

AMCV Project

Asset Management Customer Value

Industry Report



WATER SERVICES
ASSOCIATION OF AUSTRALIA

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Project Summary

Overview of AMCV 2016

Every four years since 2004, the Water Services Association Australia (WSAA) has run an international asset management process benchmarking project, with the aim of improving the standard of asset management performance within the international water sector through the identification and promotion of leading practice.

The project's vision is to create *'an international utility knowledge base that drives world class asset management to deliver enhanced customer value'*.

In 2016, the WSAA Asset Management Customer Value (AMCV) benchmarking process reflected recent global trends in asset management. The assessment and scoring process was aligned with the principles of ISO55001:2014 that reflect customer-centric and value management approaches to deliver services. A record number of forty-four participants from Australia, New Zealand, United States of America, Canada, United Kingdom and Japan participated. As another first, active participants representing the water services and the electricity utility sectors were included. The AMCV 2016 outcomes provide an international perspective on asset management processes and activities across sectors that encompass organisational leadership, customer focus, and value optimisation as well as more traditional asset management areas.



Figure A: Locations of the 44 AMCV 2016 Participants

Performance of the AMCV 2016 participants

Participants were benchmarked across seven functions of asset management, with overarching outcomes provided in **Figure B**. As in 2012, in 2016 the centralised, head office-based functions of 'asset capability forward planning' and 'asset management applications' (i.e. the use of organisation-wide systems and applications that underpin all asset management practices) were the highest scored attributes. More moderate scores were seen in 'organisational management', 'asset acquisition' and 'asset operation' functions.

The scoring for 'organisational management' reflects the influence of recent international guidance such as ISO55001:2014 and the Institute for Asset Management's most recent subject specific guidelines. These have promoted a greater focus on customers and their expectations, including on expenditure decision making which is informed by considering relative risks and value creation opportunities. Methods to respond to these modern guiding principles are still forming and maturing, albeit with pockets of sophistication.

'Asset maintenance' and 'renewal' functions and their processes and activities (which have closely linked decision requirements) were the lowest relative scored functions, continuing a trend from 2008 and 2012. Relatedly, results from a business driver survey of AMCV participants indicated knowledge and decision systems, aging infrastructure, customer interactions, and sustainable financing as the industry's key drivers. These all have strong implications with regard to balancing cost, risk and performance of existing assets. The process benchmarking supports this. Expenditure cases for future delivery needs have typically received more scrutiny than the tactical, reactive forms of asset expenditure activity, resulting in a stronger presence of accompanying processes and procedures. The delivery of risk-based planning guidance for existing assets is a key industry need.

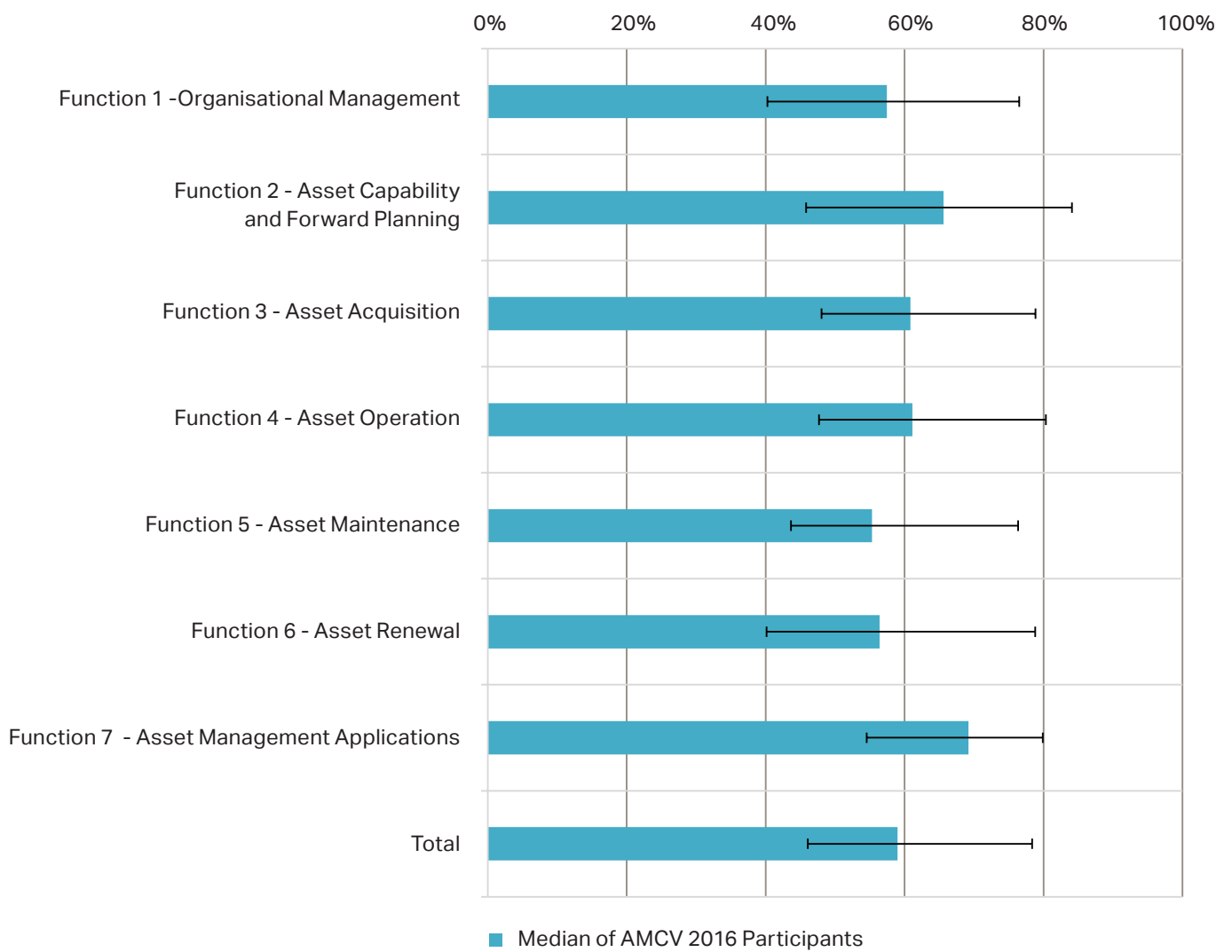


Figure B: Median scores achieved by all AMCV 2016 participants in the seven functions of asset management respectively (the bars depict the 10th and 90th percentile scores).

How the regions compared

The Australian and New Zealand participant group (31 participants) demonstrated consistently higher asset management process maturity than other regional groups as shown in **Figure C**. This likely reflects the longstanding pursuit of asset management by many of the participants from this region, along with a history of participating in the WSAA benchmarking program. For many Australian and New Zealand organisations, there is a prevalence of asset management systems that have clear links with the AMCV assessment framework.

The North American group's (11 participants) relative strengths (compared to other regions) in 'asset acquisition' and 'operations' activities come as a result of the regulations and controls in place in areas such as operational compliance monitoring, standards development, and demand projection.

In Japan there were two participants and therefore these results may not reflect the whole industry. The group's scoring is reflective of one participant that has been involved with asset management planning since 2008 (when it last participated in the WSAA program) and another which is at the very start of its journey to create and execute formal asset management strategies.

(Note that the United Kingdom was excluded from this comparison on account of having only one participant in the program).



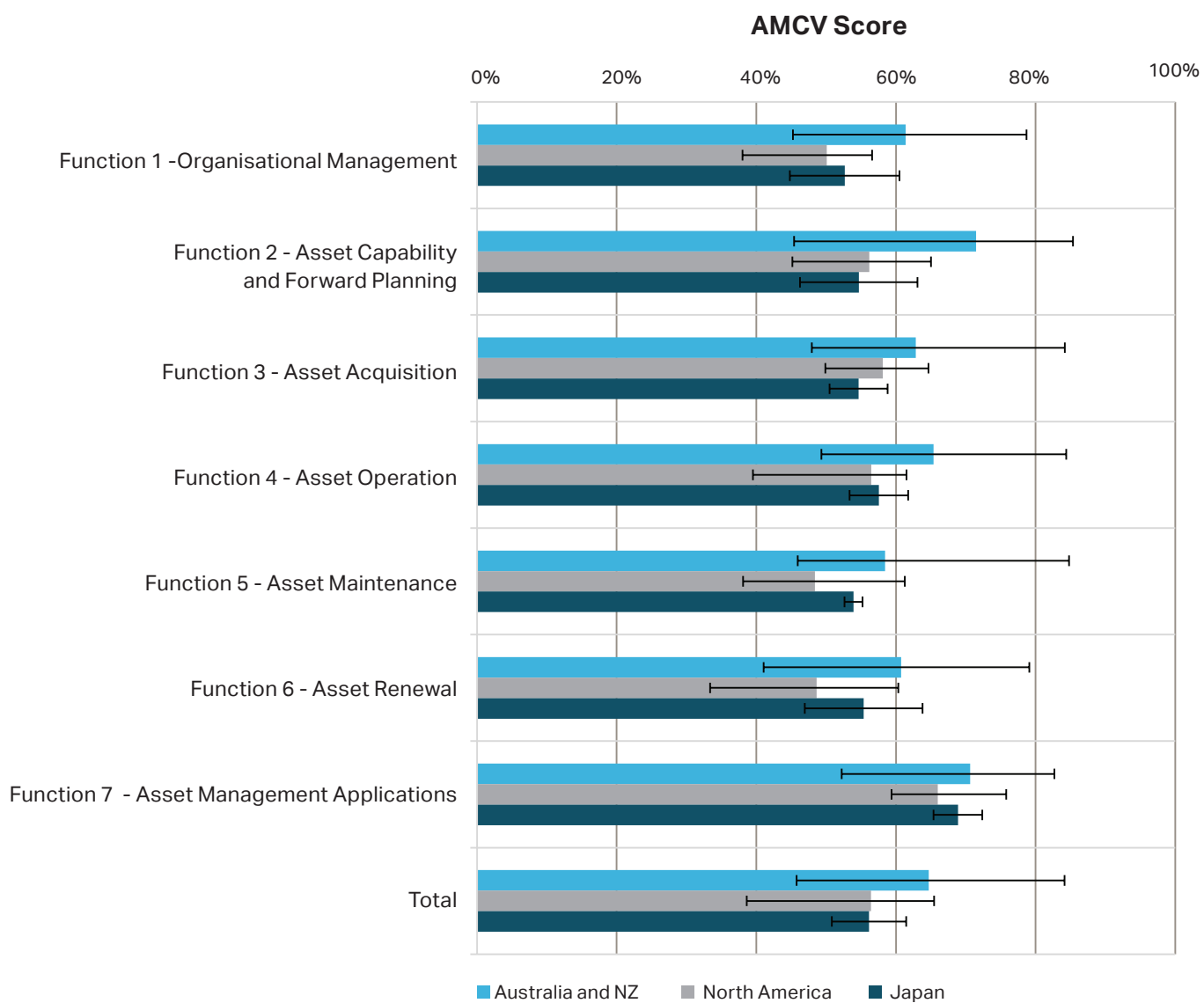


Figure C: Median scores achieved by all AMCV 2016 participants in the seven functions of asset management by respective region (the bars depict the 10th and 90th percentile scores).

Comparison by services provided

A comparison of performance by services provided is given in **Figure D** (for groups with more than three members). The bulk water suppliers, who typically have larger asset planning and delivery phases as compared to urban water suppliers who deliver new growth to communities, scored highest at 'asset capability and forward planning'. The other strong group for this function were the 'three waters' service providers who have the scope and demonstrated ability to deliver integrated water solutions.



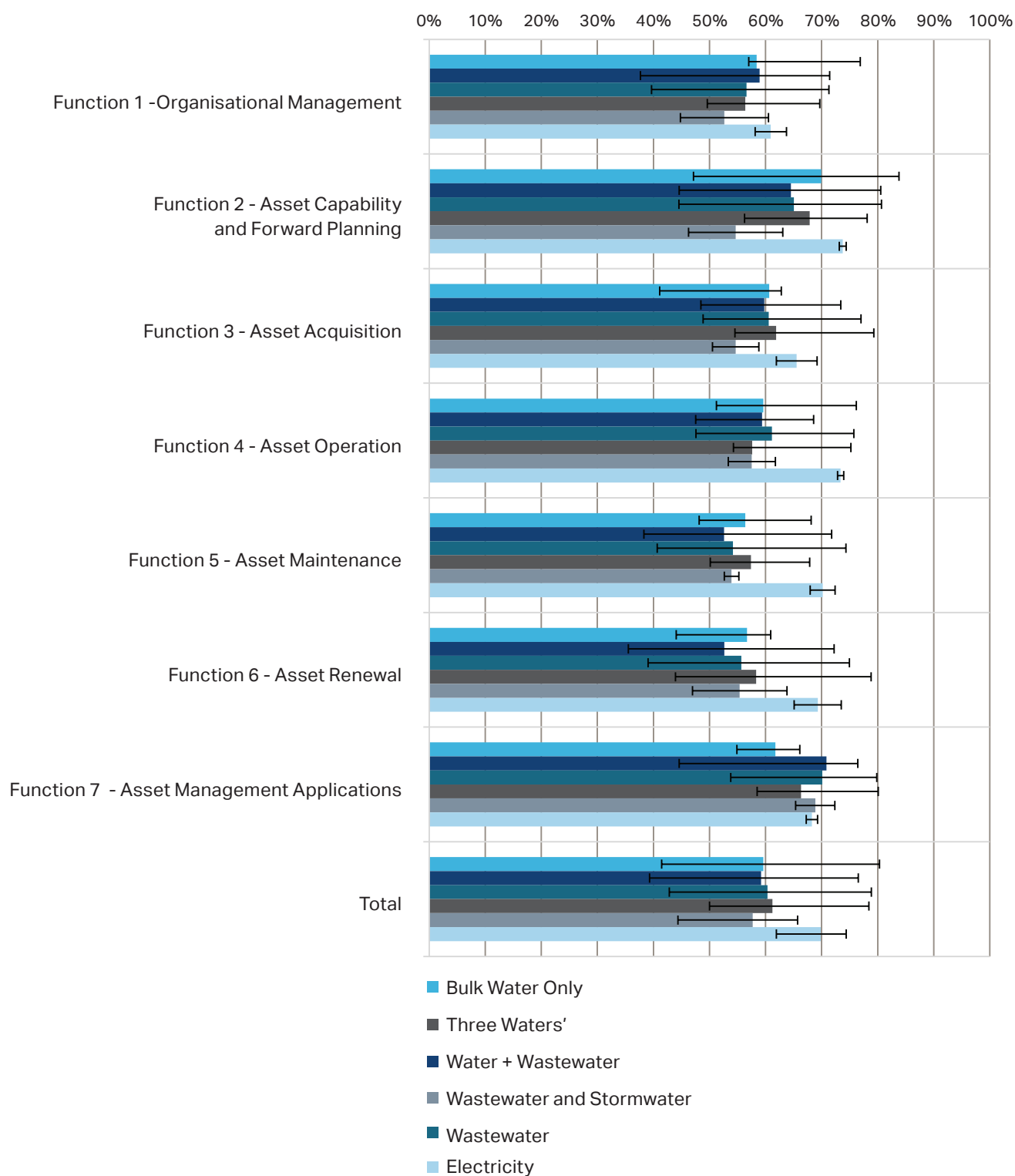


Figure D: Median scores achieved by all AMCV 2016 participants in the seven functions of asset management by respective services groups (the bars depict the 10th and 90th percentile scores).

Looking back: change since 2012

Sixteen of the 25 repeat participants from 2012 showed an overall improvement in performance in 2016, suggesting that the majority of participants that have invested in asset management planning over the past years have yielded positive organisational outcomes. In the cases where individual participant scores have decreased it was often the case that new processes had been deployed, in line with modern management principles, but these had not yet matured to the extent that the organisation's goals had yet been met.

A comparison of the median scores and scoring spread for the whole participant group between 2016 and 2012 can assist to understand progress over time in asset management process delivery. Some caution is required when assessing the chart for the following reasons:

1. There have been slight changes in the scoring methodology since 2012 to refine and improve the measure definition and align with ISO55001:2014;
2. Asset management philosophies and techniques at industry and the organisational level evolve over time, as do personnel and approaches adopted at an organisation; and
3. The participant group has changed between 2012 and 2016.

The data in **Figure E** reflects scoring for only those measures that were kept consistent between survey years. Overall 'asset capability forward planning' has strengthened as the adoption of strategic asset management planning has become more commonplace. Median scores in 2016 for 'organisational management', 'asset renewal', and 'maintenance' functions have lowered, most likely as the understanding, awareness and aspirations to deliver these work activities in community and stakeholder-minded ways have grown since 2012, which impacts the ways that participants have scored themselves this round

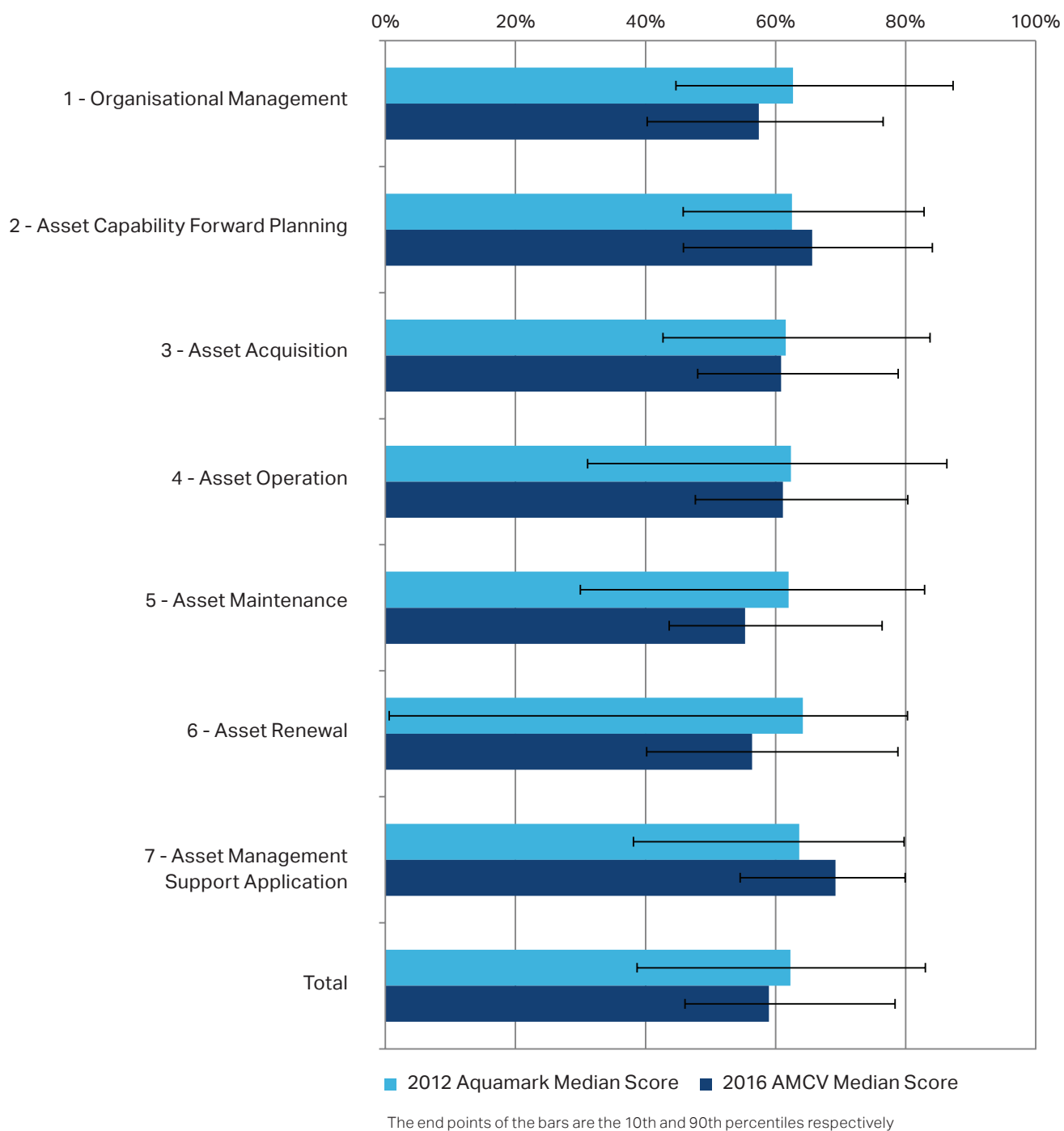


Figure E: Comparison of median 2016 score with 2012 (the end points of the bars are the 10th and 90th percentiles respectively).

2016 industry leading practices

The AMCV 2016 program provided the opportunity to share the most innovative and productive asset management processes executed around the world. A summary of the themes and characteristics of current leading practices amongst the 2016 participants were:

Themes

Research and innovation

Creation of systems that drive a culture of innovation and collaboration amongst private and public sector

Evolution and application of international principles, e.g. ISO 55001

Demonstrating alignment through maturity assessment or accreditation

Workforce evolution

Team engagement and succession planning to sustain asset values

Asset renewal investment and accuracy

Balancing investment against performance and risk profiles

Asset life prediction, planning and modelling

Considering economic, condition and design factors to drive precision and confidence in asset life predictions

Customer service and engagement modelling

Informing customers of opportunities and trade-offs and gaining feedback for major decisions on service levels and investment

Embracing technology

Driving efficiency through technology and connectivity

Integrated system planning and investment prioritisation/holistic asset management

Understanding and acting on the principle of an asset being anything that creates organisational value, so that natural, human, intellectual and knowledge assets are managed similarly to physical assets

Strategic planning and demand forecasting

Understanding 'mega-trends' in climate, population, and demographic shifts and how these will need to be accommodated by future infrastructure

International Industry drivers for change

Through the course of the program it was possible to engage with participants and the wider utility industries to understand:

- The key business drivers and the level of preparedness they have to meet the challenges and opportunities these drivers present;
- Asset management practice areas that can bring about the greatest collective improvements in organisational outcomes and value (these are dependent on region); and
- International trends in utilities and asset management which form part of the backdrop to the organisation.

A summary of each of these is provided below.

INTERNATIONAL UTILITY TRENDS AND EMERGING AREAS OF INTEREST	KEY BUSINESS DRIVERS THAT THE INDUSTRY IS GETTING READY TO FACE	FOCUS AREAS TO IMPROVE ASSET MANAGEMENT PERFORMANCE OUTCOMES
Customers at the heart of business	Maintaining or improving service levels in an affordable manner	Level of service projection
Affordability and working smarter	Using technology for customer interaction	Asset risk, performance assessment and renewal planning
Conservation, increasing demand and the role of technology	Adopting evolving risk management approach and policy for decision-making	Asset Management System (development and utilisation)
Utilising big data	Harnessing the power of knowledge management and decision support systems	Asset technical and maintenance knowledge management
Diversification in capital funding sources and greater competition in infrastructure investment	Aging infrastructure	Identification of timing of asset renewal

Industry focuses for the future

The key industry drivers for change point to the sector's priority future focus areas to drive ever greater improvements in asset management and value delivery:

- Risk-informed renewal planning (forecasting renewal timing and cost) – to balance cost, risk, performance and investment optimisation;
- Knowledge transfer and management in utilities– to retain institutional knowledge;
- Guidance on selection and integration of decision support applications for utilities– to enhance efficiency and customer value outcomes;
- Projecting customer expectations and levels of service and conveying trade-offs in ways that engage customers in the decision-making process;
- Review leading edge customer engagement approaches in the utilities sector– to inform and inspire industry.
- Capturing value from infrastructure investments and overcoming barriers to encourage innovative financing for asset delivery and renewals.

Business drivers

Organisations are getting ready to:

- Embrace technology for productivity and efficiency gains
- Elevate the customer and service user to the centre of business asset management
- Develop integrated knowledge management and decision support systems.



