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Topic (iii): Innovation

Applying Information Infrastructure to Business Transformation

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I. Introduction

1. In 2012 the Australian Bureau of Statistics (ABS) initiated the ABS 2017 transformation program that will change the way ABS collects, collates, manages, uses, reuses and disseminates statistical information. ABS 2017 carries forward and expands upon the key elements of the Information Management Transformation Program (IMTP), in particular the investment in statistical information infrastructure and building of capability to re-engineer business processes.

2. At the heart of the transformation is the re-engineering of business processes and the application of standards based statistical information to bring about a leap in re-use and automation of statistical processes. To achieve this step change in automation and re-use it is essential to manage and standardise both metadata and processes. The Metadata Registry and Repository (MRR) and Statistical Workflow Management System (SWM) provide the technical foundations for such an approach.

3. This paper will discuss the history, progress and future plans for the development and application of the MRR and SWM. It will explore the conceptual thinking and design of the MRR and SWM, as well as how the MRR handles standards such as DDI and SMX. It will also describe proof of concept and prototype work demonstrating the practical application of these key information infrastructure elements and the standards they implement. Lastly the paper will look at future plans and how MRR and SWM contribute to the ABS 2017 vision.

II. Genesis of the Metadata Repository and Registry, and Statistical Workflow Management system

A. MRR and SWM Underpinning Information Transformation

4. The challenges facing national and international statistical systems are well documented [1, 2, 4, 5, 6, 7]. The Australian Bureau of Statistics (ABS) responded to these challenges with the establishment of the Information Management Transformation Program (IMTP) in 2010 [2] which has subsequently been carried forward into the ABS 2017 Transformation Program [3].

5. Two of the key goals for ABS 2017 transformation are:

- reduce the time and cost of business operations
- grow the business through new statistical products and services,

It is through the re-use, automation and, ultimately, assembly of business processes that the ABS 2017 program will look to deliver these benefits.

6. In 2010 the IMTP identified that managing information in a consistent, coherent manner is critical for maximising reuse and automation of business processes. Amongst a range of other requirements, the need for a standards based store that enabled discovery and re-use of metadata was identified. Following on from this the concepts and design for the fundamental components of the MRR were established.

7. It was also identified that increasing the transparency, automation and re-use of business processes at the application level is critical to enable re-use of processes at the business level. Thus the need for some kind of Business Process Management System (BPMS) was also established. The concept for the Statistical Workflow Management (SWM) system grew from this to include elements such as governance, roles and responsibilities, and process modelling in addition to the BPMS software component.

8. To maximise the potential for automation of business processes, it was recognised that processes need to be highly configurable and driven by metadata, and thus the strong linkage between MRR and SWM.

9. Work on a proof-of-concept to demonstrate the practical implementation and potential benefits of MRR and SWM was commenced in late 2010 and delivered in June 2011. From July 2011 to June 2012 further work was undertaken to produce more robust MRR and SWM components and to test them against selected "pathfinder" systems to demonstrate their practical application for real business functions, using real business applications, while still demonstrating potential benefits.

10. It should be noted that re-use of process, tools and statistical information, as well as automation of processes already occurs within ABS, but that a key goal of ABS 2017 is to achieve a step-change in that re-use to a level that will ultimately enable the assembly of end-to-end processes for new collections, deliver a step change in automation across end-to-end processes and a significant reduction in labour intensive manual tasks that often result from the incompatibility between systems and processes.

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[1] Brian Pink, Jenine Borowik & Geoff Lee, *The case for an international statistical innovation program –Transforming national and international statistics systems*, Statistical Journal of the IAOS: Journal of the International Association for Official Statistics, IOS Press, http://iospress.metapress.com/content/2h5764574t6318r4/
[2] http://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/ge.50/2011/wp.10.e.pdf
[3] http://www.unece.org/fileadmin/DAM/stats/documents/ece/ces/ge.50/2012/15_Australia.pdf
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B. MRR, SWM and Transformation

11. Simply building the MRR and SWM will not achieve the goals of ABS 2017; business re-engineering, cultural change, sound enterprise architecture, effective information, process and application governance, information standards, integration of new or existing applications with MRR and SWM, metadata migration, moving to a more service oriented business, and a number of other elements must come together to ensure ABS 2017 meets its goals. Hence the MRR and SWM are part of a much broader program of transformation.

