.org/stat/platform/display/metis/GSIM+Version+0.4
5 http://www1.unece.org/stat/platform/display/hlgbas/Strategic+Vision
6 http://www1.unece.org/stat/platform/display/hlgbas/Workshop+on+Strategic+Developments+in+Business+Architecture+in+Statistics
7 Previous Censuses have successfully provided ecollection – the 2016 Census will use ecollection as the primary collection approach and will use an address register

15.   Three related key messages for the program are "Strategic Growth", "Large Step Change" and "Survive and Thrive". To do these, we need to:

- Reduce cost, such as by reducing the time it takes to move through each statistical process.
- Become more relevant by reducing the time it takes to do business.
- Reduce overall effort and change distribution of effort
- Build capability, and
- Increase products and services.

16.   If we achieve these goals we will achieve a more efficient and effective ABS, better decision making support for governments and the community, improved user and provider experience and a sustainable and growing organisation.

17.   The formation of the new Group provides a strong impetus for change and better positions ABS to integrate a wide range of cross cutting change/improvement projects for the future. Some important strategies we are using are to

- critically evaluate deliverability and the rigour of the business case associated with each project in the program;
- consolidate and better integrate projects where appropriate;
- put in place stronger program management disciplines, and
- improve and clarify governance and accountability.

18.   A business model has been developed (shown in the following diagram).
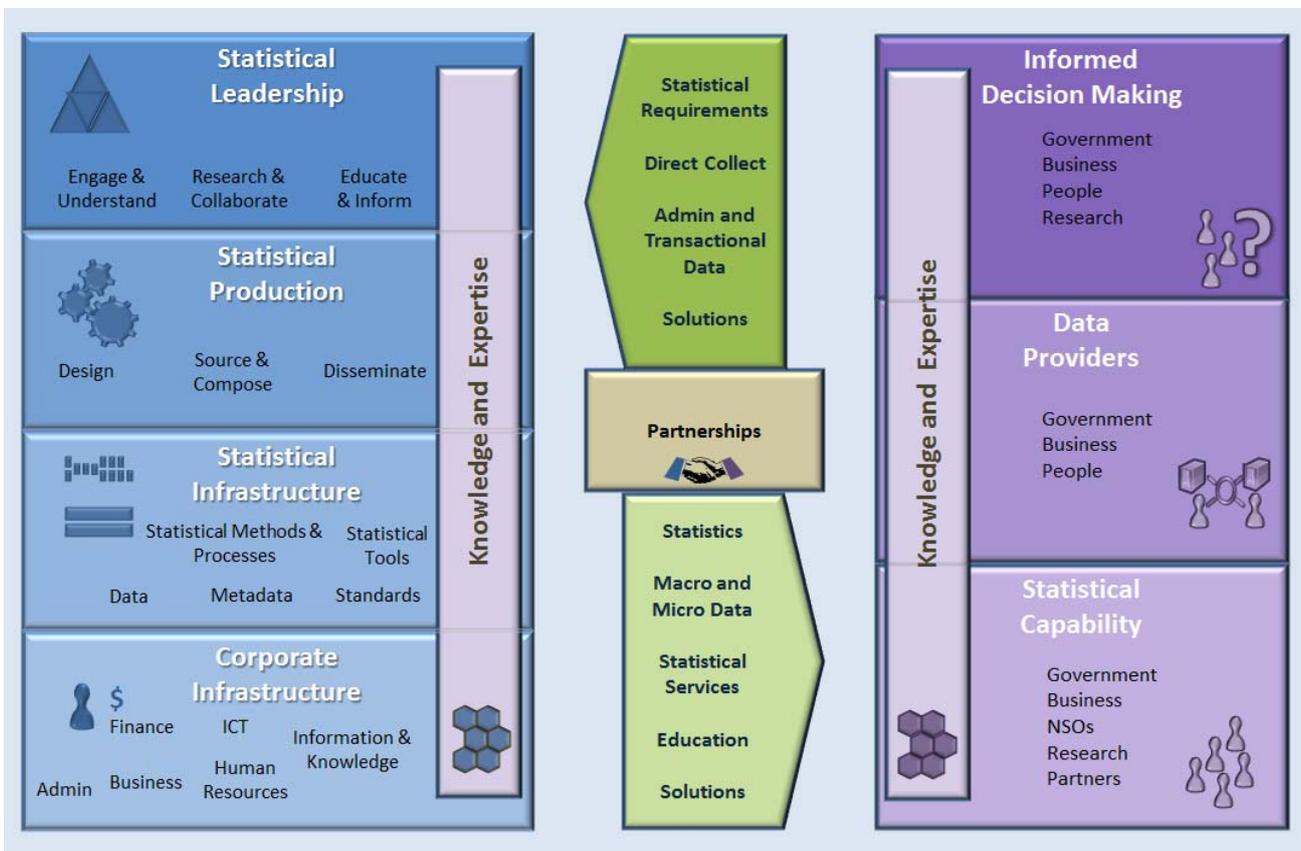
19.   We will establish metadata-driven systems and processes that achieve the aims of industrialised statistical production and effective re-use of statistical modules and components. Key foundations for the new environment include:

(a)   The Generic Statistical Business Process Model (GSBPM) – The internationally agreed model that provides a common terminology and framework for statistical production processes. The model facilitates international collaboration in the transformation of statistical production.

(b)   A Statistical Workflow Management system (SWM) which reflects the GSBPM. This system will schedule and run standardised statistical processes informed by the metadata inputs that shape and tailor the processes to the requirements.

(c)   The Generic Statistical Information Model (GSIM). A companion to GSBPM that provides a common terminology and framework for statistical information objects (statistical metadata). ABS has played a leading role in accelerating the international collaboration to develop the GSIM.

(d)   A Metadata Registry and Repository (MRR) which implements the GSIM so that components of systems can be shared internationally. Metadata will be the fuel that powers the statistical production engine. The DDI and SDMX metadata standards will be adopted.

(e)   An Enterprise Data Warehouse (EDW). A centralised repository for the data and paradata (for example. process metrics) used to produce statistical output and manage statistical production. This is needed to support the high volumes we wish to acquire and manage in the future.

20.   As well as establishing key infrastructure, we have commenced a number of transformation programs which reflect the GSBPM.

(a)   Acquire@ABS. This covers the transformation of the 'collect' stage of the GSBPM but also incorporates major portions of the other early stages of the GSBPM from "Specify needs' through to "Process" stages. This includes using existing data, acquire existing data from others and running new collections, with reduced emphasis on direct data collection through surveys

(b)   Process@ABS. This covers the transformation of the processing stage – the work that starts with the raw data provided by surveys or by administrative or other data sources and ends with the production of statistical aggregates and other raw outputs.

(c)   Disseminate@ABS. This covers the 'disseminate' stage of the GSBPM as well as portions of 'analyse'. These stages are where the raw outputs are turned into final outputs and products that meet the requirements of the users of statistical data.

21.   A critical part of ABS 2017 is the need to deliver the 2016 Population Census. The five-yearly Census of Population and Housing is the largest undertaking conducted by the ABS – it is in fact the largest peacetime operation in Australia. Successful delivery of the Census is of paramount importance. The 2016 Census will be Australia's first fully digital census and will require the development and use of ABS 2017 infrastructure.

22.   Because of the need to find significant efficiencies, we decided to focus on the areas of the GSBPM that have strong potential to deliver savings, utilise international collaboration and capability in the wider environment, and make quick progress. We need to free up human resources that can be redeployed to other stages of the GSBPM – working with users to specify needs, design of solutions that meet the requirements, interpretation of the outputs, and evaluation and improvement activity.