Future focus areas

- Risk-based asset management planning
- Strong succession planning and knowledge transfer
- Mainstreaming the use of technology, customer and decision support applications
- Fully understanding and delivering on customer-centric business operations
- Exploring innovative infrastructure renewal and delivery investment models

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1.0

Industry Asset Management
Performance in 2016

1. Introduction: driving excellence in asset management

Every four years since 2004 the Water Services Association Australia (WSAA) has run their international asset management process benchmarking project. Known previously as Aquamark and the Asset Management Improvement Program the project's main goal has historically been to improve the standard of asset management performance within the international water industry through the identification and promotion of leading practice.

In 2016 the fourth round of the program has been delivered. Reflecting that asset management is a business process used across industries to enable organisations to deliver services and value to their customers and stakeholders (cf. ISO 55001 and the International Infrastructure Management Manual) the following important changes were made:

1. The program was renamed the **Asset Management Customer Value (AMCV)** project in line with a new adopted vision and objective [Table 1](#);
2. The asset management process benchmarking questions were aligned to incorporate the principles of ISO 55001:2014. This means the AMCV 2016 has benchmarked processes and activities of participants against a holistic, total lifecycle view of asset management including organisational leadership, customer focus, and value optimisation arranged under seven asset management functions as shown at [Figure 1](#); and
3. Realising WSAA's benchmarking approach is now internationally recognised and has applicability to other industries participation was opened up to non-water sectors. For the first time electricity utilities joined the program.

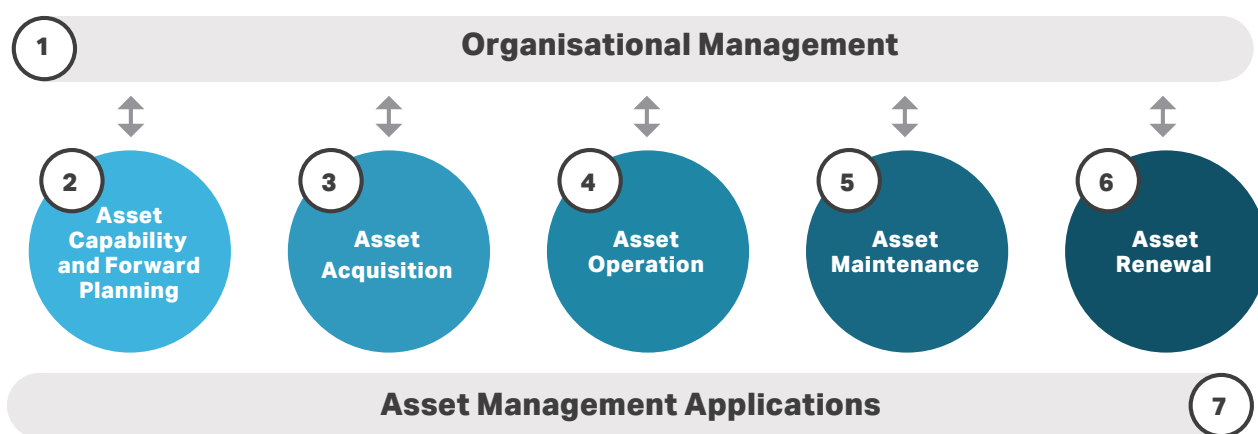


Figure 1: The seven asset management functions in the AMCV project

Overall forty-four organisations from the water and energy services sectors across Australia, New Zealand, Japan, United Kingdom, United States of America, and Canada have participated in AMCV 2016. For each participant the program provided the chance to:

- Engage with organisational leaders and outline what will drive their business going forward;
- Assess the maturity and effectiveness of asset management processes, data and technology;
- Identify their strengths and how they compare to peer organisations;
- Prepare tailored asset management improvement plans;
- Review other organisations' innovations and leading practices that can drive efficiency, productivity and higher return on investments and consider these for local applications; and
- Set a baseline against which asset management improvements can be targeted and measured.

This industry report documents the major findings, trends and insights on asset management business drivers, benchmarking outcomes, and leading practices gathered from all participants. Global, regional, sectoral, and environmental contexts and outcomes have been analysed. The report is arranged as follows:

1. AMCV 2016 profile: an overview of the project scope and participant group (**Section 2.0**);
2. Drivers for change: what the participants have said are the important challenges and opportunities they face over the coming years that will impact their directions (**Section 3.0**);
3. Industry outcomes: a regional, sectoral and operating environment comparison of outcomes, strengths and opportunities in asset management (**Section 4.0**);
4. Looking back: a comparison with the 2012 iteration of the project (**Section 5.0**);
5. Current leading practices: an overview of leading practices that have emerged and are being delivered now (**Section 6.0**); and
6. The future: The report concludes with an outline of six global priority initiatives to be considered by the industry in different regions between now and 2020 to drive ever greater improvements in asset management and value delivery (**Section 7.0**).

Table 1: Vision and objective of AMCV 2016

AMCV 2016	
Vision	An international utility knowledge base that drives world class asset management to deliver enhanced customer value
Objective	Improve the standard of asset management performance in the utility and essential services sector



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2.0

AMCV 2016 Program Overview

2. AMCV 2016 Program Overview

2.1. The project process

The project is described in its simplest form in **Table 2**.

Table 2: The project process

	Benchmarking and industry insights	Leading practices
Steps	<p>1. Understand the participants</p> <p>Each participant undertook a Business Driver Survey and Business Profiling Survey so that the organisational contexts could be understood and considered during the benchmarking</p> <p>2. Assess asset management processes</p> <p>Each participant delivered an assessment against 506 defined measures of asset management process practices in terms of development, documentation, coverage and frequency of application, and effectiveness.</p> <p>3. Independent verification</p> <p>Verification of the participant self-assessments by external and independent parties to ensure consistency both within the organisation and across all participants</p> <p>The methodology to undertake the self-assessments has been refined over the past 12 years and is outlined in Appendix A.</p> <p>4. Analysis and reporting</p> <p>Business driver analyses, process benchmarking, and participant consultation was undertaken to prepare industry insight reports</p>	<p>1. Identify leading practice nominations</p> <p>During verification interviews and through the review of the self-assessment the verifiers identified and nominated (with the participant) a series of leading practices nominations. The nominations reflected relative leading practices at an organisation as evident from AMCV 2016 benchmark scores and/or the verifier and participant's experiences and judgment</p> <p>2. Assess and shortlist leading practices</p> <p>The leading practices nominations were then assessed by an independent industry committee to identify the ones that were considered most innovative, mature, and that could translate to other organisations; a shortlist of the nominations were then selected for showcasing at the AMCV 2016 Conference</p> <p>3. Leading practices themes and reporting</p> <p>The leading practice nominations were reviewed and categorised so as to define the themes of leading practices as being currently delivered by the industry.</p>
Outcomes	<p>44 individual participant reports outlining benchmarking, strengths, and tailored focus areas for improvement</p> <p>Industry Report (this report).</p>	<p>Leading Practices Compendium</p> <p>Leading Practices conferences held in Los Angeles, USA (29-30 November 2016) and Melbourne, Australia (5-6 December 2016).</p>

2.2. The AMCV assessment

Against each of 506 measures of asset management performance, the participant has the level of process development, documentation, coverage and frequency of use, and effectiveness scored on a defined scale, which is then independently verified. The 506 measures from the assessment process are grouped into 209 sub processes and then 49 processes which form the basis of the scores for the seven asset management functions (Figure 1). Each measure has been allocated a weighting based on past industry surveys of the relative importance of that measure to achieving overall positive asset management outcomes, the weighted sum of all the measure scores roll up into process, function and overall scores of asset management process maturity.

To demonstrate the relationships between functions, processes, and measures, an example is provided as Figure 2. More detail on the scoring and verification process can be found in Appendix A.

In North America there were additional project attributes and steps, the outcomes of which are reported in individual participant reports delivered to those from that region. The specific additional processes involved for North America are outlined in the second half of Appendix A.

7 Functions

Example *Organisational management*

Corporate policy and business planning includes enablers and controls for undertaking asset management within the organisation. This function includes the "line of sight activities" from business objectives through to the preparation of asset management plans required to meet those business objectives.

49 Processes

Example *Asset Management System*

The Asset Management System comprises the organisation asset management policy, asset management objectives, SAMP, asset management plans, and the activities, processes and organisational structures necessary for their development, implementation and continual improvement.

209 Sub processes

Example *Asset Management System Scope*

The Asset Management System defines and documents the boundaries and applicability of the asset management system to establish its scope.

506 Measurements

Example *The organisation sets and documents boundaries of the asset management system*

The extent to which the organisation defines and documents the boundaries and applicability of the asset management system to establish its scope, processes required and to define the asset portfolio, whilst considering the external and internal issues, the stakeholder requirements and the interaction with the SAMP, the asset management policy and any other management systems.

Figure 2: Relationships between asset management functions, processes, sub-processes and measures

2.3. Project participants

2.3.1. Overall

Overall 44 organisations from Australia (27 participants), New Zealand (3), Japan (2), United States of America (9), Canada (2) and United Kingdom (1) participated in the project (**Figure 3**) and a full list of the participant group is in Appendix B. This participant base was a raw 19% increase from the 37 participants in 2012, however noting that two participants this round from Australia were merged from a combined five organisations that participated in 2012 the true increase was 23%. There were 25 repeat participants from 2012 comprising 57% of the 2016 group. The water services (drinking-water, wastewater, stormwater, and bulk-water services organisations) made up 42 or 95% of the participants; the other two participants were from the Australian energy utility sector.

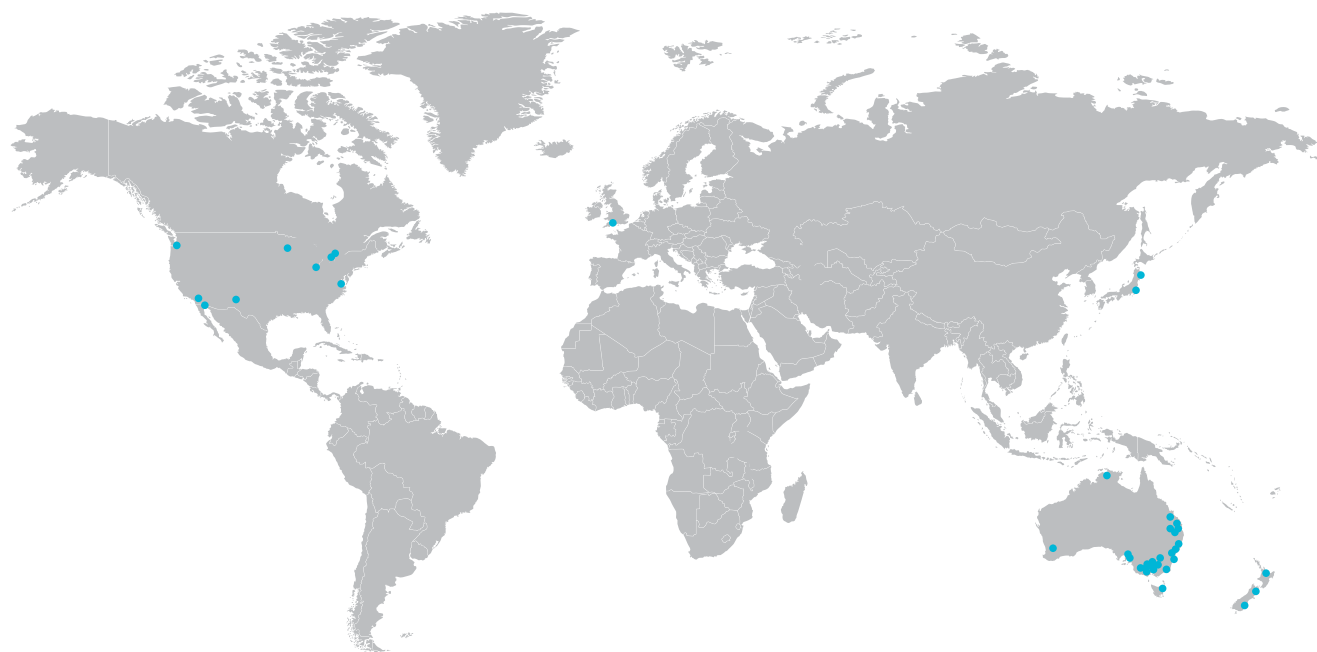


Figure 3: Map showing location of the participant utilities

Figure 4 depicts the diversity of participating organisations, based on population (vertical axis), revenue (horizontal axis), and relative asset base (diameter of bubble).

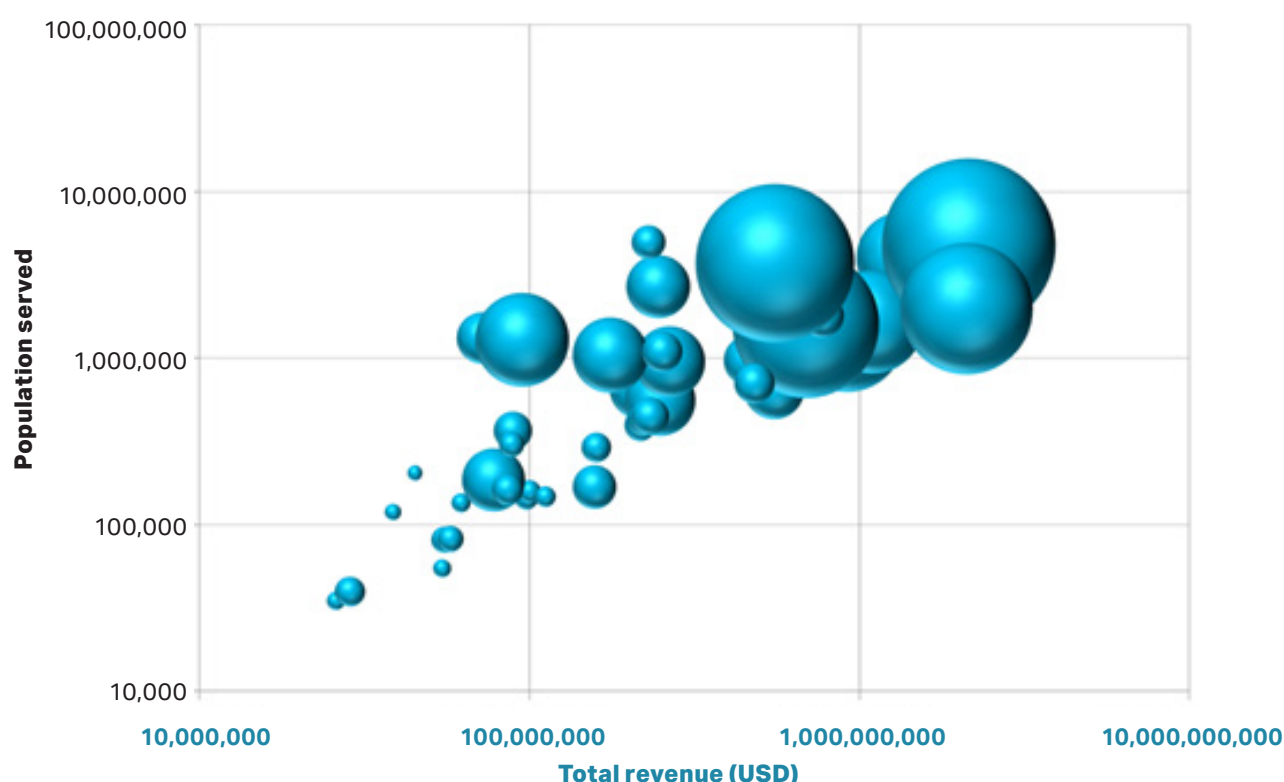


Figure 4: Project participant group by revenue, served population and asset base (bubble size = relative total asset base)

2.3.2 Region and peer groups

To understand the impacts that different regional, operational or other contexts may have on business drivers and asset management focuses benchmarking and analysis was undertaken with regard to the following participant groups:

Regional groups¹:

- Australia and New Zealand (30 participants);
- North America (comprising the 11 participants from United States of America and Canada); and
- Japan (two participants).

Peer groups:

- Participant relative size;
- Services provided;
- Operational structure; and
- Regulatory environments.

The memberships of each of the peer groups are outlined in detail at Appendix B.

¹ Note as the United Kingdom had only one participant no regional benchmarking was feasible.



Lake Estes Hydroelectric Power, Colorado USA

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3.0

Industry Drivers for Change

3. Industry Drivers for Change

3.1. Introduction

Each participant organisation responded to a Business Drivers Survey (BDS) to determine the forces currently shaping their business. Against each of 35 provided business driver statements, participants were required to score the 'importance' of the driver (on a scale of 1-5 where 1 = 'not important' and 5 = 'extremely important') and their 'preparedness to respond' (where 1 = 'not prepared' and 5 = 'extremely prepared'). The definitions of the 35 business drivers are provided in [Appendix C](#).

The BDS results have been used to assist with the identification of individual priority improvement initiatives for each participant (in the participant reports), to inform the list of industry-wide improvement opportunities (outlined at Section 7.0 of this report), and to inform the development of the themes for the Leading Practices Compendium and Conferences. Further details on what's driving the AMCV 2016 participant group is provided below.

3.2. Global perspectives

An overview of the global outcomes across all business drivers is provided in [Figure 13](#). There is some correlation between 'importance' and 'preparedness' scoring indicating that businesses undertake most preparation and planning on issues they see as high priorities. While there are regional differences the areas that have the greatest influence on business decisions tend to reflect those that are heavily regulated and align with core business functions, e.g. affordability, safety, and regulatory compliance. These were also areas where the 'level of preparedness' scores were typically high relatively as systems have been developed over many years to meet these requirements. The three most important business drivers (by importance) are listed in [Table 3](#).

Table 3: Top three Business Drivers rated by importance only

Business Driver (see definitions at Appendix C) rank	Average Importance on scale of 1-5 (all participants)	Average preparedness on a scale of 1-5 (all participants)
1. Knowledge management and decision support systems	4.5	2.8
2. Affordability	4.5	3.3
3. Value for money	4.4	3.2

The lowest priority and preparedness overall² was with regard to planning for business growth and new market entrants, noting that 43 of the 44 participants are public utilities or otherwise government-run entities. Even though talk of privatisation of utilities continues, and is more advanced in the electricity sector participants than the water sector, and private sector investment in infrastructure is increasing, the notion of utilities competing for water services business is still perceived as a far-off challenge.

By ranking the business drivers against a combination of the importance and preparedness scores a different picture can emerge, one that describes the most strongly evolving and potentially disruptive challenges to which the industry is either less equipped to meet or just starting to work out how to respond. In these results the immediate future asset management focus themes emerge, namely: customers, technology, and knowledge to inform good-decisions and manage risk. By considering the importance score divided by the level of preparedness score the three largest gaps are:

Table 3a: Top three Business Drivers taking into consideration importance and preparedness

Business Driver (see definitions at Appendix C) rank	Average importance on scale of 1-5 (all participants)	Average preparedness on a scale of 1-5 (all participants)
1. Knowledge management and decision support systems	4.5	2.8
2. Technology advancements and innovation – for customer interaction	3.8	2.6
3. Customer focus and stakeholder involvement	4.3	2.9

² Aside from the 'water resources' driver for non-water businesses, however this result was discounted as it did not apply universally to the whole participant group.

3.3. Regional perspectives

Table 4 provides a summary by region of the top three ranked business drivers in terms of:

1. The highest and lowest scoring business drivers respectively by 'importance' only;
2. The highest scoring business drivers considering the combination of how important and how prepared an organisation is to address a driver (measured as the importance score divided by the level of preparedness score); and
3. For comparison, the top ranked priority business drivers from the 2012 round.

On review of **Table 4** take note the overall participant group has changed since 2012 and that the business drivers included in the 2016 survey included some new and modified business driver definitions, as outlined in **Appendix C**.

'Knowledge management and decision support systems' is the highest priority business driver to address across all regions, as it has a high importance ranking but is also one of the drivers for which participants were least prepared. For those business drivers which are seen to be the most important, there is limited consistency across the regions. 'Affordability' is seen to be the most important business driver in Australia, New Zealand and North America where restricted government spending and customer drive to reduce living costs is changing the focus of utilities. 'Aging infrastructure' is highly important in North America and Japan but not in Australia, suggesting that Australia is more readily able to maintain and replace infrastructure as required by virtue of the regulatory environment and urban density. For those business drivers seen as of lowest importance, similarity was seen across all regions, with 'increasing completion, new market entrants' (with the exception of the United Kingdom, where the sector has been privatised).

Table 4: Business driver analysis by region

		Australia and New Zealand	North America	Japan
2016	Top 3 business drivers by 'importance' only	Affordability	Affordability	Aging infrastructure
		Knowledge management and decision support systems	Aging infrastructure	Asset criticality
		Safety culture	Capital expenditure	Safety culture
	Top 3 business drivers considering 'importance' vs 'preparedness'	Knowledge management and decision support systems	Knowledge management and decision support systems	Knowledge management and decision support systems
		Customer focus and invited stakeholder involvement	Aging infrastructure	Capital expenditure
		Technology - for customer interaction	Succession planning and training	Asset criticality
	Lowest 3 business drivers by 'importance' only	Reduction in demand for services	Business growth	Increasing competition, new market entrants
		Increasing competition, new market entrants	Increasing competition, new market entrants	Water resources Industry or business structural reform
		Business growth	Decentralised service provision	Increasing asset acquisition/ capital delivery requirements (all equally scored)
2012	Top 3 business drivers by 'priority'	Affordability constraints	Asset Acquisition	No participants in 2012
		Value for money	Demand for growth	
		Capital expenditure / debt reduction	Staff skills - experience	

3.3.1. Australia

The 2012 priority drivers in Australia were 'sustainability', 'staff skills', and 'asset replacement'. In 2016 'affordability' and 'knowledge management and decision support' have been identified as the top drivers, together with 'safety' which is a prominent and highly regulated aspect of utility businesses.

'Affordability' is a key priority for Australian participants for following a period of heavy investment in new infrastructure in response to the millennium drought. The early 2010s saw the end of a period of major new infrastructure delivery for urban water security projects in all major cities. Decreases in state revenue in some parts of Australia due to a softening in mining activity and investment have also increased the focus on 'affordability'.

The importance of 'knowledge management and decision support systems' is due to pressure to deliver more from existing assets and optimise the life cycle cost. This is partly due to regulatory pressure, but can also be attributed to advances in the ability and the availability of new tools to analyse vast amounts of data and the desire to secure efficiency and productivity gains.