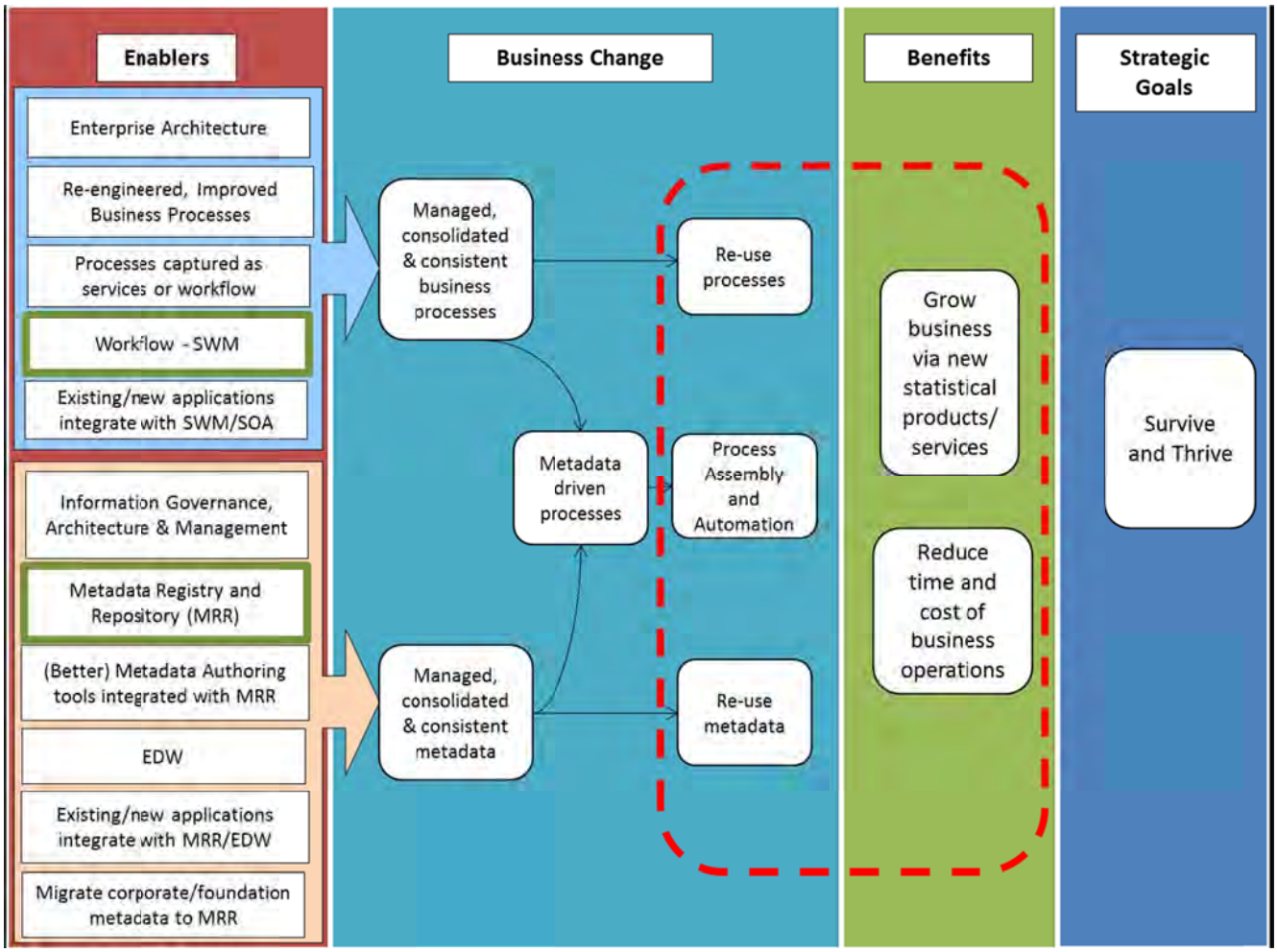

Figure 1. MRR and SWM in the context of ABS 2017 projects and benefits

12. Changing business practice requires a multidisciplinary approach to process re-engineering that encompasses the enterprise architecture because business processes are embedded in and rely upon the information, application and, in some cases, infrastructure elements of the organisation's architecture. Any significant change in a business process is likely to have ramifications for at least the information and application components of an agency's operations, and vice versa. Simply integrating applications with MRR and SWM may produce some very localised business benefits and will almost certainly change the local business process. However, in order get the most out of business re-engineering statistical, information and technical staff need to work together and iterate through the potential opportunities provided by standardised processes and statistical information.