Indicative Current and Future Effort Distribution
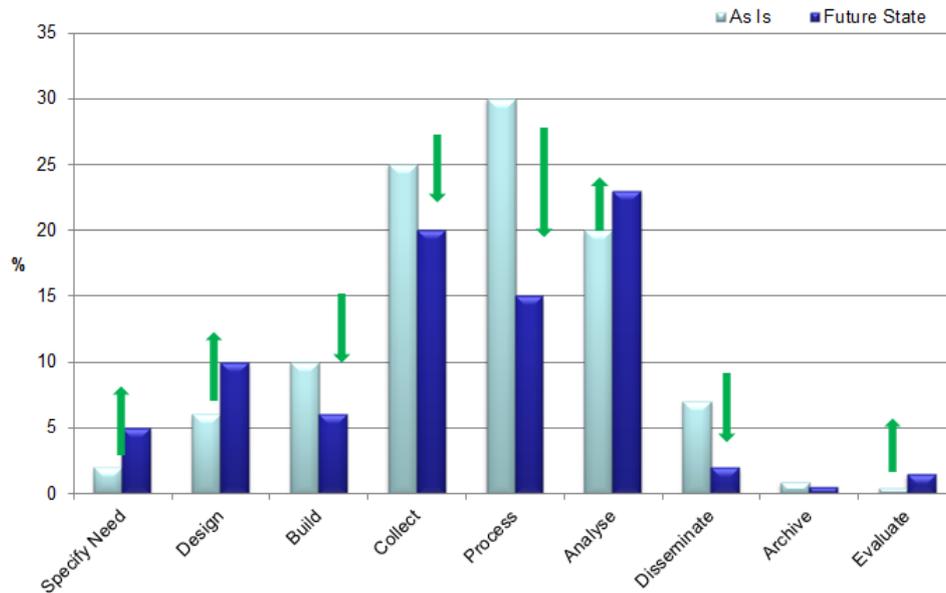
23.   The ABS has shifted from investing its capital budget in a large number of small projects across the organisation to investing in a small number of strategic enterprise-wide solutions. The ABS has identified the highest priority projects (based on the greatest savings or benefits to the organisation and our customers) and is allocating funding to those first. The projects have been challenged to work out how to achieve specific savings targets within two years. The savings need to be based on business cases that cover all costs of change and the on-going operational costs. For example, a project team has been established within the Acquire@ABS Program to work with subject matter and service areas to develop a plan for realising targeted savings from the program within a fixed period of two years. This team will assist us to accelerate progress.

24.   As a second strategy to accelerate progress, ABS commenced a process to explore the feasibility of procurement of capability (rather than building in-house) by seeking information on software and hardware capabilities of industry. Two separate requests for expressions of interest were developed - one for the provision of an Enterprise Data Warehouse, and one for key elements of the Acquire@ABS Program:

- The Enterprise Data Warehouse capability is to provide the underlying storage and retrieval services for the ABS statistical process. It will make use of big data and traditional data warehouse technology and be exposed to statistical workflow processes via a data virtualisation layer.
- The Acquire@ABS exercise included key elements of the Acquire@ABS Program, including: eForms - the ability to design a questionnaire once and publish to many channels; facilities for receiving, transforming and uploading non-ABS electronic data; mobile devices and a supporting development platform; workforce and workload systems; and an ABS client and provider communication portal. Industry was presented with information about the challenges facing the ABS and were asked to respond with ideas and capabilities that would address these challenges.

25.   These two requests for information are the first stage of a two stage planned procurement process. Response to both requests was very positive, and after completing the evaluation phase, the ABS expects to progress to a tender process on one or more of the capabilities in the coming months.

26.   A third strategy for acceleration is to collaborate with other National Statistics institutions. Web collection is one of the Statistical Network projects and is being led by Australia. To date, the most active

collaboration on the Web Collection project has been between ABS and Statistics New Zealand, around not just web collection but other aspect of data acquisition. The related ABS program is Acquire@ABS and the related Statistics New Zealand Program is "Transforming Collections". Statistics New Zealand has a member on the ABS2017 board and ABS has a member on the Statistics New Zealand Transforming Collections and IT Advisory Boards. Statistics New Zealand business and technical staff have participated in and contributed to the Expression of Interest processes and we are working to align and share requirements, capability, architecture, processes and potentially projects and technologies. It may be possible for ABS and Statistics New Zealand to each develop some of the capability needed for both organisations.

IV.   Building support for the transformation

27.   The ABS cannot achieve this transformation alone. To succeed, the ABS needs support from key stakeholder groups: government and partners, staff, survey participants and the broader community.

28.   Government is the investor in the change process. Government will supply the financial resources that underwrite the transformation, and will need to be convinced that the money invested in transformation of statistical systems provides a greater benefit than if the money were invested elsewhere. The transformation program is strongly aligned to Australian Government policy that encourages agencies to invest in electronic data collection methods, and to simplify community dealings with, and access to, government agencies. The transformation will also align with and aim to extend existing whole of government initiatives, such as standard authentication keys for businesses and households, and XBRL-based business reporting systems. The emphasis on effective management of metadata as a means of facilitating re-use and realising productivity gains will also be extensible to other government operations. If government supports the ABS transformation program then it signals to industry that more effective management of operational metadata is an area where the government is willing to invest, and so encourages industry to develop solutions within this space.