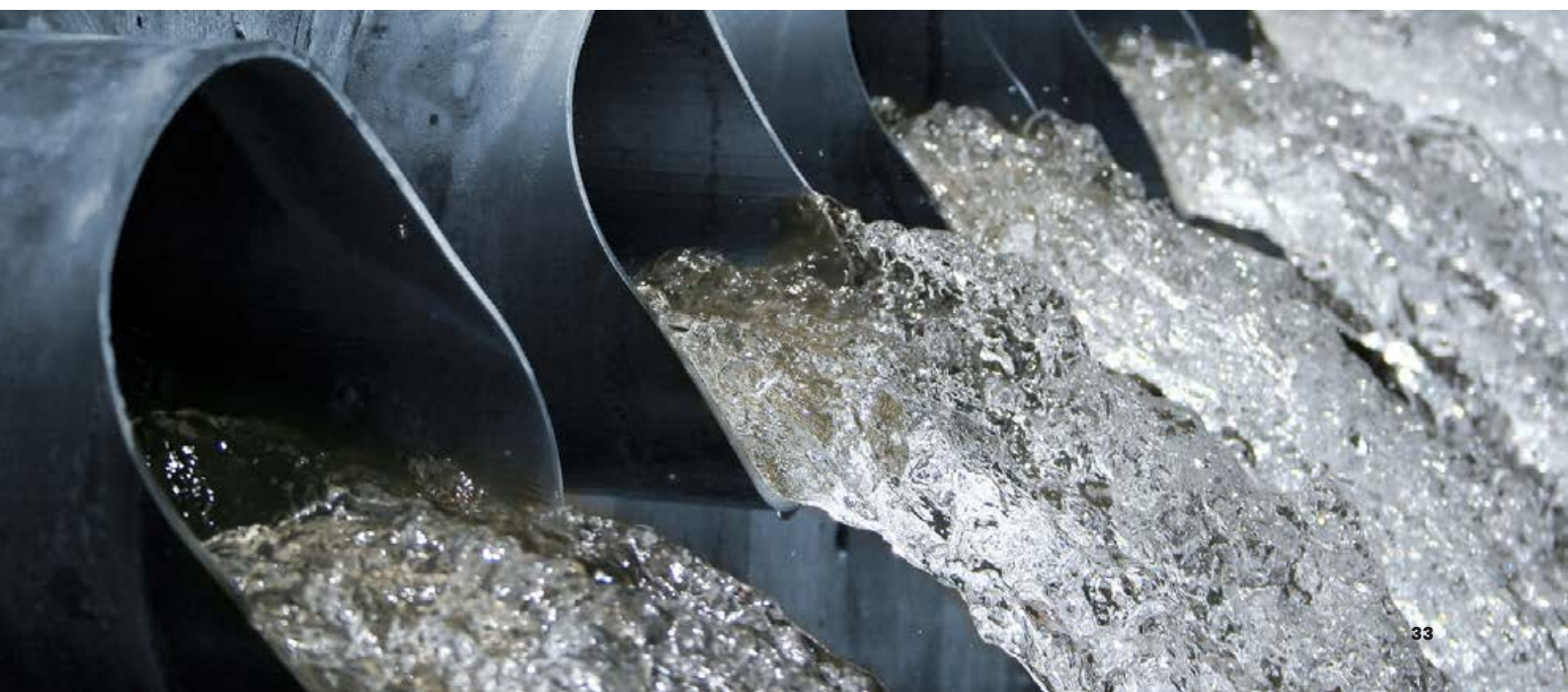
3.3.2. New Zealand

In 2016 the three most important drivers for the New Zealand participants were: 'affordability', 'aging infrastructure' and 'safety culture', compared to the 'priority' drivers of 'staff skills–experience', 'demand growth' and 'asset acquisition' in 2012.

New Zealand is currently experiencing unprecedented net growth due to large migration from overseas and high levels of internal urban migration. This means that the main urban centres such as Auckland and Christchurch are struggling with the cost of building new infrastructure to meet demand.

Conversely, smaller urban areas have static or negative population growth (due to net outward migration into larger urban areas) combined with ageing infrastructure. This results in a declining customer base and subsequently declining revenue to support the upkeep of existing infrastructure.

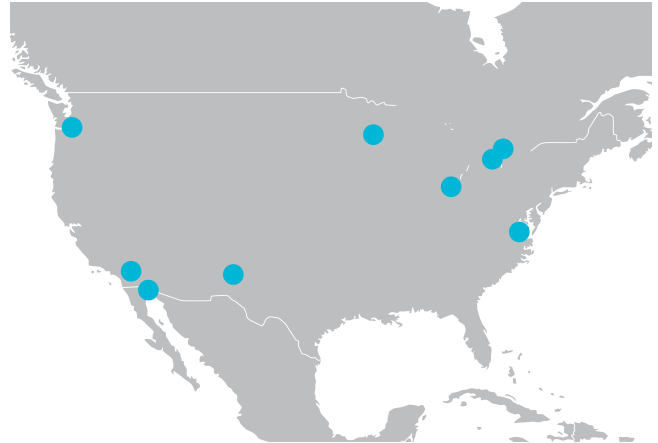
Another emerging issue in New Zealand is a strengthened focus on risk and infrastructure resilience due to recent severe earthquakes in Christchurch, East Cape and Kaikoura.



3.3.3. North America

In 2016 the three most important drivers for the North American participants were: 'affordability', 'aging infrastructure' and 'capital expenditure', compared to the 'priority' drivers of 'regulatory compliance', 'affordability', and 'aging workforce' in 2012. The 4th and 5th highest ranked drivers in 2012 were 'capital expenditures' and 'aging infrastructure', which are in the top three drivers for 2016.

The infrastructure industry in the US has put significant focus on the 'affordability' and 'aging infrastructure' drivers over the past four years, with the release of a number of highly-publicised industry reports and studies that highlight, and created awareness of, the backlog of deferred maintenance and renewal and the large 'capital expenditure' reinvestment required. This issue is especially prevalent in the north-eastern US states where older infrastructure serves very dense population, making the physical challenges of replacement of aging assets in highly urbanised environments extremely expensive.



Antelope Canyon Lake Powell Dam, Arizona, USA

3.3.4. Japan

In 2016 the three most important drivers for the Japan participants were: 'aging infrastructure', 'asset criticality' and 'capital expenditure'.

In Japan, renewal of city sewerage systems has been a primary focus as, compared to other regions, there is relatively little new or greenfield urban development. 'Aging infrastructure' has been a significant concern in the large cities where major sewerage installation projects were implemented decades ago and similar problems in small and medium sized cities are now becoming more serious. In addition, factors such as a decrease in tax revenue and sewerage charge income due to the long-term economic downturn and a declining population, and an increase in torrential rain and catastrophes (such as the Great East Japan Earthquake) have created a budgetary deficit and have plagued the local government sewerage utilities. Consequently 'capital expenditure' and 'asset criticality' have become much more prominent drivers in the implementation of asset management plans, taking into consideration risk, cost and performance.

In addition, private sector partnerships have been actively promoted in infrastructure management by the national government, mainly due to the severe financial conditions, with information and communication technology expected to contribute towards increasing the efficiency of business management in coming years.



3.3.5. United Kingdom

The United Kingdom water services are coming under increasing pressure as a result of a growing population and changing climate. To meet these challenges, the industry is changing the way water is managed and an increased pressure is being placed on water companies to be more efficient and more attentive to what their customers want.

The United Kingdom government, via economic regulators Office of Water (Ofwat) and Office of Gas and Electricity Markets (Ofgem) have developed policy to ensure a secure supply of water and energy at a fair price, now and in the future – hence, a key business focus in the United Kingdom is on 'affordability'.

In addition the Department for Environment, Food & Rural Affairs (Defra) who provides guidance to Ofwat for setting out the policy priorities for regulation of the water industry, wishes to see investment from water companies through the price review to ensure the following: enough water for people and the environment; no deterioration in the quality of the environment; improved bathing and shellfish waters, groundwaters and protected habitats; a resilient water industry that manages its infrastructure to reduce flood risk and meets the challenges of growth, development and climate change; and more partnership working to achieve the best results.



Gloriettes Dam, Pyrenees, France

3.4. Participant relative size comparison

Table 5 shows the top ranked business drivers by participant size classifications. When compared to the breakdown by region, the differences are less marked. 'Affordability' and 'knowledge management and decision support systems' are both seen as important for all three relative size groups. For the 'large' group, 'customer focus and invited stakeholder involvement' is seen as the most important driver, but there is also a perception of limited preparedness to meet the demands of this business driver suggesting they are very aware of their difficulties in connecting with their customers due to the size of their customer base. 'Aging infrastructure' is seen as more important by small and medium participants

that have smaller revenues and resources at their disposal to manage their existing assets with, and where the economy of scale does not exist as it can in larger urban areas. Smaller utilities tend to have more assets spread over wider areas serving smaller population bases for their relative budgets making it harder to justify maintenance and replacement. While 'affordability' was a key business driver for all participants, 'value for money' was seen to be more important to medium participants than the small and large groups, perhaps reflecting customer expectations in mid-sized city and urban area populations that are growing to match the levels of service expected in the largest of cities.

Table 5: Business driver analysis by participant size

		Small	Medium	Large
2016	Top 3 business drivers by 'importance' only	Affordability	Affordability	Customer focus and invited stakeholder involvement
		Knowledge management and decision support systems	Value for money	Affordability
		Aging infrastructure	Aging infrastructure	Knowledge management and decision support systems
	Top 3 business drivers considering 'importance' vs 'preparedness'	Knowledge management and decision support systems	Knowledge management and decision support systems	Customer focus and invited stakeholder involvement
		Customer focus and invited stakeholder involvement	Asset criticality	Intergenerational equity
		Affordability	Value for money	Knowledge management and decision support systems
	Lowest 3 business drivers by 'importance' only	Increasing competition, new market entrants	Reduction in demand for services	New accounting standards
		Business growth	Business growth	Reduction in demand for services
		Decentralised service provision	Increasing competition, new market entrants	Business growth

3.5 Technology, knowledge, customers, and finance are at front of mind

The measure of the industry's perceived gap between how important a driver is and how prepared it is to meet the challenge or opportunity is a better indicator of where the industry's innovations are likely to be focused over the coming years (as opposed to just considering the areas ranked highly important). In short, over the coming years, water services and the utility sector businesses globally will have a strong focus on deploying innovative ways to better understand its customers and stakeholders to meet their quality of service demands, keep costs and service prices down, and manage risk. The global business driver survey indicates that the utility industry is preparing to face the following:

- The emergence of new technology and how it can be deployed to increase productivity and efficiency (particularly intelligent systems and networks);
- The elevation of the customer and service user to the centre of business asset management which will in turn transform business metrics and further promote 'triple bottom line' principles to inform major business decisions;
- The development of sophisticated knowledge management and decision support systems that will enable effective and transparent business directions geared toward maximising value to the service providers and recipients alike. In particular, these will be needed to provide robust cases for asset renewal planning and aging infrastructure maintenance; and
- Underpinning all of the above points is the need to explore and secure alternate models for financing the service provision expected by communities into the future. Concepts such as 'value capture' and engaging the private sector to raise capital and invest in water and electricity infrastructure could be explored.



The background features a large, abstract graphic composed of several overlapping, curved blue shapes. These shapes originate from the top right and sweep downwards and to the left, creating a sense of motion and depth. The colors range from a light sky blue to a deep, dark teal. The overall composition is clean and modern, typical of corporate branding.

4.0

Industry Asset Management
Performance in 2016

4. Industry Asset Management Performance in 2016

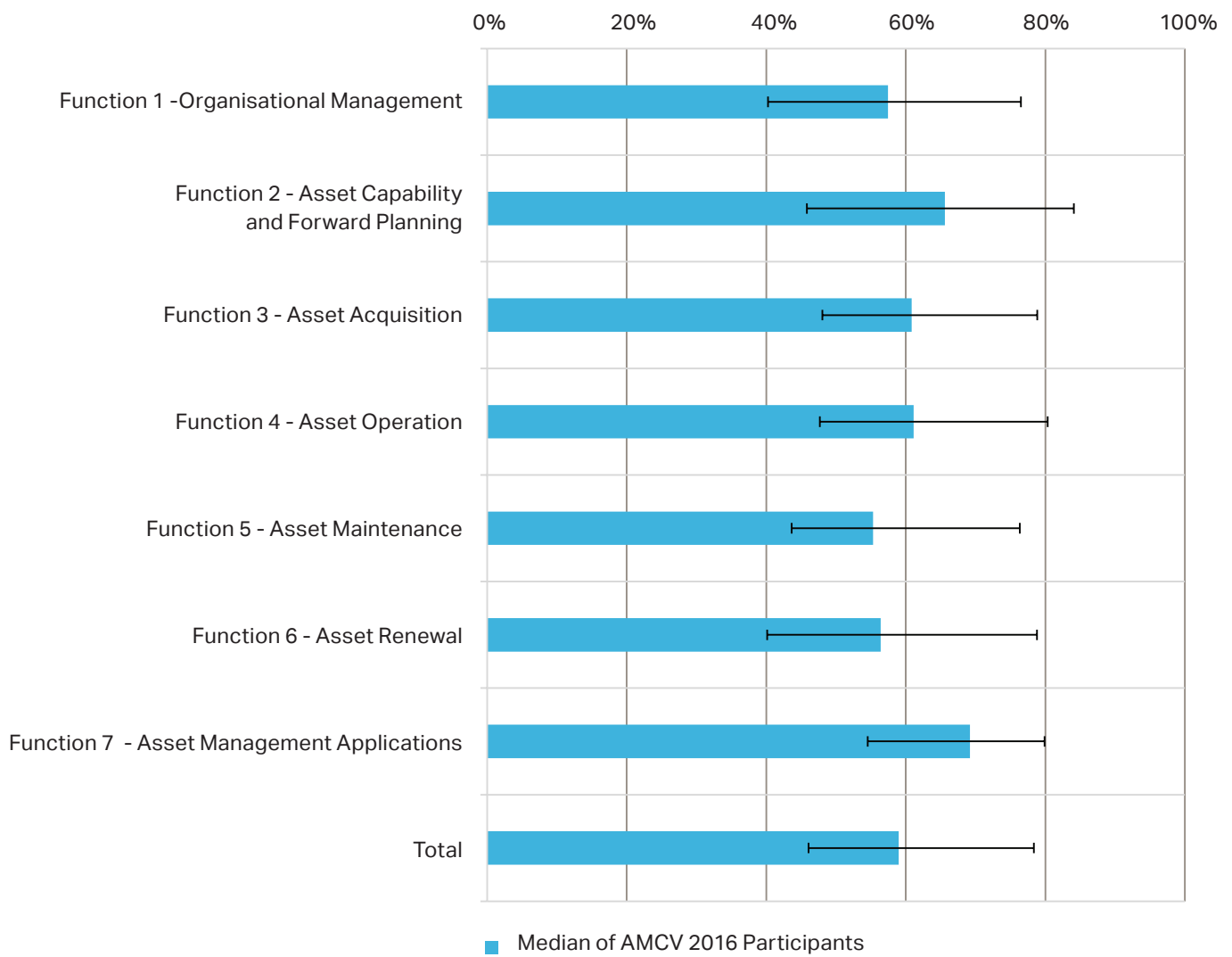
4.1. Overall AMCV benchmarking results

4.1.1. Function level

The results of the AMCV benchmarking assessment are shown in **Figure 5** and at process level in **Figure 11** to **Figure 17 (Appendix D)**. The pattern of scoring at the function level mirrors that from 2012, namely that 'asset capability forward planning' and 'asset management applications' record the highest industry scores, with more moderate scores in 'organisational management', 'asset acquisition' and 'asset operation', and with the lower scores being recorded in 'asset maintenance' and 'renewals' functions. On asset maintenance and renewal, consider that these functions and their processes and

activities (which have closely linked decision requirements) continue to be the lowest relative scored functions in 2016 continuing a trend from 2008 and 2012. The business driver survey results indicated knowledge and decision systems, aging infrastructure, customer interactions, and sustainable financing as the industry's key drivers which all have strong implications with regard to balancing cost, risk and performance of existing assets. These factors point to risk-based renewal planning guidance as a key industry need, as outlined at **Section 7.0**.





The end points of the bars are the 10th and 90th percentiles respectively.

Figure 5: AMCV score distribution for overall participant group

4.1.2. Process level high and low scores

At a process level, the highest 10 and lowest 10 average scores across the participant group are shown in **Table 6** and **Table 7**.

The results indicate the continued importance placed on growth driven-capital works planning. This in turn is driving the need for robust demand projections and consequently the more advanced level of asset management in this area. The ranking shows that there is a strong use of 'asset management applications' in general operations. However, looking at both the high and low scoring items, both show a need for improvement in the strategic planning of assets under management. The use of risk and lifecycle analysis to facilitate decision making for planning renewal and disposal of assets is one tool that can assist in providing a clear program of works that can effectively offset capital expenditure and improve the efficient running of the business. To become

a leader in asset management there is the need for a business to develop and communicate a strategy on how assets are to be maintained so that these tools can be directly aligned with business goals.

Many of the low scoring processes aligned with the business driver 'knowledge management and decision support systems' that was identified as the highest priority driver across all participants though for which there is a lower indicated level of preparedness to respond or embrace the opportunity.



Table 6: AMCV 2016 highest 10 average asset management process scores

Highest 10 Average Process Scores	
Average score	Process
75%	2.2. Demand Projection
72%	7.6. Modelling Applications
71%	7.3. Customer Applications
71%	7.4. Financial Applications
68%	7.2. Operational Applications
68%	5.5. Work Practices (Maintenance)
68%	7.1. Asset Information Applications
68%	2.4. Planning for Optimised Assets
67%	3.4. Procurement Best Value (Acquisition)
67%	4.5. Work Practices (Operation)

Table 7: AMCV 2016 lowest 10 average asset management process scores

Lowest 10 Average Process Scores	
Average score	Process
49%	5.3. Business Based Maintenance Strategy
49%	1.11. Review and Improvement Planning
52%	1.10. Configuration Management Systems
53%	6.5. Asset Rationalisation and Disposal
53%	1.12. Innovation
54%	1.9. Quality Management
54%	4.9. Asset Productivity Optimisation
55%	1.2. Optimised Life Cycle Decision Making
56%	6.2. Asset Risk, Performance Assessment and Renewal Planning
56%	4.2. Asset Operational Knowledge

4.1.3. Process level AMCV scoring improvement opportunities

Over the past 12 years WSAA has engaged with its members and the wider industry to determine the relative importance of different asset management processes – in the AMCV scoring process this relative importance is reflected as ‘weightings’ applied to different measures and asset management processes. The overall AMCV function and process scores are calculated based on the weighted average score of the measures within the process. For this reason it is useful to understand not just the areas where scores as percentages can be improved or were high (as discussed above), but the scores for processes that highly weighted and the greatest potential exists to improve AMCV benchmarking outcomes as an industry.

Of all the processes benchmarked in AMCV 2016, those in **Table 8** were the result areas where focus and improvement are likely to bring the greatest industry-wide improvements to asset management and resultant value to customers and stakeholders. As compared to the processes with the lowest scores there are several

processes from Function 2, ‘asset capability and forward planning’ in this list as well as the strong theme of improvement needed in how ‘asset renewal’ (Function 6) and ‘asset maintenance’ (Function 5) are balanced and managed. Many of these areas for improvement align with the aims and objectives of the ISO 55001 asset management standard, especially processes 1.1 ‘asset management system’, 2.1 ‘functional governance (asset planning)’ and 5.6 ‘execution of the maintenance strategy’ which discuss systems, governance and execution of asset management.

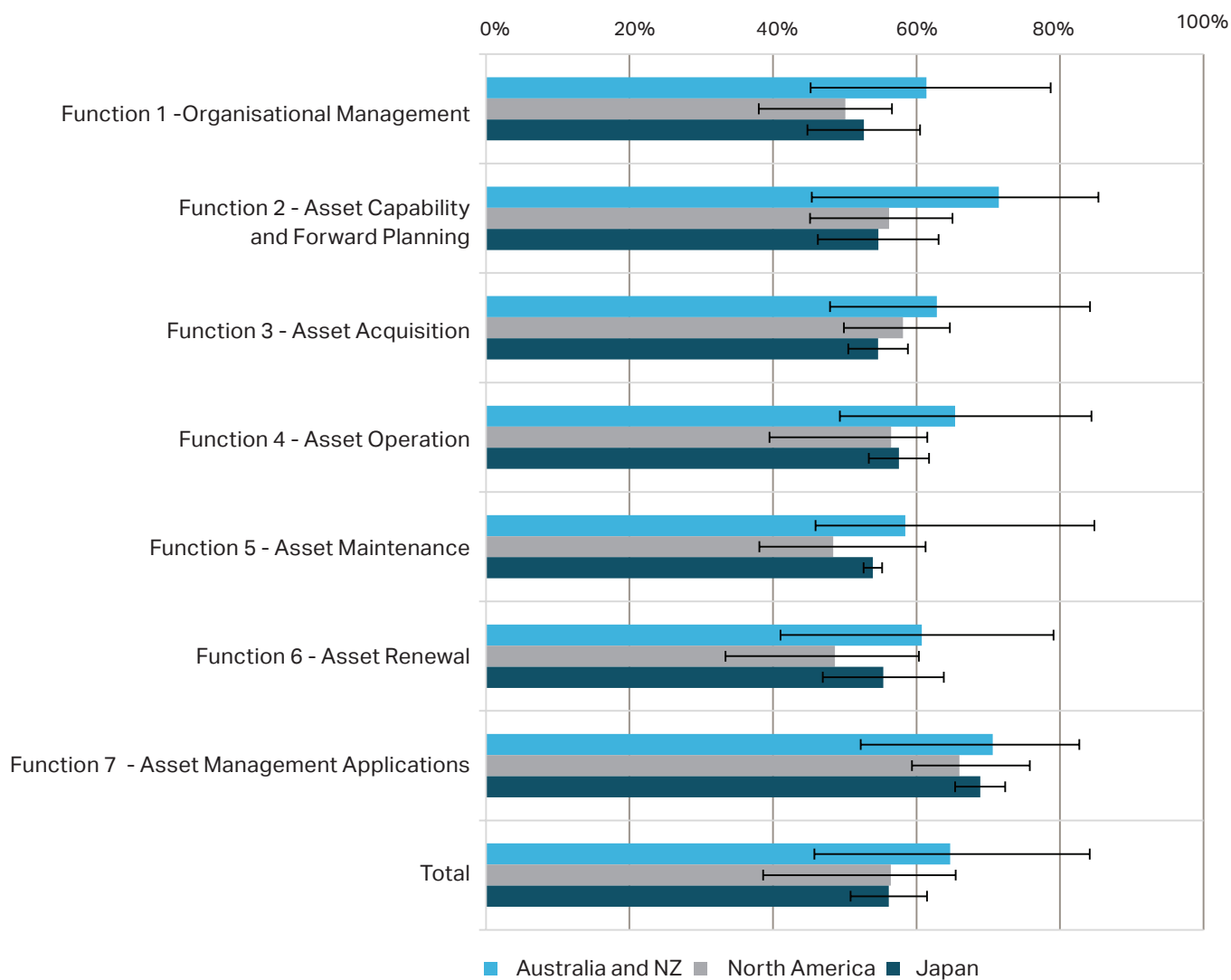
Table 8: Focus areas that can bring the greatest improvement in industry-wide AMCV benchmarking scores

AMCV process number	AMCV process title
2.3	Level of Service Projection
6.2	Asset Risk, Performance Assessment and Renewal Planning
6.4	Identification of Timing of Asset Renewal
2.2	Demand Projection
1.1	Asset Management System
6.3	Renewal Forecasting
5.2	Asset Technical and Maintenance Knowledge
5.6	Execution of the Maintenance Strategy
2.1	Functional Governance (Capability Forward Planning)
3.2	Equipment / Product / Design Standards (Acquisition)

4.2. Regional comparison

A comparison of the AMCV function results by region is provided in **Figure 6**. Keep in mind that the Japan group comprises only two participants (hence the smaller indicated range of scores); North America has 11 participants; the Australia and New Zealand group comprises 30 participants. A comparison of the scoring at the process level is at .

The Australian and New Zealand regional group has the higher indicated asset management process maturity. This likely reflects the longer history of many of the participants from this region with the pursuit of asset management and the WSAA benchmarking program in particular, and the uptake of the design of asset management systems that have clear arrangements and links with the AMCV assessment framework. The North American group's relative strengths have been in 'asset acquisition' and 'operations' activities; some strengths at the process level have been in heavily regulated or controlled aspects such as operational compliance monitoring, standards development, demand projection and in the utilisation of asset support applications. The Japanese group's scoring is reflective of a participant that has been involved with asset management planning since 2008 (when it last participated in the WSAA program) and another who is at the very commencement of its journey to create and execute formal asset management strategies.



The end points of the error bars are the 10th and 90th percentiles respectively.

Figure 6: Regional comparison of AMCV score distribution

4.3. Peer group comparison

Participating utilities were categorised into peer groups according to their relative size and services provided. The analysis for these peer groups is provided below, with the data presented at both the function and the process level in **Appendix D**. It was also possible to analyse the participants based on ownership model, operational structure and level of regulation, and outcomes and discussions on these bases is provided below as well.

4.3.1. Comparison by participant size

Participants were categorised as 'small', 'medium' or 'large' organisations based on relative consideration of the populations they serve, revenue profiles, and relative asset base (see **Figure 9** for more detail) resulting in the following groups:

- 'Large' – 12 participants;
- 'Medium' – 14 participants; and
- 'Small' – 18 participants.