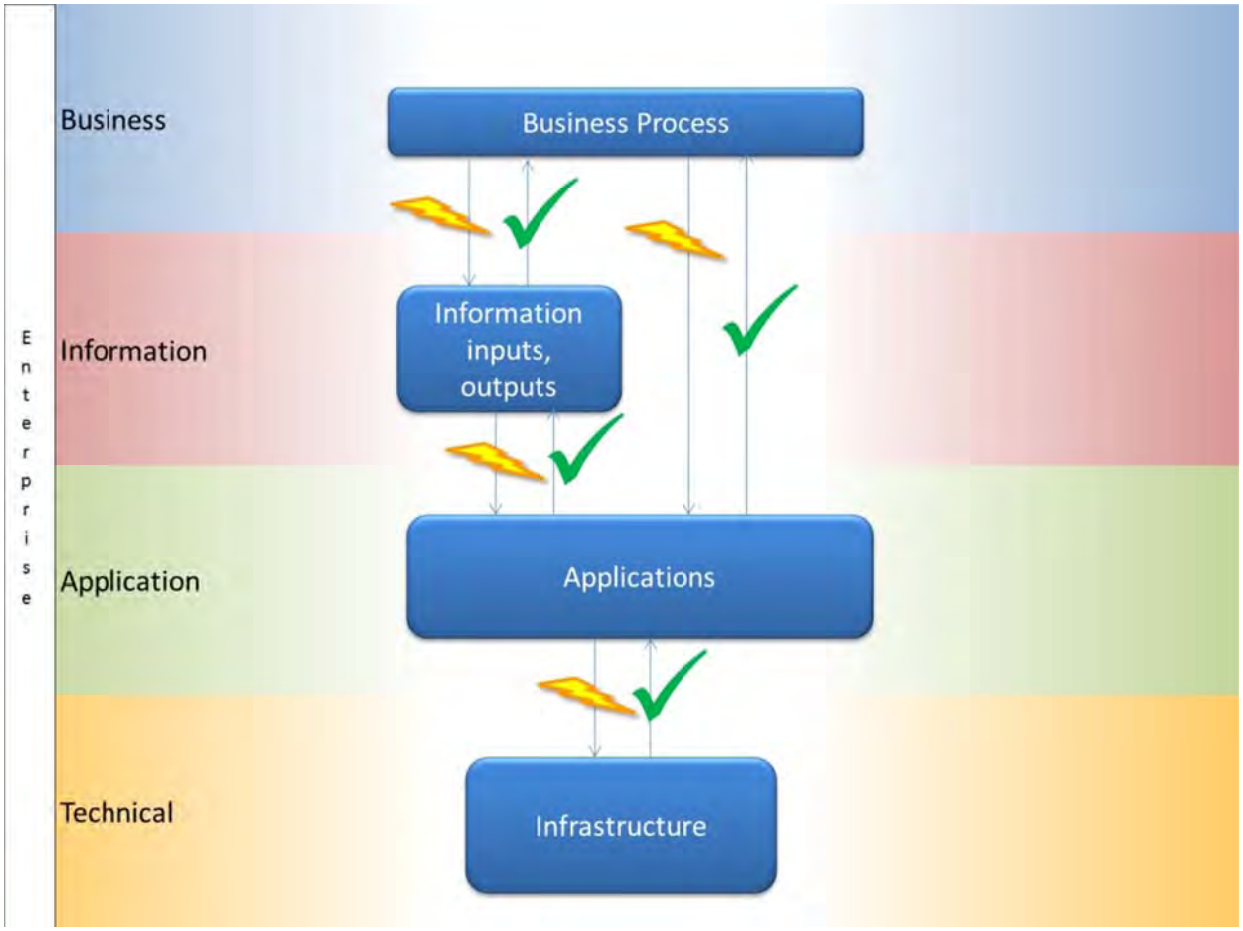

Figure 2. Architecture dependencies.
Changes in any layer of architecture have the potential to improve or break other elements.