29.   We believe that building international consensus on transformation is an important element that will help convince our governments and industry that it is worthwhile investing in our future directions. Further, by building an international coalition of support, individual agencies can invest in different elements of the transformation for the common and faster benefit of all members of the coalition.

30.   A major organisational change will not be successful without the support of staff within the organisation. For a statistical organisation this includes field collection staff as well as office-based staff. The ABS has put a strong emphasis on staff engagement with the transformation process, with highly visible support from the senior executive in the organisation. The ABS has established a centralised program management office that put a strong emphasis on change management and communication planning to engage staff and build support internally for the transformation. Workshops have been held across the ABS to get staff views on what is not working well with current systems and processes, and views on how systems and processes should change to better meet the challenges of the future. The results of this staff consultation are directly feeding into the design of the future state systems and processes.

31.   Finally, survey participants and the broader community must support the transformation for it to be successful. In consultations so far, the ABS has found very strong support within the community for the changes we are proposing. There is a high level of unmet demand for access to improved electronic reporting methods. As with other statistical agencies, the ABS puts a very high premium on the needs and the convenience of our survey participants and the ABS invests significant effort into ensuring survey participants and other providers are satisfied with our data collection instruments and methods. The transformation continues to put the survey participants at the centre of our efforts to improve ABS processes and methods.

V.   Building organisational capability

32.   The transformation that the ABS has begun is a very significant change for the organisation. Capacity and capability to effect the transformation has to be acquired and built across the whole organisation. Ensuring the necessary organisational capacity has required a number of changes to the way ABS organises and manages itself internally.

33.   One key change has been the process used within the ABS to manage ABS investment in technology, applications and systems. Under the old model, the different business groups within ABS were provided with an allocation for technology applications development and support that was managed within each business group. This meant, for example, that applications and systems for business statistics were resourced and managed separately from applications and systems for household statistics. While a centralised technology services area ensured that overall technology standards and directions were applied, there was no centralised decision making on where the money was spent and the investments were made. The ABS has now established a Strategic Finance and Investment Committee to apply this central decision making. The Strategic Finance and Investment Committee is able to look at the full allocation of technology resourcing across the organisation and allocate the high levels of resourcing that are required to undertake a major transformation program. This has resulted in much greater allocation to centralised transformation projects than would have been possible under the old model where a single business group would have been required to find the necessary resources from within its own group allocation.

34.   Secondly, the ABS has internally restructured to align the business areas that are designing and undertaking the most significant changes as a result of the transformation. A new ABS 2017 group has been established within ABS, which consists of three major business areas. The Program Design and Infrastructure Division will drive the development of the foundation infrastructure – the Metadata Registry and Repository (MRR), Statistical Workflow Management (SWM), Enterprise Data Warehouse (EDW), and adoption of an Enterpirse Architecture which aligns with the GSBPM and GSIM. The Program Delivery Division groups together the Census 2016, Acquire@ABS, Process@ABS and Disseminate@ABS programs that will use the central infrastructure to transform processes across each stage of the GSBPM. The ABS 2017 group also includes the ABS Program Management Office that will be a centre of excellence within the ABS for program management, and will provide expert services in project management, business analysis, change management, communications management, and resource management.

35.   Development of the organisational capability required under the future state environment is another important aspect of the overall transformation. The ABS is still at the early stages of this process, with the main activity currently underway being the development of the enterprise architecture for the future state environment. The architectural work will identify the range of organisational capabilities that are required in the future state, and provide a basis for producing an organisational capability development plan. While the details still need to be developed, it is clear that in the future state the ABS will need increased capability in the Specify Needs, Design, Analyse and Evaluate stages of the Generic Statistical Business Process Model, offset by reduced capability in the Build, Collect, Process and Disseminate stages. In the future state there will be greater emphasis on assembly rather than build – solutions to statistical needs will be met by assembling a solution from existing modules and well-defined processes, rather than building new solutions.

VI.   Conclusion

36.   The challenges of the new environment and the opportunity to innovate and significantly improve the business of the organisation has excited and energised staff across the ABS. The organisation is actively shaping its future and positioning itself to continue to thrive and meet the needs of Australian governments and the wider community for timely, relevant and responsive information that will guide Australia into the future.