Overall the larger utilities performed the strongest (as shown in **Figure 19** and **Figure 20**) reflecting a level of resources at their disposal beyond what smaller organisations can access as well as their ability to apply economies of scale. Larger, more complex organisations will demand more effort to coordinate and streamline asset management activities and this is reflected in the results. Only in Function 7 does the trend reverse – here smaller utilities outperform larger ones, again perhaps a reflection of the smaller levels of data and support information that is required to be managed by the applications, and the simpler environment means the users are more likely to be satisfied with the capability and functionality they have.

A more detailed process level break down of participant size data for function 1 (**Figure 21**), function 2 (**Figure 22**), function 3 (**Figure 23**), function 4 (**Figure 24**), function 5 (**Figure 25**), function 6 (**Figure 26**) and function 7 (**Figure 27**) can be found in **Appendix D**.

4.3.2. Comparison by services provided

A comparison at function level (**Figure 28**) and process level (**Figure 29**) has been undertaken based on the services provided. The number of participants in each category is as follows:

- 'Bulk water only' – three participants;
- 'Wastewater only' – two participants;
- 'Water and wastewater' – 23 participants;
- 'Wastewater and stormwater' – two participants;
- 'Water, wastewater and storm water' – 10 participants; and
- 'Electricity' – two participants

The 'wastewater only' participants generally rated lower than the other participants. However the small sample size means this may not be reflective of the true status of that service sector. Nonetheless the 'asset renewal' scores are notably low in comparison to others. The bulk water suppliers, that have typically larger asset planning and delivery phases as compared to urban water suppliers who deliver new growth communities scored highest at 'asset capability and forward planning'. The other strong group in this function was the 'three waters (drinking water, wastewater and stormwater)' service providers who have the scope and demonstrated ability to deliver integrated water solutions. The 'electricity' sector group comprises of two participants serving regional cities in very different environments (Canberra and Darwin). There are relative strengths in tactical operational and maintenance areas as well as in service level projections (influencing 'asset capability planning' scores), perhaps influenced by the more stringent regulatory structure the Australian electricity sector operates under compared to the local water sector.

4.3.3. Comparison by operational structure

A comparison by operational structure has been undertaken at function level (**Figure 30**) and process level (**Figure 31**). The number of participants in each category is as follows:

- ‘Corporation’ - 28 participants; and
- ‘Internal department’ – 13 participants.

Note that the following groups have been excluded from the graph for privacy reasons as there is only one participant in the group:

- ‘Council cooperative’; and
- ‘Private corporation’.

Corporate utilities have outperformed internal departments in all functions apart from ‘asset acquisition’. This implies that perhaps the additional interfaces and the demonstration of enterprise-wide processes and standards directly to the assets being assessed are additional challenges that have to be overcome by internal departments. However the maturity gap between these two peer groups has been closing since 2008 which is demonstrative of the worldwide push for quality asset management services at all levels of government. There is the potential for some regional influence in these scores as in Australia and New Zealand, 25 out of 30 participants were corporations compared with Japan where both participants were internal departments and the North American region where six out of the 11 participants were internal departments.

4.3.4. Comparison by type of regulation

A similar comparison was completed for the participants based on type of regulation (**Figure 32** and **Figure 33**). The number of participants in each category is as follows:

- ‘Extensive’ - 28 participants;
- ‘Partial’ – 15 participants; and
- ‘Other’ – 1 participant.

The extensively regulated entities have outperformed partially regulated entities in all aspects. To conclude that the driver of extensive regulatory compliance and accountabilities in financial, social and environmental areas appears to be driving a greater level of asset management maturity may be misleading, as the greater number of peer group members are Australian participants, and this result may be reflecting a regional impact rather than a regulatory environment one. Nonetheless the AMCV 2016 outcomes suggest that the role of the regulator may be an important one in driving continuous improvement in asset management.

4.4. Scoring component analysis

4.4.1. Functions 1 to 6

Scoring within the WSAA AMCV tool for Functions 1 to 6 requires allocation of a score ranging from 1-5 in four distinct areas: (i) process development, (ii) documentation, (iii) coverage and frequency of application, and (iv) effectiveness with regard to meeting the intent of the measure statement. The scoring methodology is explained in **Appendix A**. Function 7 has a different scoring approach as discussed under section **4.4.2** below.

There are two observations worth noting based on the data presented in **Appendix D Figure 34**:

- There is a particularly strong component score for 'coverage and frequency' of application of processes for asset maintenance activities, reflecting the high proportion of routine and consistent work activity required in this space; and
- Asset renewal is the one function where process 'effectiveness' has the lowest component score against the other components. This is indicative of the sentiment across the participant group that, far from being mature, the methods to best enable a balance between cost, service risk and performance to inform renewal investment and undertakings are still forming and are yet to be proven.

4.4.2. Function 7

The 'asset management support applications' function refers to information systems and data, and is structured differently to the other six functions, with scoring being undertaken against 10 measures for each group of applications. The overall summary in **Table 9** below provides an indication of the median score for each application group and measure. This difference in scoring is potentially contributing to the high representation of processes from Function 7 in the top scoring processes overall. The scoring methodology is explained in **Appendix A**.

Lighter orange cells represent comprehensive applications where the participant is confident that the system functionality imposes lesser restrictions in its application, and darker orange cells depict limited systems that require improvements to fully meet current basic needs.

Overall the participants convey satisfaction with the methods they use to maintain security of their data and the reliability and availability of the applications. Opportunities for improvement relate to the system inter-connectivity in particular the linkage of financial applications and data with the asset information and operational application, and the development of stronger risk systems that can support consistent asset management decision-making.



Hoover Dam, Nevada, USA

Table 9: Average scoring profile for Function 7 by application group and measure

		Measure										
		Functionality	Capacity	Data Availability and Integrity	Data Security	System Interconnectivity	Reporting Functionality	Usability	Application Maintenance and Replacement	Application Reliability and Availability	Delivering Outcome Requirements	Application Average
Application Group	1. Asset Information Applications	68%	77%	62%	86%	53%	56%	63%	64%	79%	62%	67%
	2. Operational Applications	67%	74%	60%	82%	55%	58%	64%	68%	80%	68%	68%
	3. Customer Applications	67%	64%	68%	88%	53%	62%	67%	69%	82%	64%	68%
	4. Financial Applications	65%	64%	69%	86%	51%	62%	64%	66%	84%	64%	67%
	5. Risk Systems	58%	57%	56%	79%	44%	54%	56%	57%	74%	57%	59%
	6. Modelling Applications	76%	72%	65%	82%	57%	66%	67%	68%	76%	72%	70%
	Measure Average	67%	68%	63%	84%	52%	60%	64%	65%	79%	64%	67%



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5.0

Looking back: 2012 to 2016
Comparison

5. Looking back: 2012 to 2016 Comparison

5.1. Comparability of 2012 and 2016 results

Comparison between 2016 and 2012 outcomes can assist to understand progress over time. In doing so some caution is required for the following reasons:

1. There have been changes in the scoring methodology since 2012 to refine and improve the measure definition and align with ISO 55001:2014 as summarised in [Appendix A](#). This has involved reducing the overall number of measures, re-defining some, and adding new measures;
2. Asset management philosophies and techniques at industry and the organisational level evolve over time, as do personnel and approaches adopted at an organisation; and
3. The participant group is different. There is a 57% overlap between the utilities that participated in the 2016 AMCV and the 2012 program.

Awareness and aspirations about what asset management can achieve for an organisation have grown since 2012, and new practices that may be aligned to current leading practices may have been put in place at some organisations but not yet had the time to yield and demonstrate the desired outcomes. As a result, some organisations may have scored lower in 2016 than in 2012, which might not fully reflect their progress. Nonetheless, for the measures that were the same between the 2012 and 2016 assessments, a comparison was made between the current and prior scoring, as presented in the following sections.

5.2. Function level benchmarking comparison

As seen in [Figure 7](#) 'asset capability forward planning' scoring has strengthened as the adoption of strategic asset management planning has become more commonplace. Median scores in 2016 for 'organisational management', 'asset renewal', and 'maintenance' functions have lowered as the understanding, awareness and aspirations to deliver these work activities in community and stakeholder-minded ways have grown since 2012. This is associated with: international guidance such as ISO55001:2014 and the Institute for Asset Management that have promoted a shift to risk-informed investment and decision-making; and the greater focus on customers and their expectations. Methods to respond to these modern guiding principles are still forming and maturing.

Sixteen of the 25 repeat participants from 2012 showed a performance improvement in 2016. Amongst the participants that have obtained lower scores in 2016, it was noted during independent verification that many had indeed advanced their asset management process development in areas but then have scored their execution and outcomes lower this round than in 2012. This was attributed to the fact that universally the organisations tended to be holding themselves to higher standards for achievement in 2016 and that they believed the new practices were still to be proven.

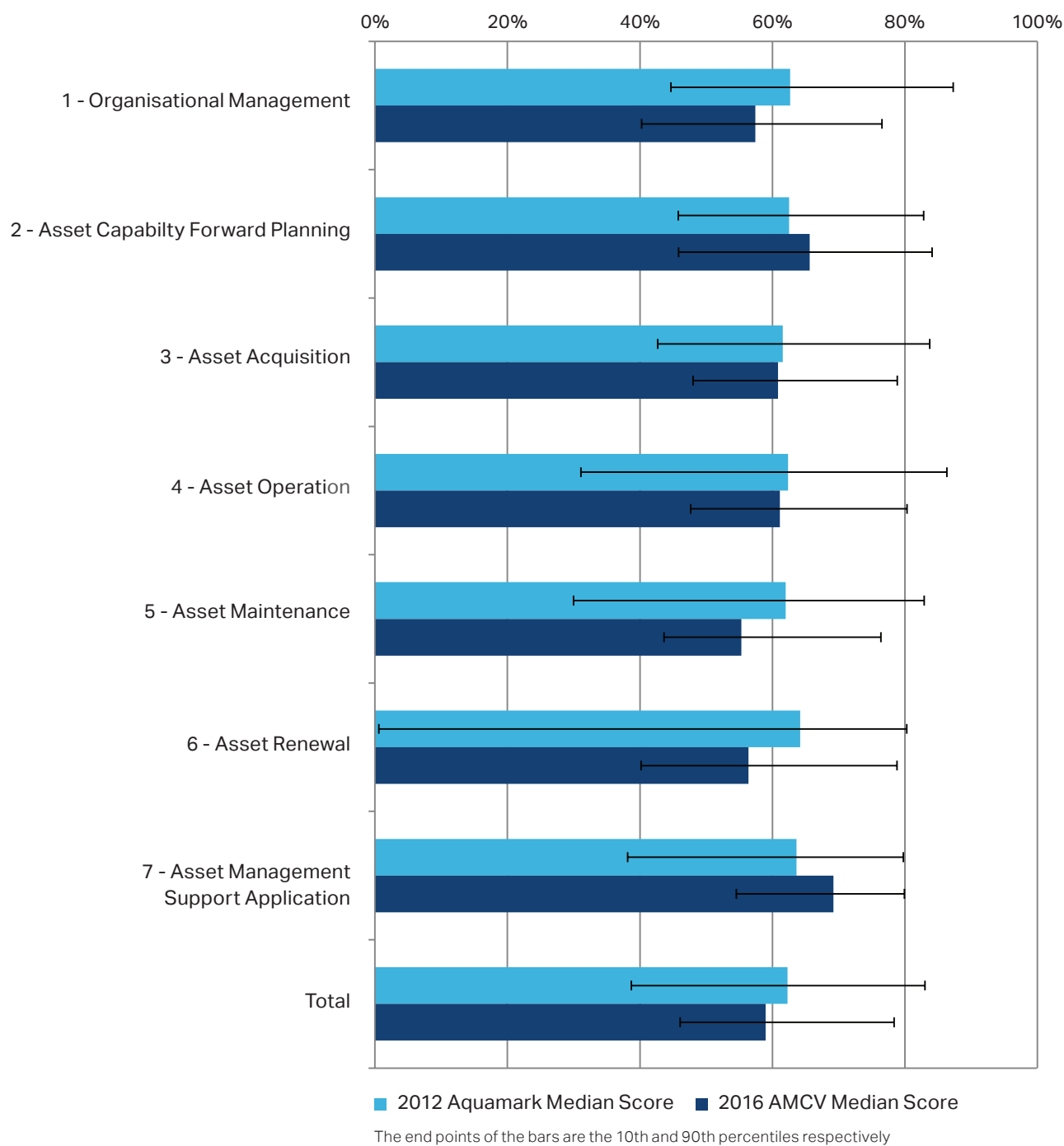


Figure 7: 2012 to 2016 benchmarking comparison for repeat participants and common assessment measures





6.0

Asset Management Leading Practices

6. Asset Management Leading Practices

A key component of the AMCV project is to identify where participants are leading in their asset management practice and share these 'leading practices' with other participants. Sharing between participants was facilitated through the Leading Practice Conferences, held in 2016 in Los Angeles and Melbourne, where identified 'leading practices' were presented by participants followed by numerous opportunities for questions and further discussion. For many participants, this was one of the most worthwhile aspects of the AMCV project because they were able to discuss real life ways to make improvements to how asset management is approached in their businesses. These leading practices were grouped by theme, which are listed with the theme characteristics in **Table 10**. Many of the leading practices identified were associated with areas that presented opportunities for improvement. To address knowledge gaps there is a degree of consistency

between the leading practice themes and the identified low process level scores. This also increased the learning opportunities among participants. **Section 7.0** of this report discusses improvement areas for the industry as a whole, taking into consideration some of the learnings from the leading practices.

The leading practice selection process is explained in **Appendix F** and the agendas for the two leading practice conferences have been included in **Appendix G**. Detailed information on the leading practices is provided in the 2016 *Leading Practices Compendium* (under separate cover). The compendium gives detail around the leading practice including the areas of asset management it relates to, motivation for the implementation of the practice, process for implementation and lessons learnt during the process.

Table 10: Leading practice themes and characteristics in 2016

Theme	Characteristics of leading practices
Research and innovation	Creation of systems that drive a culture of innovation and collaboration amongst private and public sector
Evolution and application of international principles, e.g. ISO 55001	Demonstrating alignment through maturity assessment or accreditation
Workforce evolution	Team engagement and succession planning to sustain asset values
Asset renewal investment and accuracy	Balancing investment against performance and risk profiles
Asset life prediction, planning and modelling	Considering economic, condition and design factors to drive precision and confidence in asset life predictions
Customer service and engagement	Informing customers of opportunities and trade-offs and gaining feedback for major decisions on service levels and investment
Embracing technology	Driving efficiency through technology and connectivity
Integrated system planning and investment prioritisation/holistic asset management	Understanding and acting on the principle of an asset being anything that creates organisational value, so that natural, human, intellectual and knowledge assets are managed similarly to physical assets
Strategic planning and demand forecasting	Understanding 'mega-trends' in climate, population, and demographic shifts and how these will need to be accommodated by future infrastructure

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7.0

Industry Roadmap

7. Industry Roadmap

7.1. Introduction

This section draws together the findings of the AMCV benchmarking assessment, industry knowledge, research and opinion to provide readers and participants with the steps for improvement in key areas between now and the next phase of AMCV in 2020.

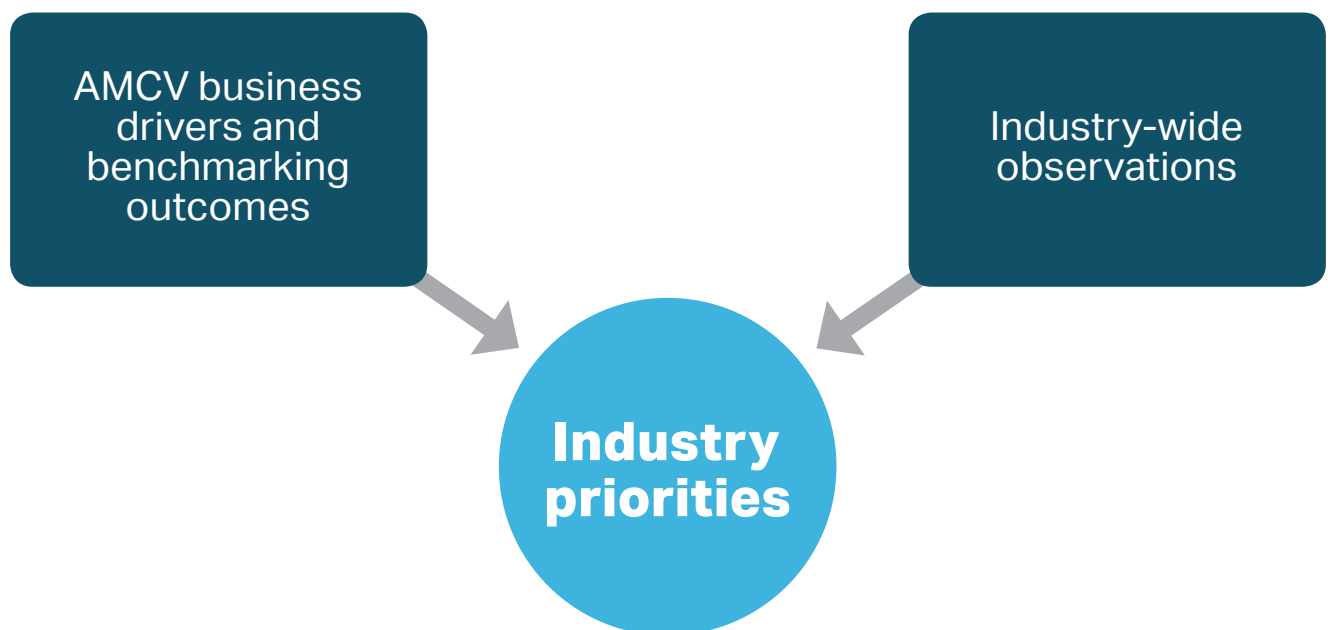


Figure 8: Schematic of inputs that have been used to determine the industry priorities.

7.2. Industry trends

Utilities and water services providers in today's market are facing a number of challenges that will drive change in the approach to asset management. Increasing demand due to population growth, regulation, delivery of service, scarcity of traditional water supplies and pressures on energy resources, and aging infrastructure are raising the unit price of water, electricity and wastewater. Climate change is expected to have an impact on the operations of all utilities. Such examples include drought on water supplies, extreme rainfall events exceeding stormwater capacity, greater demand on our electricity networks during heatwaves or events of extreme cold weather and damage to electrical transmission lines during storms and bushfires³.

Water and electricity are considered to be basic necessities. Government and community pressure means that water and energy prices must be kept low. The scope to increase revenue to offset increasing costs is limited. Utilities have to work their assets smarter and more efficiently to account for increasing demand of capital. Adding to this challenge, and indeed to asset management of all infrastructure, is the shift worldwide in population demographic.

Many countries are seeing a decline in the proportion of the population that are working adults⁴. By 2050, 23% of the Australian population is predicted to be aged 65 or over⁵. Similar predictions are being made for New Zealand, the USA, Canada and the UK, and more than 28% of Japan's population is expected to be 65 years or over by 2050⁶. As a result, government tax funding will be supported by a smaller pool of the population, and competing priorities for government funding to support the growing elderly population is expected to see a general decline in government investment in infrastructure as a whole⁶. The gap between the available capital to be spent on water and energy infrastructure and the actual capital needed is only expected to increase in the future⁷.

Coming from these challenges we expect the following six trends to play a key role in asset management of infrastructure assets by utilities and in the industry as a whole.

1. Customers at the heart of business

Historically communication between utilities and customers has been limited to the bill, usage restriction requirements (e.g. water restrictions during the millennium drought in Australia) and notification of service disruptions for maintenance. Increasing expectations from consumers^{8,9}, coupled with the introduction of regulation to increase standards of customer service is leading to greater engagement by utilities with their customers as there is a shift in focus to place the consumer at the focus of their business¹⁰. Utilities are increasingly seeking to target how and where their services are being delivered, opportunities for improvement, as well as increase the visibility of their service to their consumers⁸. There is a drive to be seen as a safe and reliable service provider by consumers, and this is expected to come about through increasing communication by utilities⁹. In the face of this change there will be a rise in demand to provide improved customer service with minimal cost, such as self-service, and deployment of customer service staff when and where they are needed¹⁰.

This change will focus on minimising service disruptions, actively communicating planned and unplanned service disruptions to consumers, and provide greater transparency in business practices and decisions. This will see the rise in the use of digital communication platforms to allow for updates to consumers in real time. This will manifest as an increased uptake of advanced metering infrastructure (AMI), or "smart meters" to capture data in real time.

3 Engineers Australia, "Infrastructure Report Card," Engineers Australia, 2010.

4 PwC, "Asset Management 2020: A Brave New World," PwC, 2013.

5 U.S. Census Bureau, "International Population Reports P95/16-1: An Ageing World: 2015," U.S. Government Publishing Office, Washington, DC, 2016.

6 Department of Infrastructure and Regional Development, "Trends; Infrastructure and Transport to 2030," Australian Government, 2014.

7 Economic Development Research Group Inc., "Failure to Act: The Economic Impact of Current Investment Trends in Water and Wastewater Treatment Infrastructure," American Society of Civil Engineers, 2011.

8 Deloitte, "State of the Water Sector Report," Australian Water Association, 2015.

9 Black & Veatch, "2016 Strategic Directions: Water Industry Report," Black & Veatch, 2016.

10 Deloitte, "Water Tight 2.0: The top trends in the global water sector," Deloitte, 2016.



2. Affordability and working smarter

A trend in decreasing water and electricity consumption, largely through the use of more water and energy efficient appliances, urbanisation, government regulation, and greater conservation efforts by individuals (e.g. installation of home solar panels or water tanks), is leading to a decrease in revenue to water and electricity utilities as costs to deliver service increase. Ageing infrastructure and increasing regulation are increasing the cost of doing business, meaning asset owners have to work, and spend, smarter^{7 8 11}. Increased costs cannot always be passed on to the consumer as the price of energy, water and wastewater services is regulated by government bodies in some areas¹⁰. Even so, the prices of water and energy, and whether they need to be changed, are recurring subjects in the industry^{8 9}.

In a recent survey of Australian water sector professionals it was found that 32% of urban and 26% of rural water sector professionals found the price of water to be too low⁸. This reflects opinions in other geographies, such as in the USA, where the price of water is considered by industry to be far too low⁹. A survey of the energy sector found that 'pricing and margin enhancement' was considered to be of high importance for respondents for the future delivery of their business¹². Another survey in 2013 found that the vast majority of Australian consumers (84% nationally) consider electricity prices to be too high¹³, coinciding with an increase in electricity prices to accommodate an increased spend on ageing infrastructure¹⁴.

Water and energy utilities are increasingly finding that they must do more with less^{9 15}. The increasing emphasis on low lifecycle costs and risk management will see the uptake of asset management practices and technology in order to reduce operational costs without compromising service delivery¹⁶.

3. Regulation and uptake of asset management practices

A shift in focus of infrastructure owners to maximise the performance of existing assets will result in a need for improved asset management practices. Infrastructure owners are keen for their assets to not only reach their intended design life, but to increase efficiency in the running of their assets^{17 10}. These efficiencies may include reduced costs, better use of resources (e.g. personnel, energy sources), better planning of renewal and use of future funding/revenue streams. This trend is also being reflected in the construction of new assets, with greater emphasis on lifecycle costs as opposed to traditional capital cost.

There is an increasing trend worldwide by government bodies to regulate and mandate minimum asset management requirements for infrastructure asset owners¹¹. Such examples include the regulating Office of Water in the UK, the Local Government Act in New Zealand, MAP-21 (Moving Ahead for Progress) federal legislation in the USA, and the introduction of the Asset Management Accountability Framework (AMAF) in Victoria, Australia.