III. MRR and SWM in Detail

B. The Metadata Registry and Repository: Concepts, Design and Functionality

13. The Metadata Registry and Repository is designed to be the centralised, standards based, authoritative store of statistical metadata for the ABS. It consists of:

1. the Repository – the centralised store for standards based statistical metadata, and
2. the Registry – the catalogue that tells a user what's in the repository.

14. The MRR has three main functions:

- register metadata,
- search for metadata, and
- retrieve metadata

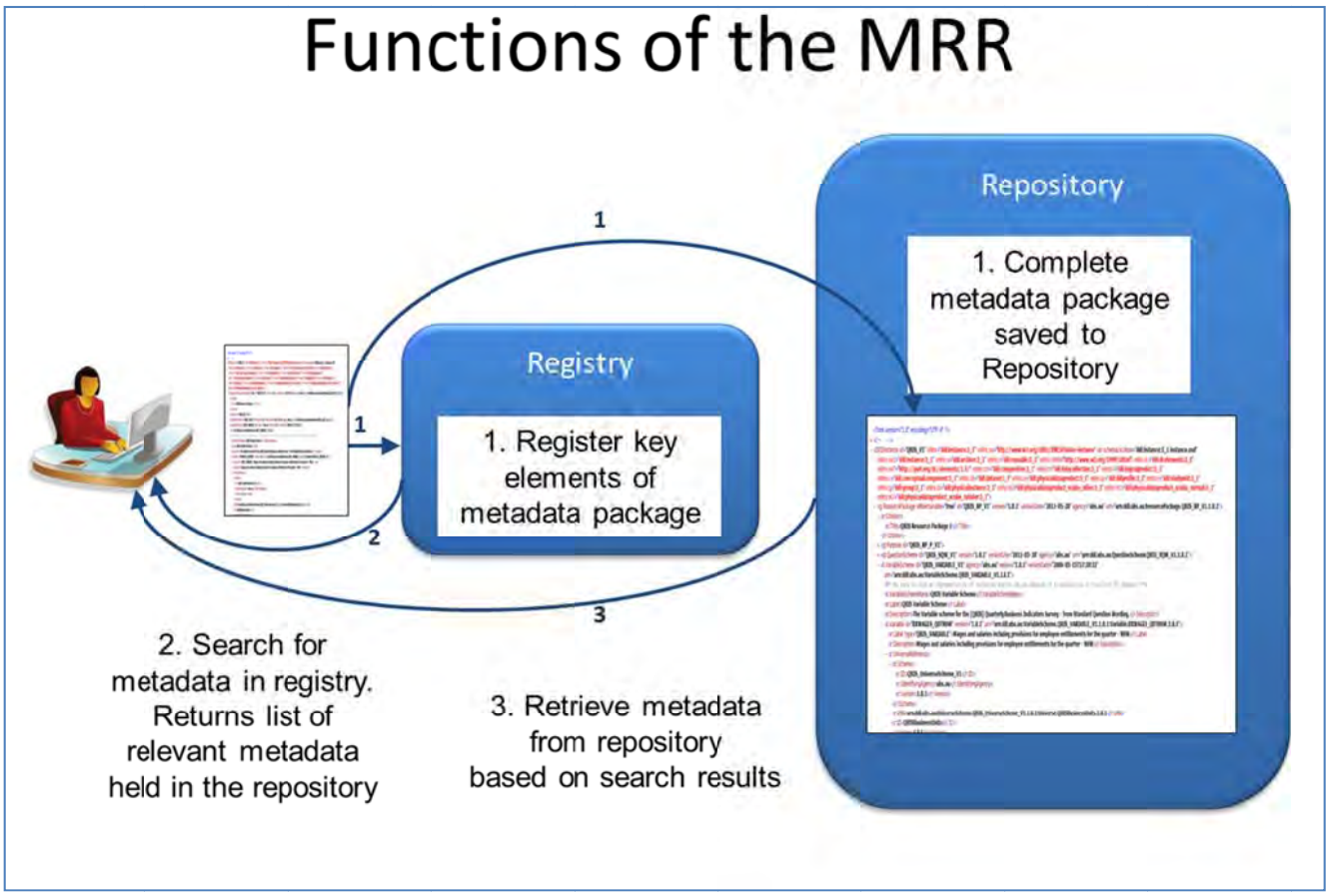

Figure 3. Functions of the MRR

15. The split of the MRR into two components facilitates its three main functions. Upon registering a piece of metadata to the MRR, selected elements of the metadata package are recorded in the registry, while the metadata package is saved in its entirety in the repository. The registered elements provide an index for the complete metadata package and are the elements most likely to be used in searching. Only metadata conforming to approved standards will be able to be registered (in the first instance specific versions of DDI and SDMX).