Increasing regulation will lead to an increase in the uptake in asset management practices, driving improved asset management outcomes. We are likely to see increasing efforts by asset owners to benchmark their asset management performance against relevant government requirements as well as ISO 55001:2014. Larger and more mature asset owners are likely to seek certification against ISO 55001:2014, whereas smaller and less mature asset owners are expected to only adopt a smaller, more manageable, number of practices at a time (i.e. "aligning" their practices). Tailored asset management plans are set to become more common as asset owners begin to adopt asset management practices within their organisations.

11 Institute of Public Works Engineering Australasia, "International Infrastructure Management Manual," Institute of Public Works Engineering Australasia, 2015.

12 PwC, "14th PwC Global Power & Utilities Survey. A different energy future; Where energy transformation is leading us," PwC, 2015.

13 Energy Efficiency Council, CHOICE & Brotherhood of St Laurence, "Survey of Community Views on Energy Affordability - Australia," Energy Efficiency Council, 2013.

14 C. Tran, "Worldwide electricity prices: How does Australia compare?," Australian Energy Council, 28 April 2016. [Online]. Available: <https://www.energycouncil.com.au/analysis/worldwide-electricity-prices-how-does-australia-compare/>. [Accessed 23 November 2016].

15 Infrastructure Australia, "Infrastructure Australia Audit: Our Infrastructure Challenges; Report - Volume 1," Infrastructure Australia, 2015.

16 McGraw Hill Construction & CH2M HILL, "Water Infrastructure Asset Management: Adopting Best Practices to Enable Better Investments," McGraw Hill Construction, 2013.



4. Utilising big data

Worldwide, water utilities have been increasing the amount, and variety, of data they are collecting¹⁰, which is a global trend in the asset management market as a whole^{4 18}. This is only expected to increase with the implementation of AMI, but is also being seen in greater condition assessment campaigns by asset owners.

Asset owners will have access to a greater choice of asset management systems, and increased competition in the market will drive down prices. As a result smaller asset owners previously priced-out of expensive asset management information systems will begin to have access to systems that will assist in the collection and analysis of their data.

However, understanding what data to collect, what to do with it, and how, is key. Asset owners will need to find ways to leverage their data into clear business outcomes. The aim of collecting data should be to improve or develop a clear and informed process for making business decisions regarding reactive and proactive asset management¹⁰. Use of data and analytics can lead to monitoring of assets in real time, facilitating to real-time communication and allowing decisions on the management of assets to be informed¹⁷. Collection, analysis and modelling of data can provide insights to improve that may previously have not been possible and allow for clear predictions of future needs allowing for increase in operational efficiency through proactive maintenance and infrastructure planning^{10 17}. By setting out a clear decision making process, the reasons behind business decisions can be readily communicated and defended under scrutiny from regulators and consumers⁴.

¹⁷ KPMG, "Foresight; A global infrastructure perspective," KPMG, 2016.

¹⁸ Infrastructure Asset Management Exchange, "Infrastructure Asset Management Report," The Institute of Asset Management, London, 2015.



5. Conservation, increasing demand, and the role of technology

Urbanisation and population growth^{10 3} are placing a strain on water supplies. In order to continue to provide services expected by consumers the planning and investment in alternate water sources and how they will feed into the current infrastructure is crucial. Examples of alternate water supplies include natural sources (rivers, lakes), recycled water, urban stormwater and desalination⁸.

Increasing pressure worldwide on governments to meet clean energy targets is mandating a shift away from the use of fossil fuel power stations to renewable energy and is seeing a massive step-change in the way power is generated and delivered to market^{19 20 21}. The continual decrease in the cost of solar energy and government incentives (such as the Solar Panel Rebate in Australia and the extension of the Investment Tax Credit for solar in the USA) has also seen an increase in the uptake of residential solar panels and micro-grid technology^{22 23 24}
19 22.

The potential impacts on water and energy quality (both for processing by the utility and to the consumer), infrastructure durability (e.g., effect of water chemistry on existing pipes, longevity of solar panels maintained by home owners or other non-utility entities) and the cost of implementation are challenges that need to be considered^{9 10}. To prevent or delay the need for alternative sources requires effective management of existing sources. Conservation and demand

management are important but these have direct impacts on the revenue of a utility.

The drive to conserve existing resources, utilise alternative resources and minimise wastage is expected to see a rise in the use of technology. A prime example of this is the use of smart meters, already implemented in the energy sector, which allow utilities and consumers to track consumption in real time, and improved detection of faults to expedite restoration of service following outages. A similar use of these in the water sector is expected to see marked improvements in service to consumers, as well as improved detection of pipeline leaks for timely repair, which will minimise revenue loss, environmental impacts and water loss¹⁰. Other technologies set to change the water sector include improved membrane technology for water filtration (broadening the scope of potential alternate water sources) and strategies to use sludge (the by-product of water treatment) as an energy source to offset electricity costs¹⁰.

The use of data and technology in asset management as well as interconnections between technologies used (e.g., SMART cities) are going to see an increase in the risk of cyber-attacks on infrastructure assets. For this reason cyber security is a growing concern that will see the need for more sophisticated IT systems and risk management practices^{25 17}.

19 AECOM, "Australia's Off-Grid Clean Energy Market; Research Paper," Australian Renewable Energy Council, Sydney, 2014.

20 AECOM, "New Global Analysis Reveals Extent of Trend to Cleaner Energy," AECOM, 2015. [Online]. Available: <http://www.aecom.com/us/press/new-global-analysis-reveals-extent-of-trend-to-cleaner-energy-2/>. [Accessed 23 November 2016].

21 Infrastructure Australia, "Australian Infrastructure Plan; The Infrastructure Priority List; Project and Initiative Summaries," Australian Government, 2016.

22 H. Saddler, "Power Down; Why is electricity consumption decreasing?," The Australia Institute, 2013.

23 S. Lozanova, "5 Solar Energy Trends for 2016 in the Residential Market," Triple Pundit, 7 January 2016. [Online]. Available: <http://www.triplepundit.com/2016/01/5-solar-energy-trends-2016-residential-market/>. [Accessed 23 November 2016].

24 C. Nunez, "Solar Energy Sees Eye-Popping Price Drops," National Geographic, 2 October 2015. [Online]. Available: <http://news.nationalgeographic.com/energy/2015/10/151002-solar-energy-sees-eye-popping-price-drops/>. [Accessed 23 November 2016].

25 The Institute of Asset Management, "State of the Infrastructure Industry," The Institute of Asset Management, 2016.

26 World Economic Forum, "The Future of Electricity; Attracting investment to build tomorrow's electricity sector," World Economic Forum, 2015.

27 Economic Development Research Group Inc, "Failure to Act; The Impact of Current Infrastructure Investments on America's Economic Future," American Society of Civil Engineers, 2013.



Brisbane River, Qld, Australia

6. Competition in infrastructure investment

Globally USD 6.7 trillion needs to be invested into the water sector by 2050¹⁰. Similar estimates by the International Energy Agency (IEA) estimate that an investment of USD 7.6 trillion will be needed by OECD countries by 2040²⁶. In the US alone, the predicted gap between available funding and funding required by 2040 for upgrades of water and wastewater infrastructure is expected to be USD 143.7 billion⁷, and USD 4.7 trillion for all infrastructure²⁷. Note that this picture has a level of regional dependency. The level of renewals is not the same in all regions, nor is the approach and need for public sector investment consistent. It is telling that the North American region participants rated 'aging infrastructure' as a far higher priority in the BDS than other regions.

It has been a common practice since the 1980s for public-private partnerships (PPPs) to fund and deliver infrastructure projects¹⁷. The benefits not only included the injection of capital, but the improvement in procurement and delivery of infrastructure projects by the private sector¹⁷. Competition for government funding for infrastructure is only expected to worsen as more assets reach the end of their design life and require more frequent maintenance and renewal works. Recent trends have seen the push to seek private investment for projects to compensate for the lessening in available funding from governments due to declining tax revenues from an aging population, increase of the pension age, and expenditure on healthcare services. All these conditions are projected to worsen in future^{6 7 9 28 16 18}. Asset recycling is set to increase globally as a way to unlock capital to fund new infrastructure projects²⁹. However, while this practice is highly effective it may

be an unreliable source of funding as it can become politicised due to public outcry over privatisation of national assets. Indeed, even new infrastructure projects can become politicised, which can deter potential private investors and prompt the establishment of independent infrastructure bodies³⁰.

There are projections for a significant increase in the volume of assets seeking investment by 2020 with predicted worldwide assets under management of around USD 101.7 trillion, up from USD 63.9 trillion in 2012⁴. With more equity entering the market, the competition to secure private investments in infrastructure is set also to increase¹⁷. This competition is expected to reduce investment returns on low-risk assets¹⁷, such as water and wastewater utilities. Investors may instead opt for higher risk higher return investments in emerging markets¹⁷. Government and public entities will need to make their projects more appealing should they wish to attract private investment by focusing on delivery over minimising risk¹⁷, and find more innovative ways to "value capture" on projects (e.g. improved and sustainable economic activity and population growth, improved accessibility, environmental improvements, etc.)^{17 30}.

28 Australian Government Productivity Commission, "An Ageing Australia: Preparing for the Future," Commonwealth of Australia, 2013.

29 Arcadis, "Third Global Infrastructure Investment Index 2016; The UK: Bridging the Investment Gap," Arcadis, 2016. 30 AECOM, "Value Capture Roadmap," Consult Australia, 2015.

30 AECOM, "Value Capture Roadmap," Consult Australia, 2015.

T. Gleeson, Y. Wada, M. Bierkens and L. van Beek, *Nature*, vol. 488, p. 197–200, 2012.

7.3. Future initiatives

Future improvement opportunities and initiatives were identified through a combination of:

- Business driver and business profiling survey results;
- AMCV assessments completed by participants;
- Onsite interviews with participants conducted by the verifiers, and
- Building on the 2012 program's industry improvement opportunities and a wider review of trends influencing utility and water services business and organisational needs.

When considering the 2012 and 2016 outcomes there have been a number of recurring themes with regard to present challenges and future focuses, particularly surrounding planning and forecasting maintenance and renewal of assets and documentation. The recurrence of these themes is indicative of the complexity and scope of these opportunities. Being able to confidently plan and forecast future operational and capital expenditure is invaluable for sound business performance, but is difficult and improvement is expected to be incremental. Accurate and informed decision making and forecasting of maintenance and renewal of assets is dependent on availability of information, quality of information, understanding the market (changes in current and future use), and an understanding of risk. Documentation of asset management processes supports this by outlining clear direction on the collection, storage and use of information to facilitate this process.

These opportunities align with trends in industry to increase the collection of data, utilise technology to capture and analyse information, and improve asset management processes. Improved planning of maintenance and renewal will also help to ease the pressure on capital currently faced by governments globally. Use of this data to support business decisions will also assist in transparent communication with customers and government regulators.

An appreciation of industry trends and these opportunities has been used to create the industry improvement initiatives in **Table 11**. Recurring themes found in ranked business drivers, areas for greatest asset management improvement amongst participants and the industry trends were used to identify these improvement initiatives. Each of the initiatives can be adapted to match a particular region's context and needs. These initiatives seek to:

1. Resolve a gap in performance between lower and higher performing participants;
2. Align with priority business drivers; and
3. Respond to industry trends.

Table 11: Industry-wide improvement initiatives

Improvement Initiative	Objective	Benefits	Key deliverables	Business Driver and Region
Advance industry competence in risk based, renewal planning	Improve the industry's ability to confidently forecast asset replacement and renewal costs and timing in a manner show clearly how to manage the balance between cost, performance, risk and investment optimisation	<ul style="list-style-type: none"> - Consistent 'good practice' industry approach to renewal planning - Ability to forecast based on limited data - Robust and defensible investment planning - Increased alignment to the ISO 55000 series. 	<p>Understand current challenges as well as good and leading practices.</p> <p>Compile good practice guidance material.</p> <p>Determine the optimal format for industry engagement and uptake of the material. This could be a decision support tool, a guideline or other interactive tool.</p> <p>Determine how to best achieve and assess industry competence. Identify ways to support continuous improvement including sharing of lessons learnt from the implementation of improvement initiatives.</p>	<p>Aging Infrastructure - North America and Japan</p> <p>Capital expenditure – North America and Japan</p> <p>Asset Criticality – Japan</p> <p>Affordability – Australia/New Zealand/ North America</p>
Enhance the maturity of succession planning and knowledge management processes in a utility context	Assist the utility industry in improving practices that retain institutional knowledge through formal efficient capture and transition processes	<ul style="list-style-type: none"> - Improved industry knowledge retention - Preparedness for the aging work force - Future – proofing utilities industry through effective succession planning 	<p>Develop a white paper on each topic of succession planning and knowledge management, including a compendium of good practice case studies.</p> <p>Derive and articulate the fundamental principles of establishing an enterprise wide knowledge management system.</p> <p>Develop a maturity road map to assist utilities in understanding how to implement good practice.</p> <p>Develop support materials to assist knowledge transfer.</p> <p>Assess currently available options and if needed develop materials to support implementation.</p> <p>Identify ways to assess the success of this initiative including the uptake of the guidance material to outline future improvements.</p>	<p>Succession Planning and Training – North America</p> <p>Knowledge Management and Decision Support Systems - All regions</p>

Improvement Initiative	Objective	Benefits	Key deliverables	Business Driver and Region
Guide the selection and evaluation of decision support applications	Enabling enterprise wide knowledge sharing that facilitates collaboration within utilities to enhance efficiency and customer value outcomes.	<ul style="list-style-type: none"> - Improved data analytics - Better management decisions - Enhanced ability to source data across the organisation. - Single source of the truth. - Improved ability to interact with customers. - Real time access to all data in the business. 	<p>Define the key principles and needs relevant to utility businesses for the selection and evaluation of decision support systems.</p> <p>Develop case studies of approaches regarding data analytics in service (e.g. banking) and asset intensive sectors (e.g. electricity).</p> <p>If needed, develop tools to assist water utilities with assessing their data analytics needs.</p> <p>Consider an industry approach to assessing and rating the usefulness of decision making tools.</p>	Knowledge Management and Decision Support Systems - All regions
Guide the definition and projection of customer expectations and levels of service in utilities	Guide utilities on processes and practices for customer engagement and involvement in setting and projecting levels of service, and subsequently measuring and implementing the levels of service objectives.	<ul style="list-style-type: none"> - Higher customer satisfaction. - Enhanced ability to engage with customers. - Clear understanding of the customer value proposition driven by customer needs and expectations. - Improved ability to negotiate with regulators for better customer outcomes. 	<p>Develop a model or articulate pathways through case studies of how to effectively translate customer needs and wants into level of service objectives across the businesses.</p> <p>Work to define customer metrics that relate to customer expectations, to drive better customer outcomes.</p> <p>Examine defining business metrics that underpin the delivery of customer service levels throughout the value chain.</p> <p>Evaluate how customers' expectations impact asset management practices and costs.</p> <p>Have a process to review the documents produced and refine them using industry feedback.</p>	Customer focus and Invited stakeholder comment – Australia and New Zealand

Improvement Initiative	Objective	Benefits	Key deliverables	Business Driver and Region
Review leading edge customer engagement approaches in the utilities sector	Inform and inspire the utility industry on what can be achieved using 'state of the art' customer engagement approaches.	<ul style="list-style-type: none"> - Future-proofed industry. - Technology leverage. - Thought leadership. - Customer satisfaction and engagement 	<p>Assess the current tools and techniques available for customer engagement in terms of their suitability and effectiveness within the water sector.</p> <p>Develop a state of the industry report/white paper of current approaches, highlighting leading practice.</p> <p>Generate clear criteria that would assist utilities becoming an informed user and purchaser of customer engagement approaches and technology.</p> <p>Consider developing a web portal that provides useful information and where organisations can share their experiences.</p>	Technology for customer interaction – Australia and New Zealand
Enhance value capture from infrastructure investments and overcome barriers to encourage financing for asset delivery and renewals	Provide incentives and confidence to utilities on dealing with the private sector to encourage innovative ways to maintain desired service levels and performance	<ul style="list-style-type: none"> - New revenue models to deliver services. - Financial sustainability and flexibility. - Efficiency through competition. - Suite of methods for capturing community and wider economic benefits that can demonstrate investment value. 	<p>Develop a needs based understanding of the likely capital constraints for each region.</p> <p>Use this understanding of capital constraints to define knowledge gaps and options for addressing the areas of value capture, valuing intangibles and barriers to investment.</p> <p>Undertake projects as necessary to address local knowledge gaps and develop tools/approaches for specific issues.</p> <p>Share project outcomes and lessons learnt across utilities.</p>	Affordability – Australia/New Zealand/ North America



Appendix A

Project Overview and
Scoring Methodology



Appendix A:

Project Overview and Scoring Methodology

Project approach

The 2016 AMCV assessment was carried out either as a self-assessment by the participant or a facilitated self-assessment. These are explained below.

Self-assessment: Each utility participant was responsible for their own self-assessment against the AMCV measures. These self-assessments were independently verified by an external party.

Facilitated assessment methodology: Independent consultants provided support through on-site meetings, evidence reviews, scoring and survey data entry. Each measure was discussed with relevant participant personnel at facilitated workshops.

AMCV tool overview

In 2016, for the first time, AMCV was delivered via an online interactive platform (<https://app.amcv.wsaa.asn.au>). WSAA's AMCV tool is now internationally recognised and applicable to any industry and sector globally that undertakes asset management. The WSAA AMCV Framework is based around seven core functions covering the asset lifecycle from its conception (planning) to ultimate replacement, fitted within an organisational context of corporate goals/policy and business support systems. For AMCV 2016 the benchmarking tool was updated to reflect international trends in asset management and growing industry expertise. It assists organisations to identify ways to deliver business and customer value by working through seven key functions of asset management.

Within the tool the seven core functions are subdivided into some 49 processes, 209 sub-processes and further into 506 measures. Each measure is provided with a weighting to show its relative importance compared to other measures within a function. The AMCV tool facilitates scoring against each measure on both process capability and process execution, and aggregates the maturity score up to the function level.

Project Approach

February 2016
Training of participants.
March - July 2016
Business driver and profiling survey across all participants.
April - July 2016
Participant assessments using the AMCV tool.
May - August 2016
Verification of assessment by AECOM.
October - November 2016
Draft Participant Reports
November - December 2016
Leading Practices Conferences and launch of Industry Report with Leading Practices Compendium
December 2016 - January 2017
Final Participant reports prepared and distributed

Verification of self-assessment

Following completion of the self-assessment an independent verification was carried out for each participant to ensure the accuracy and validity of the self-assessment scoring results.

An independent verification was carried out across all participants that undertake the self-assessment to ensure the accuracy and validity of the self-assessment scoring results. The verification was undertaken over a period of two-days by two verifiers. At the end of the two-days a brief presentation was made to senior/executive level staff to review the AMCV process and preliminary findings.

The purpose of the verification was to:

- Check a selection of the self-assessment results to ensure the assessment was reasonable.
- Ensure consistency of self-assessment across all participants in the AMCV project.
- Ensure that the results are fit-for-purpose for the benchmarking exercise.

A 20% sample of measures was chosen for the verification. The make-up and rationale for the selected measures is set out below.

1. 20 Core Measures:

- The most heavily weighted measures with the most point scoring impact are assessed and verified;
- Balancing this with ensuring that all Functions are represented in the core measures.

2. 20 Top Scoring Measures:

- The top 20 scoring measures (excluding the core measures) would be extracted from the self-assessment and verified.

3. 10 Low Scoring Measures:

- The lowest 10 scoring measures, calculated as a percentage of the achieved vs. possible score, would be extracted from the self-assessment and verified.

4. 8 Leadership and Customer Value Measures:

- Specific measures that were selected as they link to leadership and customer value.

5. 25 Highest Priority as indicated by Business Driver Survey:

- For each of the five top rated business driver **themes** as nominated by the participant, a set of five measures were selected for verification.

6. 10 Participant Selected Measures:

- 10 measures selected by the participant for their own reasons (i.e. they seek clarification, resolution of different opinions in their business, have deemed them to be highly important to the business (through selection of the star ratings in the AMCV tool), etc.)

7. Verifier Selected Measures:

- The verifier was able to select an additional 8 measures to challenge or further explore. The rationale included:
- The documentation supporting the claims were poor or missing
- The measure is possibly linked to a "leading practice" identified by the verifier
- The verifier uses experience or discretion to identify additional measures it would see use in assessing, based on the Business Profiling Survey, or other reasons.

AMCV linkages and partnerships in North America

The AMCV 2016 participants in North America have trialled a unique approach to the program that has included several linkages with two industry associations to help align the AMCV program with other North American programs and initiatives. A Tailored Collaboration Project was formed under the Water Research Foundation (WRF) with a steering committee comprising industry association representatives from WRF, the American Water Works Association (AWWA) and Water Environment Federation (WEF), along with utility leaders. The Project Advisory Committee was formed comprised of asset management individuals and expertise from Anchorage Water and Waste Water Utility, Tacoma Water, and private consultants. WSAA was a funding partner providing access to the AMCV project. Utility leaders from Portland Water, Metropolitan Council Environmental Services, DC Water, Toho Water, and Albuquerque and Bernalillo County Water Utility Authority made up the balance of the Steering Committee.

Guidance was provided through an initial workshop to provide initial direction and priorities for the North American effort. Regular reviews were conducted throughout the AMCV process, including oversight for an evaluation process and business case to assist in determining potential enhancements to benchmarking efforts in North America. It was provided as an additional component of the North American AMCV project.

Several initiatives were implemented that complemented the standard WSAA AMCV process and drove strong engagement with the North American industry. The approach highlighted the opportunities and reviewed the benefits of undertaking different levels of benchmarking simultaneously as it assessed AMCV scores against the considered results from Effective Utility Management (EUM) framework and participants were able to compare outcomes with the scores in the American Water Works Association (AWWA) Metric Benchmarking. Below is a brief description of the aspects North American approach. Outcomes from these additional initiatives have been included in the North American participants' individual reports.

1. ISO 55000 mapping

ISO 55000:2014 is the new International Standards Organization (ISO) International Standard for Asset Management. The suite of documents includes:

- ISO 55000 which provides an overview of the subject of asset management and the standard terms and definitions;
- ISO 55001 contains the requirements for an integrated, effective management system for asset management; and
- ISO 55002 provides guidance for the implementation of such a management system.

The development of these standards was accomplished with participation by representatives from 31 countries. The standard is outcomes and value driven (rather than being asset centric) and comprises 71 'shall' statements that define the principles and create impetus for value-driven asset management.

WSAA was engaged with utilities and consultants over the last couple years to align its own benchmarking process and measures with the new standard. The North American participants were provided with the AMCV scores presented against the ISO55001 'shall' statements. It was acknowledged that further work necessary to explore how best to use AMCV results in relation to ISO 55000 compliance and certification needs.

2. Effective Utility Management links

Effective Utility Management (EUM) was developed initially by the Association of Metropolitan Water Agencies, the American Public Works Association, the AWWA, the National Association of Clean Water Agencies, the National Association of Water Companies, the United States Environmental Protection Agency, and the Water Environment Federation (WEF) in order to promote effective utility management. This group identified ten attributes that effectively managed utilities focus on and what they strive to achieve. EUM has been widely accepted and adopted as a management framework in North America. The ten attributes are:

- Product Quality;
- Customer Satisfaction;
- Employee and Leadership Development;
- Operational Optimization;
- Infrastructure Strategy and Performance ;
- Enterprise Resiliency;
- Community Sustainability;
- Water Resource Sustainability ;
- Stakeholder Understanding and Support; and
- Financial Viability.

The AMCV measures were mapped to these 10 attributes and reports were generated displaying overall utility scores against each of the 10 attributes. The aim was to assist utilities in understanding the processes that influenced particular aspects of asset management. The long term outcome would be that by using the AMCV process benchmarking in this way it should be straightforward for participants to understand the actions they need to take to improve their EUM scoring.