16. Analogous to the functionality the registry provides is an application such as Amazon's advanced search. The advanced search allows user to search for books by keywords, author, title, ISBN and various other attributes. But a user can not search by customer reviews, ratings, chapter titles, whether it is available for pre-order, the full text of the book etc. So only certain metadata about books are searchable because it only makes sense to search on those attributes. Equally, in the case of statistical metadata, it may make sense to search for the text in a particular survey question, but it is unlikely to make sense to search on a question's sequence in a survey instrument.

17. At the heart of the registry is the canonical model that defines what elements of metadata can be registered. It is currently called the ABS Transitional Metadata Model (ATMM). The model is heavily influenced by GSIM and it is transitional specifically because it is anticipated that in due course it will effectively become a subset of GSIM. The ATMM is essentially the list of metadata objects that make sense to make available via search. The full extent of what metadata objects will need to be defined in the ATMM is unknown, and so the MRR is designed for scalability in terms of adding new objects to the ATMM model.

18. From the point of view of sustainability it will be desirable to keep the size of the ATMM to some minimum. Each object in the ATMM needs to be mapped to its equivalent in the standards that the MRR will accept (for example x in SDMX is mapped to y in ATMM). For that reason it will also be desirable to keep the number of standards the MRR will accept to a minimum.

B. The Statistical Workflow Management System (SWM)

19. The SWM provides the basis for building, automating, and re-using processes from high level workflow through to low level technical process. Essentially it has been conceived as the best way to capture, coordinate and effectively centralise business processes (where it makes sense to do so). It also provides the engine for metadata driven processes.

20. Without strong governance there is a high likelihood of duplicating processes and/or building inappropriate components using SWM, thus achieving little re-use or automation. As such the concept of SWM goes beyond the use of BPMS software to encompass governance, including role and responsibilities around building and implementing new processes.

21. In this sense the concepts behind SWM very much overlap and align with SOA. As part of it's transformation the ABS looking to move towards a SOA, and in both the case of SWM processes and atomic services the agency is developing the governance and work practices to ensure that components are built using SWM or services only where it makes sense to do so.

22. At a technical level SWM is based on the ActiveVos software. ActiveVos
- is web services based
- provides standards process fragments
  - e.g. email, approval processes
- provides subscription/notification services
- provides a process catalogue
- provides process design tools and repository
- uses standards based modelling (BPMN 2)

23. It is envisaged that capturing processes in SWM will require three layers of modelling:
- A high level business process model – built by business analysts/and process re-engineers with statistical staff (as part of the multidisciplinary approach discussed earlier)
- A detailed business process model – built by business analysts, using modelling tools
- The executable business process in ActiveVos – requires technical knowledge

24. As noted SWM will be used for both high and low level processes. Work practices involving some minimal level of scrutiny will be developed for dealing with low level processes.

25. In the longer term it is envisaged that SWM will provide the basis, if not the actual interface, for assembling high level processes for new collections. The execution of the new end-to-end collection process will require a significant amount of configuration of both statistical metadata (collection names, concepts, etc) and process metadata or paradata (location of input and output data, methods). This represents a significant change from current business practices and requires a high degree of maturity in operating SWM and SOA.

IV. Achievements

26. A technical proof of concept for the MRR and SWM was delivered in June 2010. The purpose of the proof of concept was to prove the technical feasibility of a number of elements of the planned information infrastructure (including use of DDI and SDMX), inform further development towards production implementation, build capability in relevant standards and technical skills, and demonstrate the potential benefits of applying the key concepts to the statistical business.

27. The use of standards, MRR and SWM was demonstrated using different business scenarios:

- Survey instrument generation
  - Form creation
  - Changes to standard question wording
  - Rolling forward a survey instrument
- Discovery of metadata by end users
- Frames creation process

28. The proof of concept successfully demonstrated the technical feasibility and potential benefits of employing MRR and associated standards, and SWM to aspects of business processes. It also reinforced the crucial role metadata plays in driving process.