3. American Water Works Association Benchmarking and assessing 'importance' and 'urgency' of different AMCV measures

AWWA conducts an annual survey of over 160 water, wastewater, and combined utilities. It is focused on metric performance and includes the collection and comparison reporting for more than 50 measures. It also collects profile information and business driver information. Participation is expanding, measures are regularly refined, and regional feedback is sought at conference workshops.

WSAA engaged with AWWA and its Benchmarking Committee to align the AMCV and AWWA business profile and business driver information, and additionally to map the AWWA metric measures to AMCV functions. North American AMCV participants were encouraged to also complete the AWWA benchmarking survey and process and to indicate the level of "importance" and "urgency" for addressing each of the AWWA metric indicators and AMCV measures. The outcomes of the AWWA metric mapping and the priority and urgency scores afforded to different AMCV measures were included in North American individual participant reports. Their value has been in providing additional input for the recommended utility improvements listed in the individual participant reports. Along with business drivers, maturity scoring, and comparisons with other utilities, the importance and urgency ratings helped identify priority areas of needed focus for addressing gaps and improvement opportunities, and could be considered in the future to help refine the weightings afforded to different AMCV measures.

Appendix B

Participants and Peer Groups

Appendix B:

Participants and Peer Groups

Project Participants

The project participant group of 44 organisations from the water and energy services sectors in Australia, New Zealand, Japan, USA, Canada and the UK is listed in **Table 12**.

Table 12: Project Participants

Region	Participant	Services provided
Australia & New Zealand	ActewAGL	Electricity
Australia & New Zealand	Auckland City Council	Stormwater
Australia & New Zealand	Barwon Water	Water & wastewater
Australia & New Zealand	Christchurch City Council	Water & wastewater & stormwater
Australia & New Zealand	City West Water	Water & wastewater
Australia & New Zealand	Coliban Water	Water & wastewater
Australia & New Zealand	Dunedin City Council	Water & wastewater & stormwater
Australia & New Zealand	East Gippsland Water	Water & wastewater
Australia & New Zealand	Gippsland Water	Water & wastewater
Australia & New Zealand	Gladstone Area Water Board	Bulk water
Australia & New Zealand	Goulburn Valley Water	Water & wastewater
Australia & New Zealand	Hunter Water Corporation	Water & wastewater & stormwater
Australia & New Zealand	Icon Water	Water & wastewater
Australia & New Zealand	Melbourne Water Corporation	Water & wastewater & stormwater
Australia & New Zealand	MidCoast Water	Water & wastewater
Australia & New Zealand	Power and Water Corporation – Power Services	Electricity
Australia & New Zealand	Power and Water Corporation – Remote Operations	Water & wastewater
Australia & New Zealand	Power and Water Corporation – Water Services	Water & wastewater
Australia & New Zealand	Queensland Urban Utilities	Water & wastewater
Australia & New Zealand	SA Water	Water & wastewater & stormwater
Australia & New Zealand	Seqwater	Water & bulk water
Australia & New Zealand	South East Water	Water & wastewater

Region	Participant	Services provided
Australia & New Zealand	Sydney Water	Water & wastewater & stormwater
Australia & New Zealand	TasWater	Water & wastewater
Australia & New Zealand	Toowoomba Regional Council	Water & wastewater
Australia & New Zealand	Unitywater	Water & wastewater
Australia & New Zealand	Wannon Water	Water & wastewater
Australia & New Zealand	Water Corporation	Water & wastewater & stormwater
Australia & New Zealand	WaterNSW	Water & bulk water
Australia & New Zealand	Yarra Valley Water	Water & wastewater
Japan	Sendai City	Wastewater & stormwater
Japan	Yokohama	Wastewater & stormwater
UK	South West Water	Water & wastewater & stormwater
North America	Albuquerque Bernalillo County Water Utility Authority	Water & wastewater
North America	DC Water	Water & wastewater & stormwater
North America	City of Vancouver	Wastewater
North America	Los Angeles Sanitation	Water & wastewater & stormwater
North America	Metropolitan Council Environmental Services	Water & wastewater
North America	Montgomery County Environmental Services	Water & wastewater
North America	Portland Water Bureau	Water
North America	Rancho California Water District	Water & wastewater
North America	Region of Peel	Water & wastewater
North America	Toho Water Authority	Water & wastewater
North America	Region of York	Water & wastewater

Peer Groups

In addition to the regional groups, peer groups were identified based on the following:

Utility size: (small, medium and large) based on population served, asset base, and total revenue. (Figure 12)

Services provided:

- Water only
- Wastewater only
- Water and wastewater
- Wastewater and stormwater
- Three waters, *i.e.* drinking, waste, and storm water services
- Stormwater only (only one participant so not included in Industry Report comparison for privacy reasons)
- Electricity only (only one participant so not included in Industry Report to preserve participant confidentiality)
- Electricity, water and wastewater (only one participant so not included in Industry Report to preserve participant confidentiality)

Ownership model:

- Government owned
- Government owned and run
- Public (only one participant so not included in Industry Report comparison for privacy reasons)
- Shareholder owned (only one participant so not included in Industry Report comparison for privacy reasons)
- Other

Operational structure:

- Corporation
- Internal department
- Council cooperative (only one participant so not included in Industry Report comparison for privacy reasons)
- Private Corporation (only one participant so not included in Industry Report comparison for privacy reasons)
- Other (only one participant so not included in Industry Report comparison for privacy reasons)

Level of regulation:

- Extensive - economic regulation of revenues and/or prices, and performance regulation of customer services and product quality
- Partial - regulation of service performance or standards but not economic regulation
- None/not mentioned (only one participant so not included in Industry Report to preserve participant confidentiality)

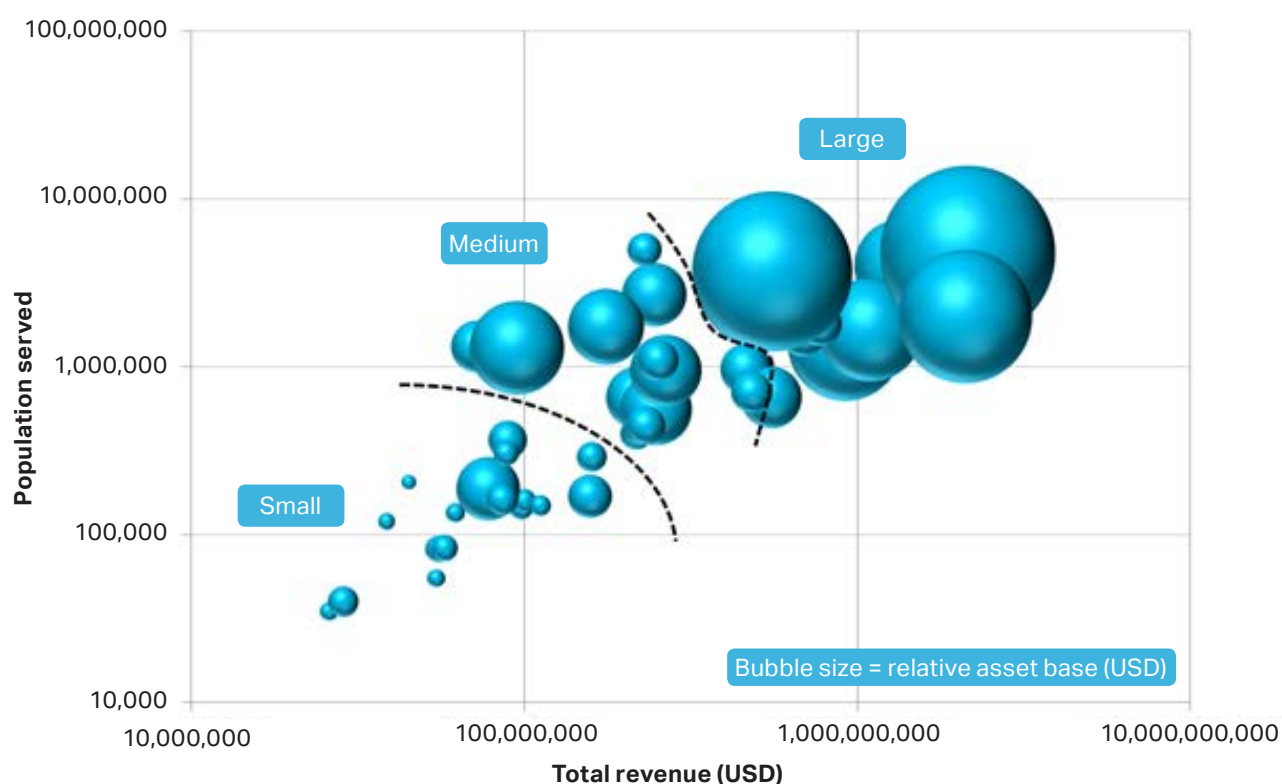


Figure 9: Peer group size categories

Each participant's categorisations are in [Table 13](#) below.

Table 13: Peer Group Categories

Peer group categories							
Participant	Size	Country	Region	Ownership model	Operational structure	Level of regulation	Services Provided
ActewAGL	Medium	Australia	Australia & New Zealand	Other	Corporation	Extensive	Electricity Only
Albuquerque Bernalillo County Water Utility Authority	Medium	United States of America	USA & Canada	Government owned and run	Corporation	None	Water and Wastewater
Auckland City Council	Medium	New Zealand	Australia & New Zealand	Government owned and run	Internal department	Partial	Stormwater only
Barwon Water	Small	Australia	Australia & New Zealand	Government owned	Corporation	Extensive	Water and Wastewater
Christchurch City Council	Small	New Zealand	Australia & New Zealand	Government owned and run	Internal department	Extensive	Three Waters

Peer group categories							
Participant	Size	Country	Region	Ownership model	Operational structure	Level of regulation	Services Provided
City of Vancouver	Small	United States of America	USA & Canada	Government owned	Internal department	Partial	Wastewater Only
City West Water	Medium	Australia	Australia & New Zealand	Government owned	Corporation	Extensive	Water and Wastewater
Coliban Water	Small	Australia	Australia & New Zealand	Government owned and run	Corporation	Extensive	Water and Wastewater
DC Water	Medium	United States of America	USA & Canada	Government owned and run	Corporation	Partial	Three Waters
Dunedin City Council	Small	New Zealand	Australia & New Zealand	Government owned and run	Internal department	Partial	Three Waters
East Gippsland Water	Small	Australia	Australia & New Zealand	Government owned	Corporation	Extensive	Water and Wastewater
Gippsland Water	Small	Australia	Australia & New Zealand	Government owned	Corporation	Extensive	Water and Wastewater
Gladstone Area Water Board	Small	Australia	Australia & New Zealand	Government owned	Corporation	Extensive	Water only
Goulburn Valley Water	Small	Australia	Australia & New Zealand	Government owned	Corporation	Extensive	Water and Wastewater
Hunter Water Corporation	Medium	Australia	Australia & New Zealand	Government owned	Corporation	Extensive	Three Waters
Icon Water	Medium	Australia	Australia & New Zealand	Government owned	Corporation	Extensive	Water and Wastewater
Los Angeles Sanitation	Large	United States of America	USA & Canada	Government owned and run	Internal department	Partial	Three Waters
Melbourne Water Corporation	Large	Australia	Australia & New Zealand	Government owned	Corporation	Extensive	Three Waters
Metropolitan Council Environmental Services	Medium	United States of America	USA & Canada	Public	Council cooperative	Partial	Wastewater Only
MidCoast Water	Small	Australia	Australia & New Zealand	Government owned and run	Internal Department	Partial	Water and Wastewater
Montgomery County Environmental Services	Small	United States of America	USA & Canada	Government owned and run	Internal Department	Partial	Water and Wastewater

Peer group categories							
Participant	Size	Country	Region	Ownership model	Operational structure	Level of regulation	Services Provided
Portland Water Bureau	Medium	United States of America	USA & Canada	Government owned and run	Internal department	Partial	Water Only
Power and Water Corporation – Power Services	Small	Australia	Australia & New Zealand	Government owned	Corporation	n/a	n/a
Power and Water Corporation – Remote Operations	Small	Australia	Australia & New Zealand	Government owned	Corporation	Partial	Electricity, Water and Wastewater
Power and Water Corporation – Water Services	Small	Australia	Australia & New Zealand	Government owned	Corporation	Extensive	Water and Wastewater
Queensland Urban Utilities	Large	Australia	Australia & New Zealand	Government owned	Corporation	Extensive	Water and Wastewater
Rancho California Water District	Small	United States of America	USA & Canada	Government owned and run	Other	Partial	Water and Wastewater
Region of Peel	Medium	Canada	USA & Canada	Government owned and run	Internal department	Extensive	Water and Wastewater
SA Water	Large	Australia	Australia & New Zealand	Government owned and run	Corporation	Extensive	Three Waters
Sendai City	Medium	Japan	Japan	Government owned and run	Internal department	Partial	Wastewater and Stormwater
Seqwater	Large	Australia	Australia & New Zealand	Government owned	Corporation	Extensive	Water only
South East Water	Large	Australia	Australia & New Zealand	Government owned	Corporation	Extensive	Water and Wastewater
South West Water	Large	United Kingdom	United Kingdom	Shareholder owned	Private Corporation	Extensive	Three Waters
Sydney Water	Large	Australia	Australia & New Zealand	Government owned	Corporation	Extensive	Three Waters
TasWater	Medium	Australia	Australia & New Zealand	Other	Corporation	Extensive	Water and Wastewater
Toho Water Authority	Small	United States of America	USA & Canada	Other	Corporation	Partial	Water and Wastewater
Toowoomba Regional Council	Small	Australia	Australia & New Zealand	Government owned and run	Internal department	Extensive	Water and Wastewater

Peer group categories							
Participant	Size	Country	Region	Ownership model	Operational structure	Level of regulation	Services Provided
Unitywater	Medium	Australia	Australia & New Zealand	Government owned and run	Corporation	Extensive	Water and Wastewater
Wannon Water	Small	Australia	Australia & New Zealand	Government owned	Corporation	Extensive	Water and Wastewater
Water Corporation	Large	Australia	Australia & New Zealand	Government owned and run	Corporation	Extensive	Three Waters
WaterNSW	Medium	Australia	Australia & New Zealand	Government owned	Corporation	Extensive	Water only
Yarra Valley Water	Large	Australia	Australia & New Zealand	Government owned	Corporation	Extensive	Water and Wastewater
Yokohama	Large	Japan	Japan	Government owned and run	Internal department	Partial	Wastewater and Stormwater
Region of York	Medium	Canada	USA & Canada	Government owned and run	Internal department	Extensive	Water and Wastewater

Appendix C

Business Driver Survey

Appendix C:

Business Driver Survey (BDS)

Introduction

In developing the BDS, inspiration was taken from the issues presented in a variety of international infrastructure industry publications including the ISO 55000 Asset Management series and the most recent Australian Water Association's State of the Sector and American Water Works Association's State of the Water Industry reports. Against each business driver statement the AMCV participants were asked two questions:

- a. How do you rate the importance of this driver in terms of how it will influence business decisions from now until 2020?

- b. How adequately do you rate your current business approach and preparedness to respond to this driver?

Answers were provided on a scale of 1-5, where 1 = 'not important/inadequately prepared', 2 = 'somewhat', 3 = 'moderately', 4 = 'very' and 5 = 'extremely' important/prepared'.

The business drivers were grouped into 10 themes as demonstrated below.

Business Driver Descriptions

Theme	Definition	Change in definition since 2012
Regulation and standards	Regulatory compliance New or changing service standards and levels of operational performance being approved and monitored by an external regulatory body in areas such as product quality, service reliability, customer response, or asset performance	No change
	Industry or business structural reform Significant reform such as new organisation formation, amalgamation, disaggregation, or sale	No change
	Business performance improvement requirements External or internal requirements for governance improvements, improved transparency in decision-making, improved level of commercial practice (e.g. corporations law), business risk management	No change
	Mandated long term asset planning There is a requirement for long-term asset management plans to be submitted and approved by an external regulatory body	No change
	New accounting standards New accounting standards are or will drive changes to processes, systems or external reporting	No change
	New asset management standards Either external or internal requirements exist to comply or align with international or national asset management standards or guides, such as PAS 55 or ISO 55000	No change
Financial	Affordability constraints Costs are or will be constrained as a result of customer requirements or affordability commitments, and/or willingness to pay for services provided	No change
	Demonstrating value for money External or internally set value for money criteria, which are driving or will drive capital and operating cost efficiencies and optimising cost, service level and risk management	No change
	Capital expenditure reduction/reduce debt A significant need to reduce capital expenditure or debt levels exists, or there is subjection to capital rationing/funding limitations requiring a high level of either capital prioritisation or improved justification, investment planning or decision-making in capital programs	No change
	Determination regulation of revenues and/or prices/rates New or changing economic regulation in the form of revenues or prices being determined (deterministic regulation) or recommended (recommendatory regulation) by an external regulatory body based on revenue/pricing submissions	Change in name only

Theme	Definition	Change in definition since 2012
Sustainability	Inter-generational equity Improvement is required in terms of balancing the economic, social and environmental outcomes for current and future generations	Change in name only.
	Climate change and environmental uncertainty Improved system resilience is required as a result of long term climate change, increasing uncertainty in natural events (floods, forest/bush fires, drought), or primary resource limitations	Modified - Minor adjustment to make relevant for all utilities (not just water)
	Reduce carbon emissions and resource lifecycle impacts and/or recover resources It is necessary or desirable to meet requirements to reduce carbon emissions or engage in carbon trading/pricing schemes, and/or to reduce other resource lifecycle impacts (e.g. materials and energy impacts as per ISO 14000, virtual water footprint as per ISO 14046, etc.)	Modified – to include other resource lifecycle impacts
Customer expectations and demand	Customer-driven service level improvement Service levels will be increased through customers leading in making their desires known with regard to areas such as service reliability (e.g. reducing repeat asset failures and customer interruptions), quantity (e.g. increased energy peak capacity or water pressure) or quality (e.g. improved aesthetic water quality, faster internet speeds)	Modified - Minor adjustment for clarification
	Your customer focus and invited stakeholder involvement A requirement of the organisation to engage with customers in the development of levels of service, definition of problems, creation of solutions and understanding of costs and trade-offs	Modified – To include development of levels of service.
Resources and service demand	Demand growth or primary resource limitations Significant increase is expected in demand (quantity) for services, or primary resources (other than water) are limited, driving a need for attention to demand growth planning, demand management, or considerations of new or more reliable resources	Modified – Minor adjustment to make relevant for all utilities (not just water)
	Reduction in demand for services Reduction in demand for some services (such as through population decline, or being usurped by other service demands [e.g. email's impact on the demand for postal services]), necessitating focus on service levels, asset rationalisation and disposal	Modified - Minor adjustment to make relevant for all utilities (not just water)
	Water resources For water provider utilities: Scarcity or change in water resource availability driven by climate variability, drought and/or population growth, driving a need for attention to demand growth planning, demand management, or considerations of new or more reliable resources; for non-water provider organisations: Changes in availability or allocations of water resources that currently enable your ability to provide a service or product, driving a need for attention to demand growth planning, demand management, or considerations of new or more reliable resources	New

Theme	Definition	Change in definition since 2012
Asset lifecycle management	Knowledge management and decision support systems Obsolete, unsupported, poorly integrated or incompatible information and management systems that inhibit organisation capability in analysis and decision-making, or, there are opportunities to adopt new technologies such as intelligent systems, mobile computing, etc. to collect, house and share information internally for asset management decisions and delivery	Combination of two previous drivers
	Evolving risk management approach and policy A review of the organisation's approach to risk management and a change in risk appetite will drive changes in the ways that decisions are made and how technical, financial, community, regulatory and other risks & opportunities are balanced to provide core services	New
	Increasing asset acquisition/capital delivery requirements Significant increase or major challenges in delivery of a capital program is or will demand attention to increased design and implementation capability, consideration of procurement mechanisms, quality control, project management or asset handover	No change
	Aging infrastructure Aging infrastructure and/or uncertainty in future renewal obligations will demand focus on asset replacement or renewal planning and potentially asset life extension	No change
	Asset criticality Significant asset risks, failures or incidents have been attributed to maintenance issues, or there is imbalance between reactive and planned maintenance requiring a renewed focus on asset maintenance programs	Change in name only.
	Decentralised service provision Service provider responses or external policy directions may require consideration of decentralised or other alternate management and service delivery approaches to increase reliability of service over asset lifecycle	New
Workforce evolution	Staff skills & experience retention during periods of change Increased capability and sustainability of the organisation's workforce and corporate knowledge management is required due to a changing external or internal environment (e.g. retiring workers, high staff turnover, outsourcing, restructure or similar)	Split one previous driver into two.
	Succession planning and training An aging or otherwise transient workforce will require a particular strategy to ensure that corporate knowledge and skills can be maintained	Split one previous driver into two.
	Safety culture Improvement in asset management is required as a result of an increased workforce and public safety focus, either through external or internal requirements	Change in name only.
	Sourcing and recruiting Efficiencies will be sought that will drive a review of the human resource models and structures used to deploy labour and undertake core functions of the business (e.g. insourcing vs. outsourcing)	New
Business resilience and continuity	Infrastructure/physical asset resilience and security Business decisions will be influenced by considerations of criticality and vulnerability of infrastructure to events that can have catastrophic consequences, including natural hazards and acts of sabotage	Modified
	IT and cyber-systems resilience and security Business decisions will be influenced by considerations of criticality and vulnerability of corporate knowledge and information, IT systems, and other elements of the business at risk of cyber security breaches	New

Theme	Definition	Change in definition since 2012
Efficiency and continual improvement	Continuous improvement commitments The organisation is driving internal continuous improvement programs to meet its own objectives for improved effectiveness and efficiency or to meet its own quality management systems requirements	No change
	Increasing competition, new market entrants The organisation competes for the right to manage the assets and provide services. Increasing competition will drive decision-makers to seek more effective, efficient and innovative solutions to meet customer desires and hold patronage	New
	Business growth A core business objective will be to profitably increase the organisation's share of the market and/or customer base as either the organisation service provider and/or in the asset management services spaces	New
Technology	Technology advancements and innovation – for customer interaction Change is driven by an opportunity to deliver smart metering, real-time information and electronic engagement platforms with customers to improve their experiences and the asset management and business outcomes	Split one previous driver into two.
	Technology advancements and innovation – for services delivery Change is driven by the need to adopt new technologies such as decentralised energy and water systems, more efficient processing systems, driverless car technology, etc. to continue to competitively and reliably provide the core customer service/s	Split one previous driver into two.



Appendix D

Detailed Data

Appendix D Detailed Data

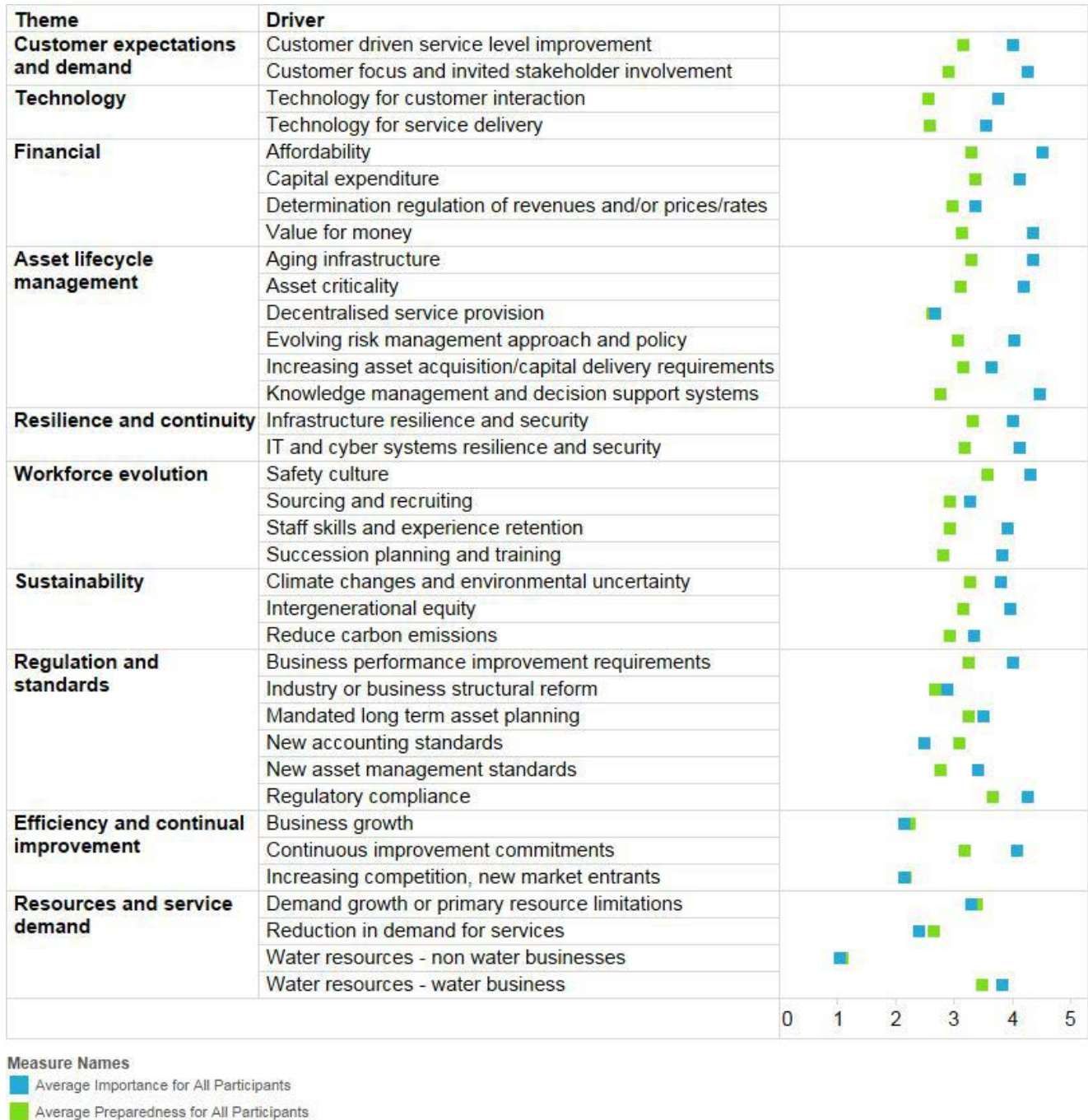


Figure 10: Average business driver 'importance' and preparedness' scores from all participants