29. Based on the success of the proof of concept further work was approved to produce a more robust MRR, and further test the use of standards, MRR and SWM against existing applications. Four “pathfinder” projects were chosen:

- E-form generation
- Integration with REEM (Remote Execution Environment for Microdata)
- Editing (micro and macro), and
- Dot.stat

30. In July 2012 two of the pathfinder projects (REEM and e-forms) successfully demonstrated technical integration, use of standards, and the potential benefits for business users. Specifically they demonstrated:

- Integration with the three key services of MRR (register, find and retrieve metadata) and re-use of these services by different tools
- DDI held in MRR being used to
  - Automatically generate an e-form
  - Allow a third party tool to access data directly from a data warehouse and generate tables for analysis
- Use of SWM to
  - Automate workflow for e-form approval
  - Automate handling of a-synchronous events for long processes

The other pathfinders did not achieve the anticipated results for a number of reasons to do with scope, priority, resource availability and lack of technical skills, rather than any technical issues.

31. Other lessons from the pathfinder integration include

- SWM is good for doing things quickly we would otherwise have to code
- SWM is good for "joining up" systems
- As far as we have used it, SWM provides a sound basis for re-usable processes
- SWM exposes and documents business process in a more transparent way (than code embedded in applications)
- DDI is not perfect and we will need to develop profiles, extend it and/or use other standards where appropriate (and sustainable)
- Skills and understanding around standards are essential, and currently rare
- A multidisciplinary approach is most successful – joint teams with members who understand business processes and business requirements, information needs and standards, as well as technologies have more chance of successful and useful integration

32. Ultimately, the pathfinder integration projects demonstrated that the fundamental concepts and technologies behind MRR and SWM are sound.

V. What's Next?

33. There are three key priorities for 2013:

- Delivering MRR and SWM into production by December 2013
- Working with early adopting projects to raise and deal with issues prior to production release of MRR and SWM by December 2013
- Begin integration with, and migration of metadata from, existing metadata sources

34. Along with an Enterprise Data Warehouse, MRR and SWM will provide the information infrastructure backbone for ABS's applications architecture. However, for metadata to flow from end to end through various applications, the "left-hand-side-of-GSBPM" applications and corporate metadata tools need to be using and populating the MRR: if there is no metadata in the MRR by the time a collection cycle reaches, for example the process and analysis phases, metadata will need to be cobbled together from various existing sources (much like existing business practice) and there will be no opportunity for metadata to automatically drive the next step in the process. Hence the focus for the next 6-12 months will be integrating critical metadata tools and sources with the MRR. In the first instance this will mean the wrapping of existing tools with functions to populate the MRR and then moving into redevelopment of those systems in the next 1-2 years.

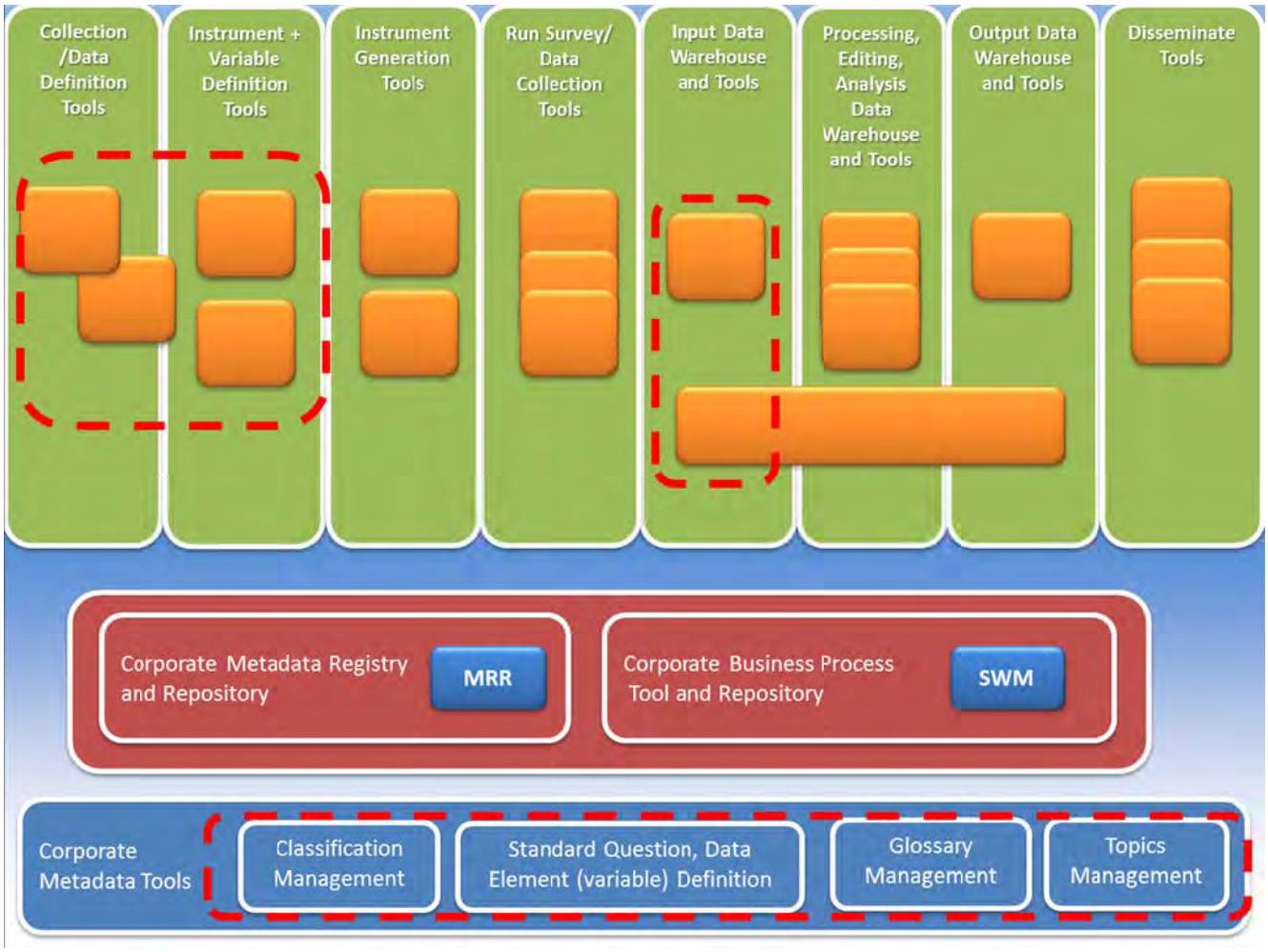

Figure 4. Priority applications for integration/linking to MRR

35. As they integrate with MRR and SWM early adopter projects working with specific subject matter collections will identify any issues/gaps with the information infrastructure, as well as opportunities for business change. It is likely in the early stages of adoption that SWM will be more easily integrated to existing tools and systems than MRR due to the fact that MRR needs metadata in it before it can be usefully used to automate process.

36. After establishing integration with critical foundation tools and systems, the agency will look to integrate with key systems and redevelop processes where there are obvious opportunities for efficiency. This will include looking at key systems within our Acquire@ABS and Census 2016 projects.

VI. The vision for the future

37. The ultimate vision for ABS is to be able to respond to client requests for new products in a very timely manner by assembling large chunks of the end to end process from a business process catalogue. Much of the end-to-end process will be automated. This will still demand a thorough needs analysis and design phase, but rather than building new tools and processes, business areas will assemble existing components to support the end-to-end process. Much less time will be spent massaging data and metadata in order to move it through the end-to-end process as systems and tools will consistently use standardised metadata.

38. To enable automation a significant amount of metadata (both statistical metadata and process metadata, or paradata) will be configured during the set up phases for collections. In itself this represents a major change to existing business practice. Running new cycles of existing collections will be driven largely by changes in the configuration of metadata.

39. As the ABS moves towards this vision is expected that benefits will begin to accrue from localised re-use of both process and metadata. It is probable that this will occur at lower technical levels in the initial stages of the transformation and gradually grow into re-use that is more business focused and tangible to business clients as the agency changes the way it does business. Benefits must be delivered on a regular and ongoing basis if the transformation program is to retain momentum and ultimately deliver on the future vision.

VI. Summary

40. The MRR and SWM are critical foundation elements for changing the way ABS will manage its metadata and processes. In conjunction with a number of other elements the two systems provide a strong base for metadata and process re-use, metadata driven and automatable processes and, ultimately, enable the goals of the ABS 2017 transformation program. Key concepts and technologies behind these systems have been, and continue to be, tested against real systems in the ABS. ABS will continue the program of integration with these systems with tools and applications as funding and resource constraints allow, and incremental benefits will be delivered along the way to the end goals of process assembly and a step change in automation.