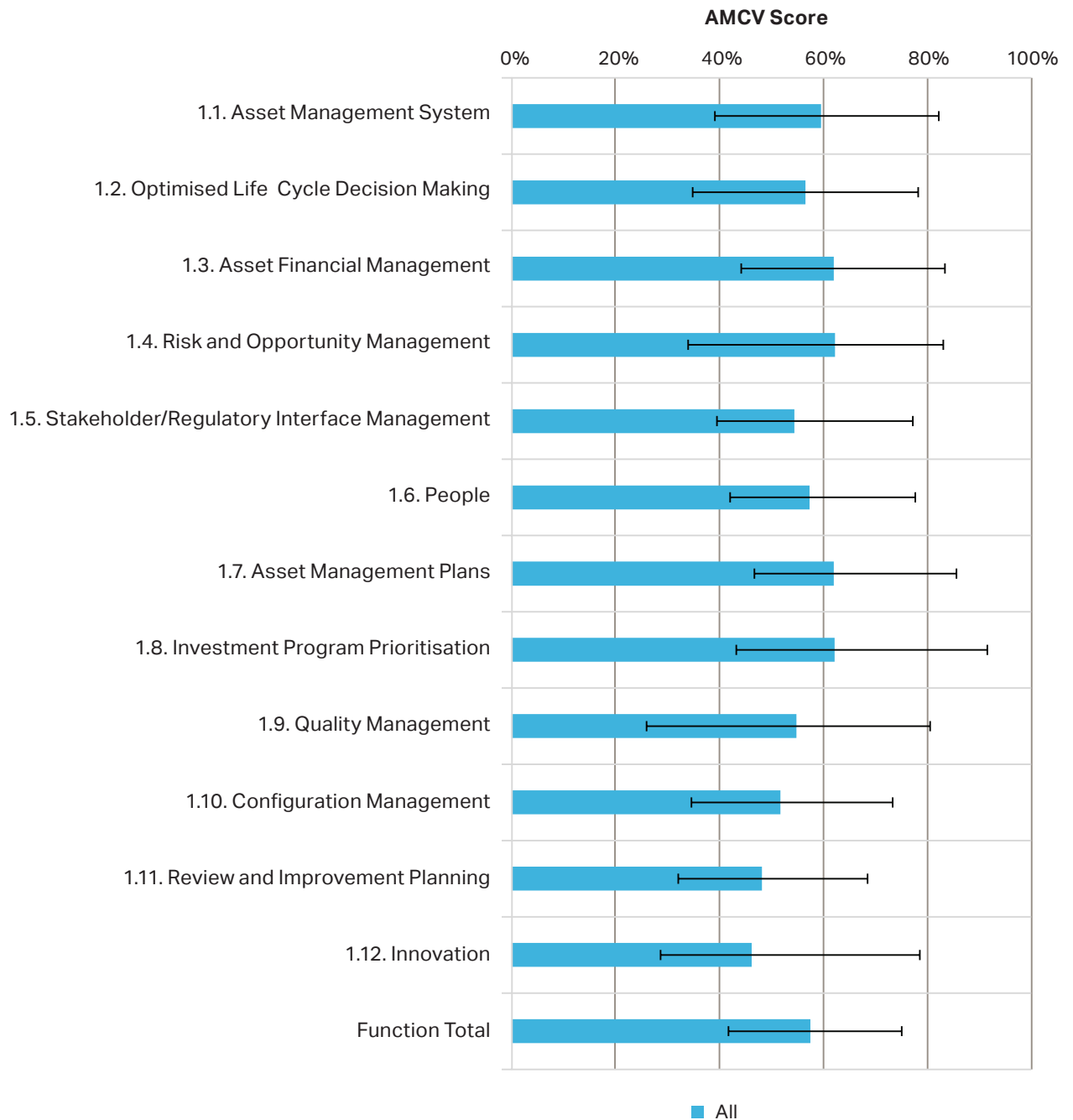


Figure 11: All 2016 participants' AMCV scores in Function 1 at the process level

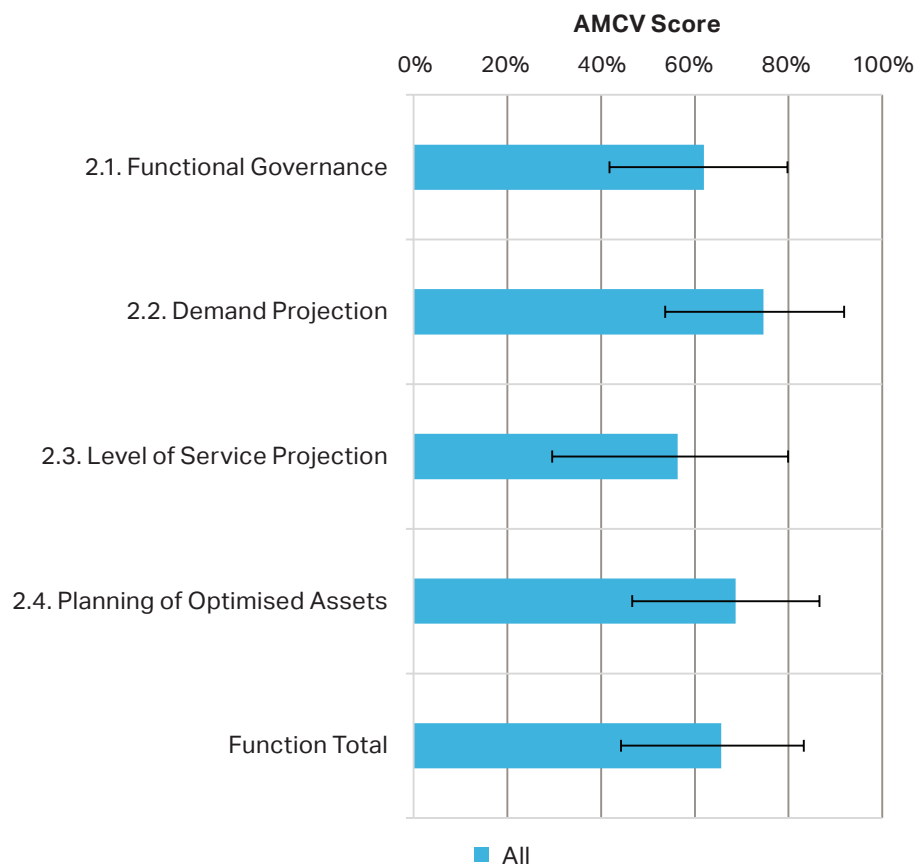


Figure 12: All 2016 participants' AMCV scores in Function 2 at the process level

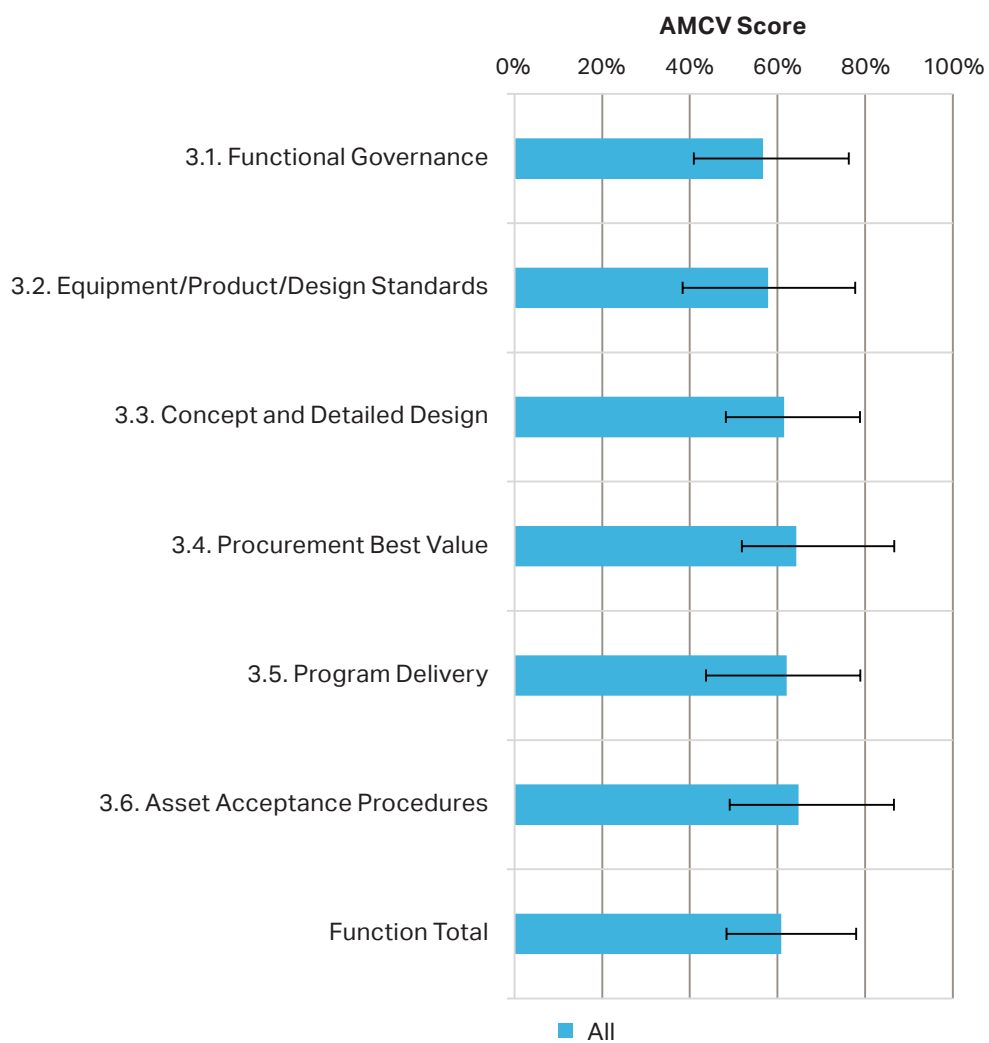


Figure 13: All 2016 participants' AMCV scores in Function 3 at the process level

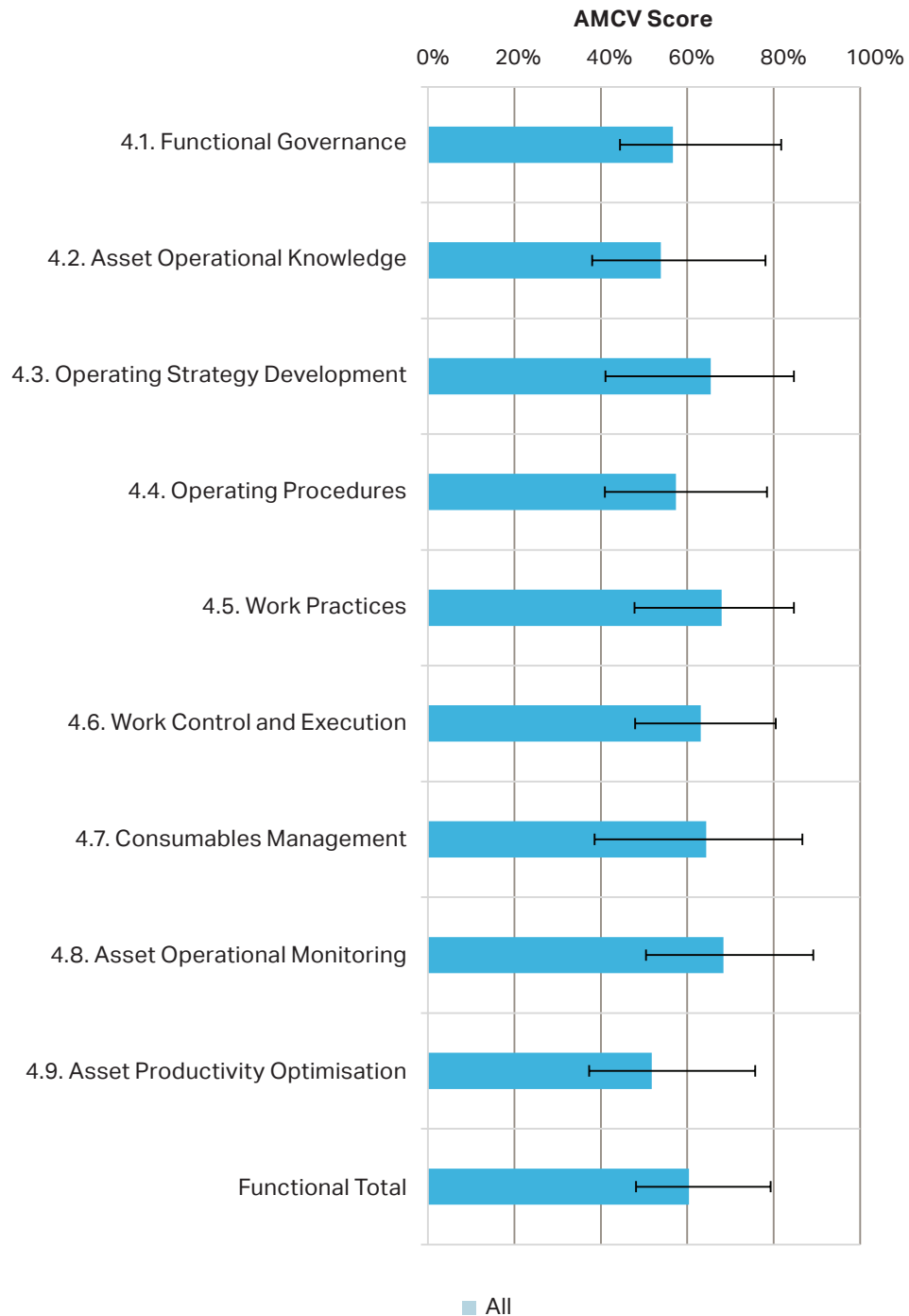


Figure 14: All 2016 participants' AMCV scores in Function 4 at the process level

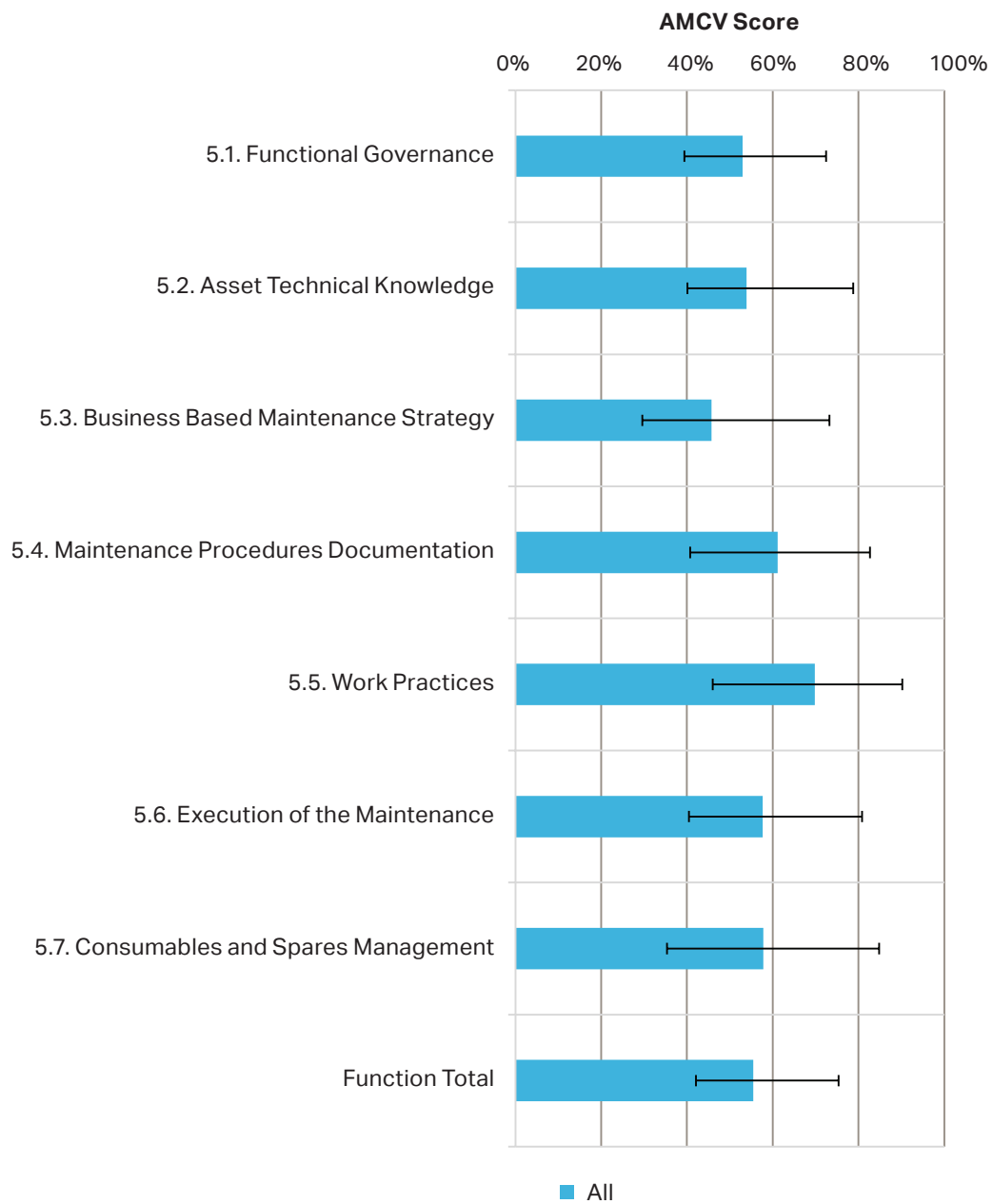


Figure 15: All 2016 participants' AMCV scores in Function51 at the process level

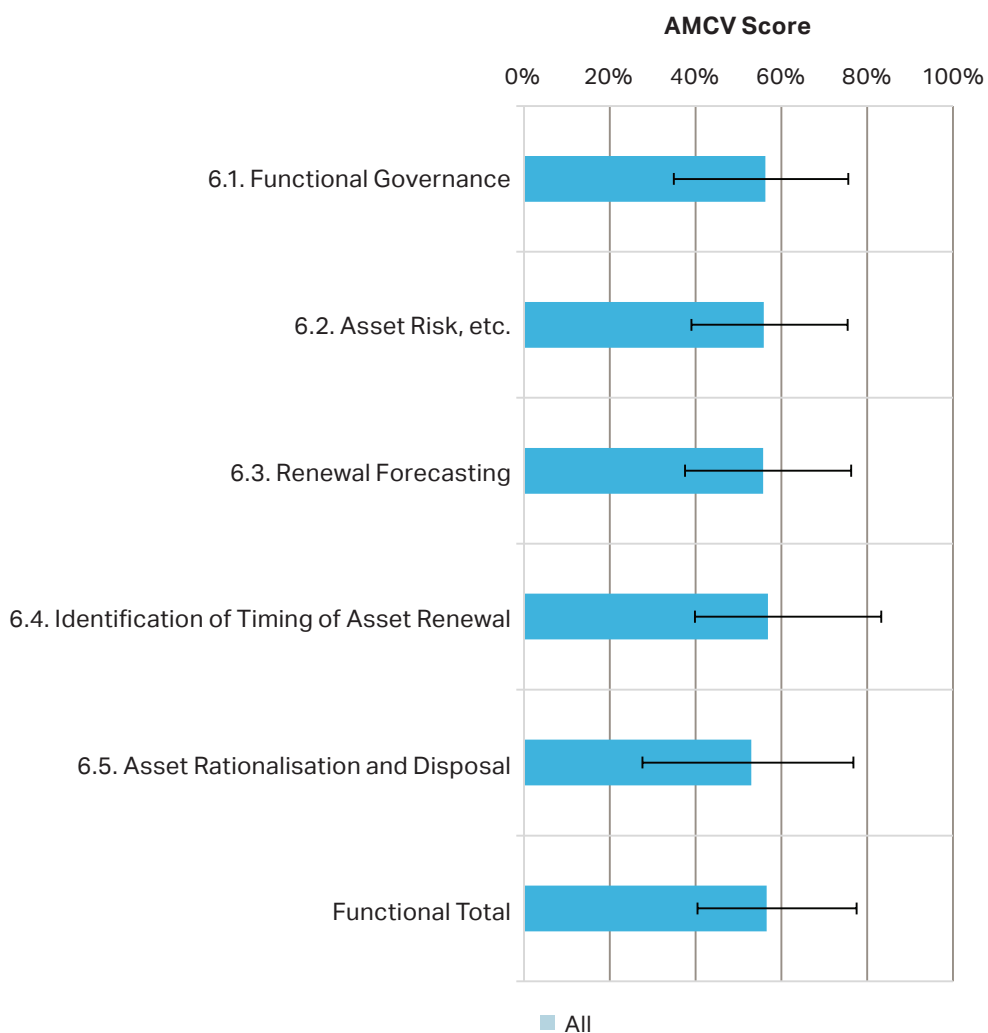


Figure 16: All 2016 participants' AMCV scores in Function 6 at the process level

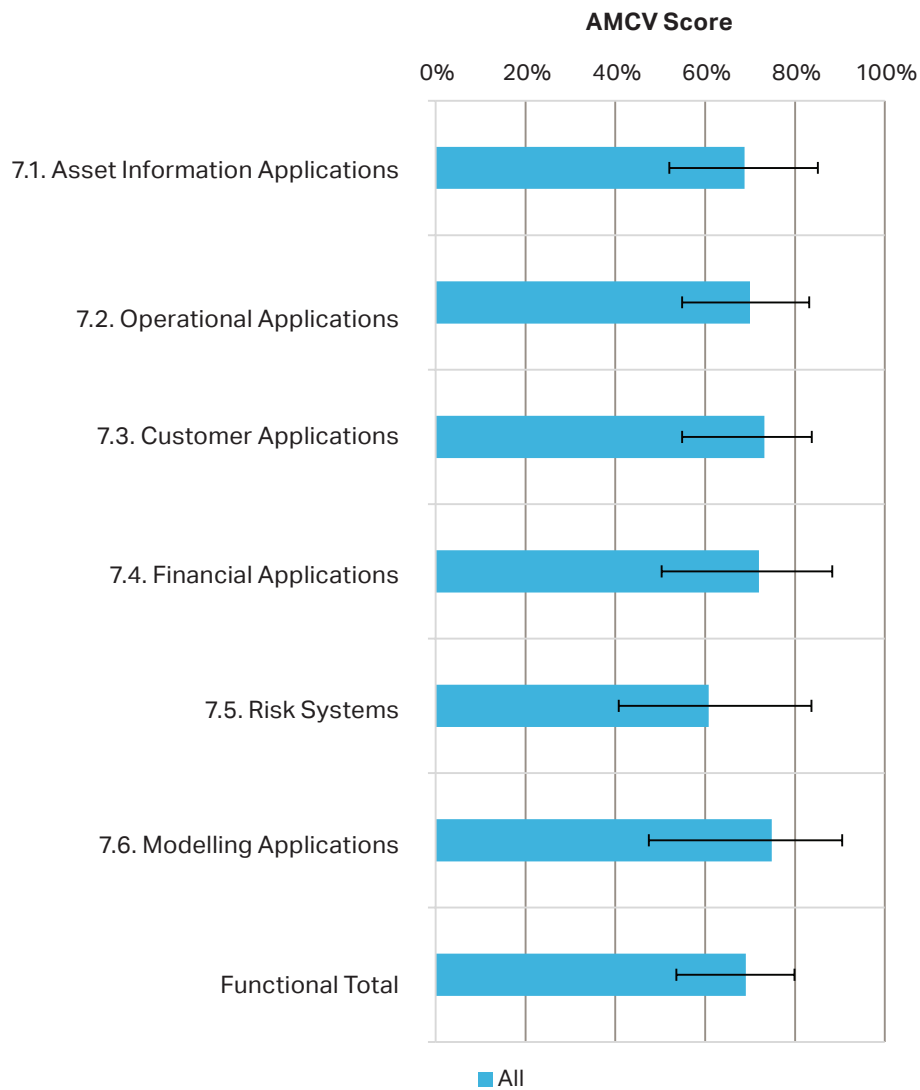


Figure 17: All 2016 participants' AMCV scores in Function 7 at the process level



Figure 18: Regional comparison of AMCV scores at the process level

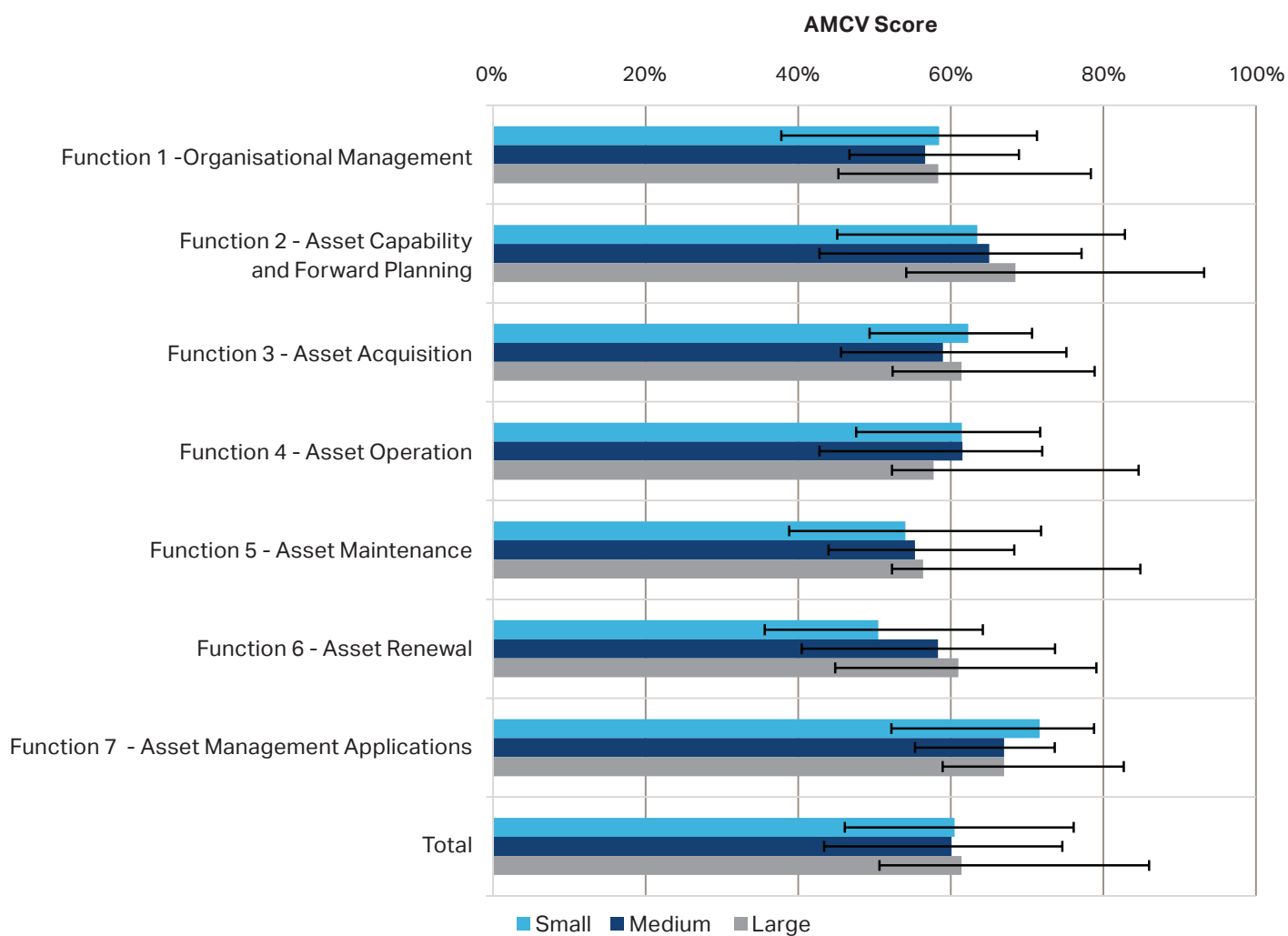


Figure 19: Peer group asset management maturity comparison by participant size at function level

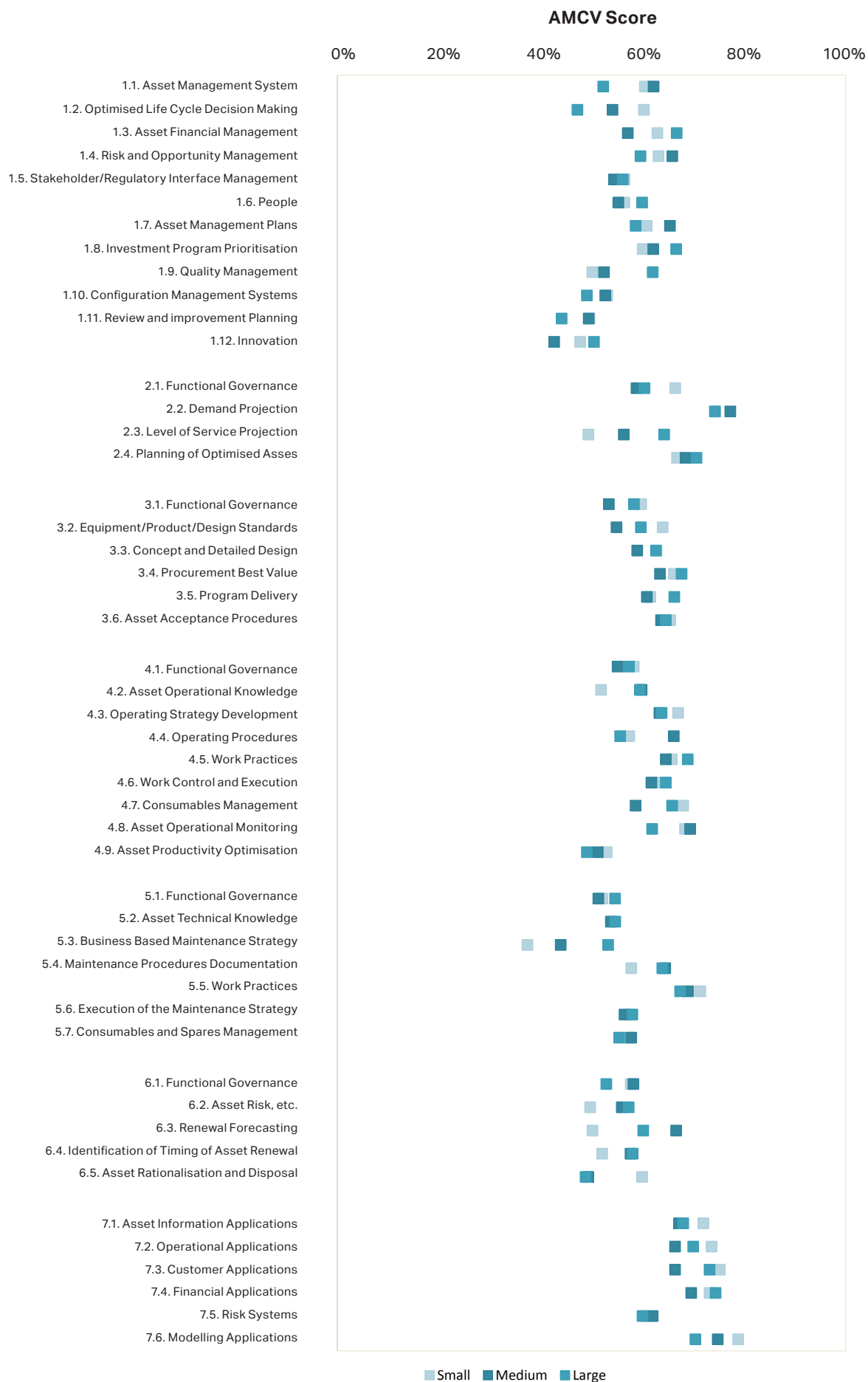


Figure 20: Peer group asset management maturity comparison by participant size at process level

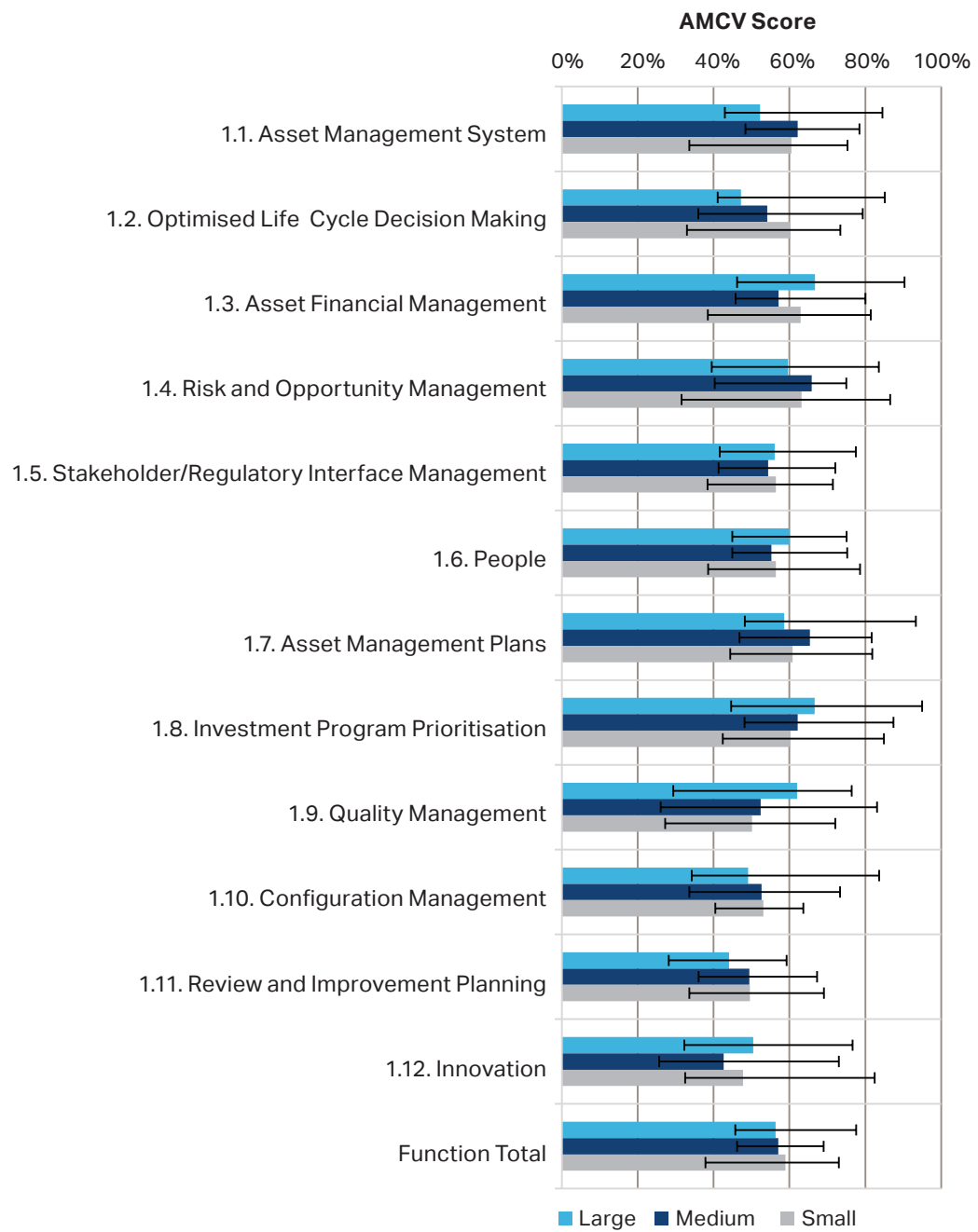


Figure 21: Peer group asset management maturity comparison by participant size for function 1 at process level

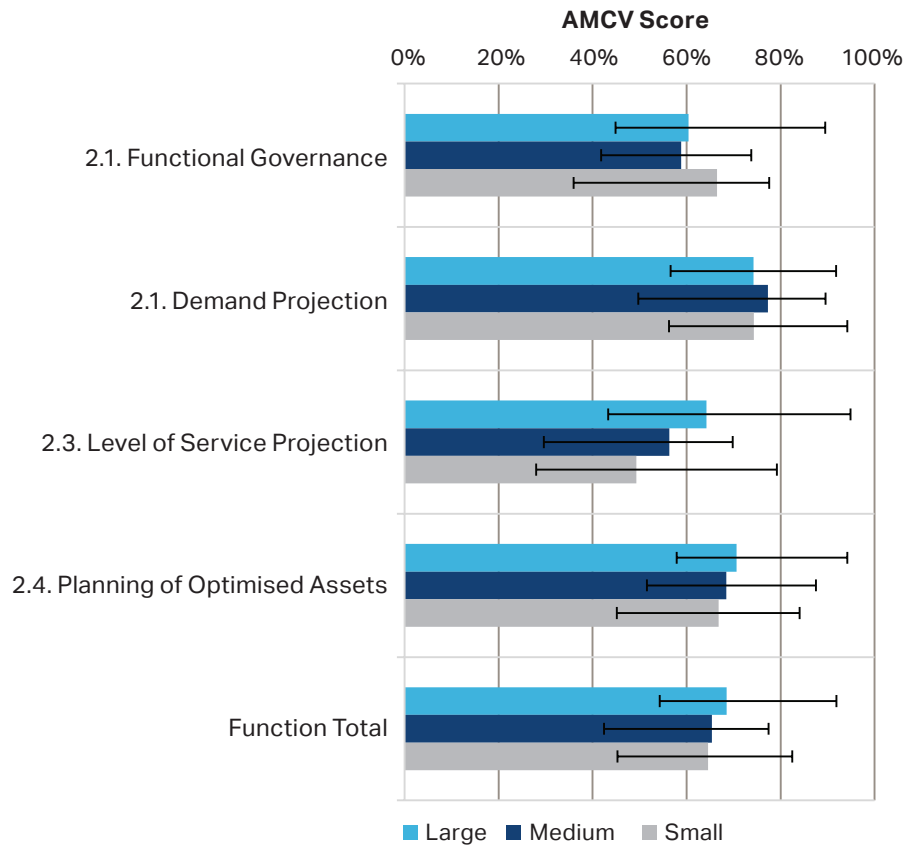


Figure 22: Peer group asset management maturity comparison by participant size for function 2 at process level

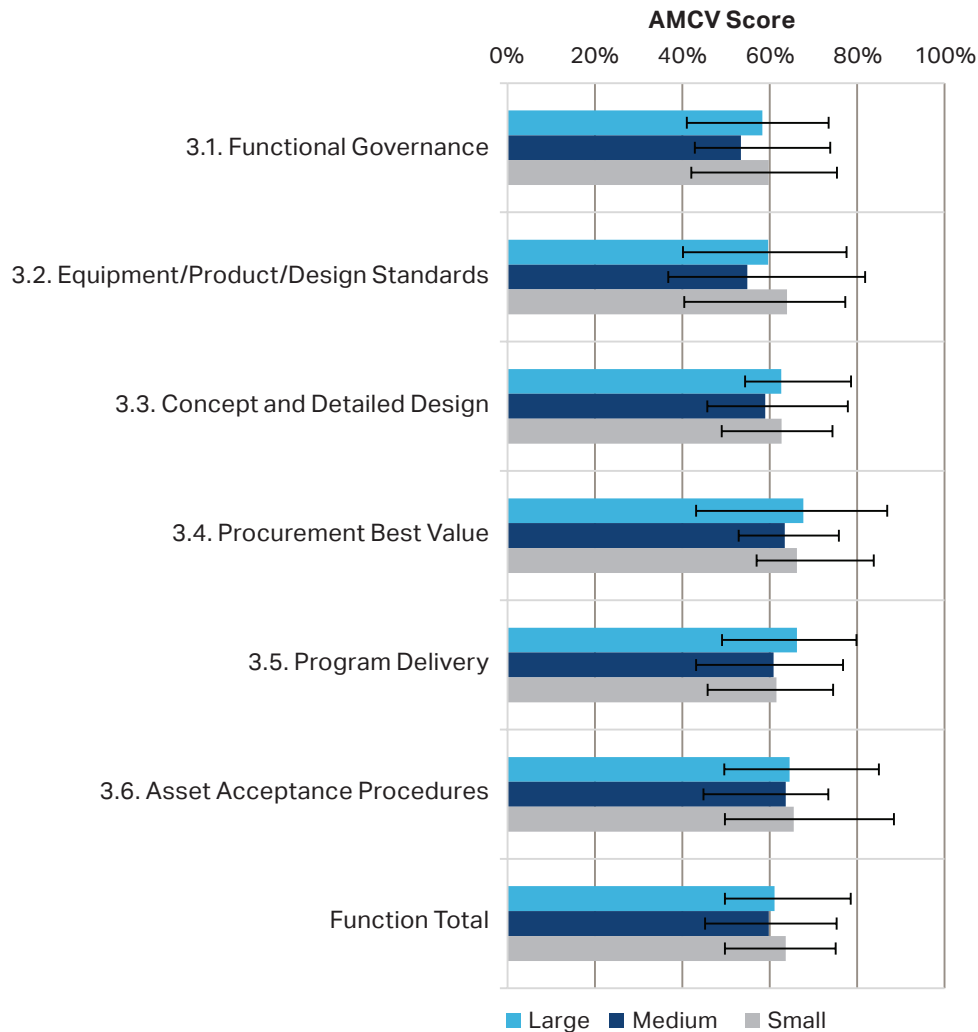


Figure 23: Peer group asset management maturity comparison by participant size for function 3 at process level

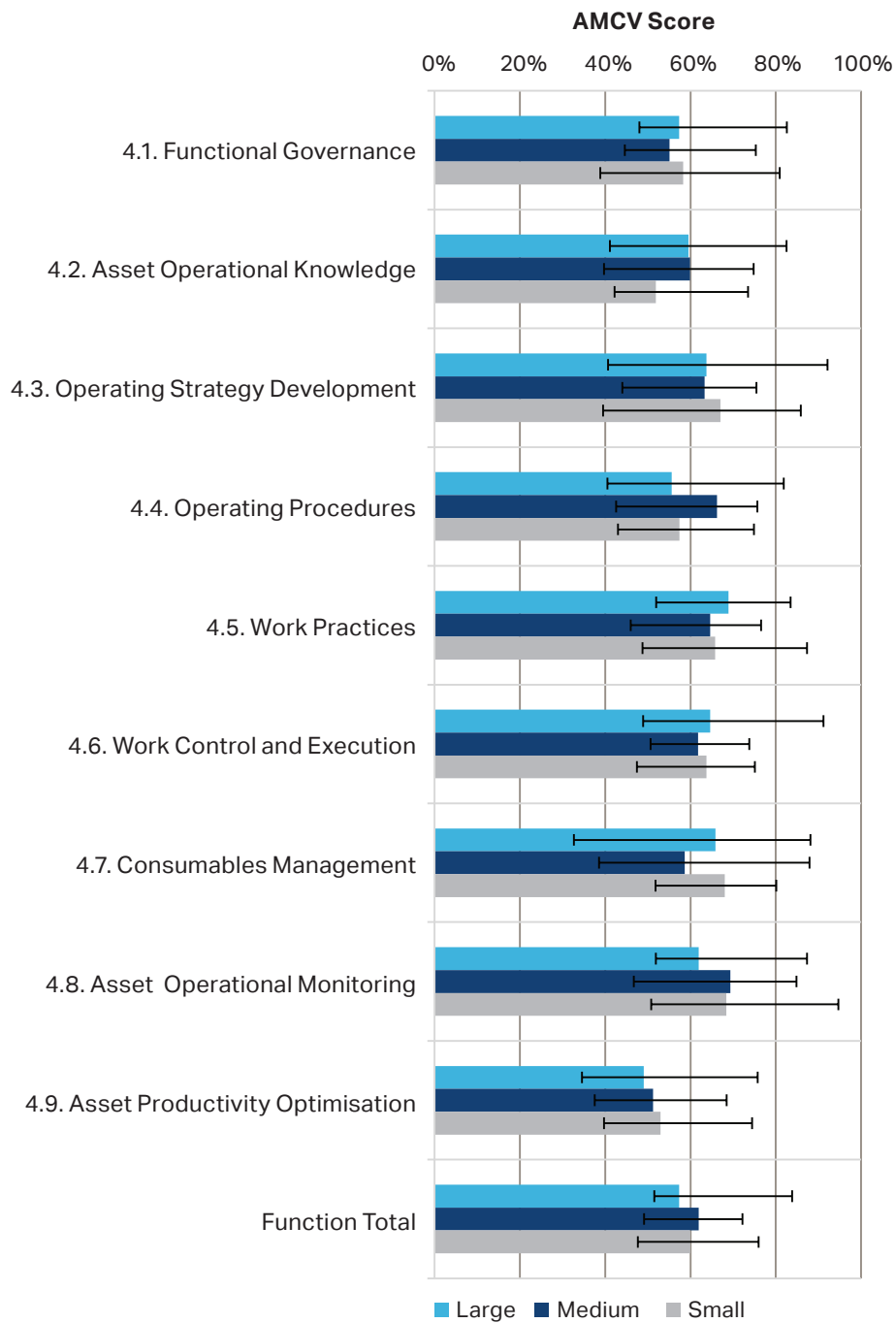


Figure 24: Peer group asset management maturity comparison by participant size for function 4 at process level

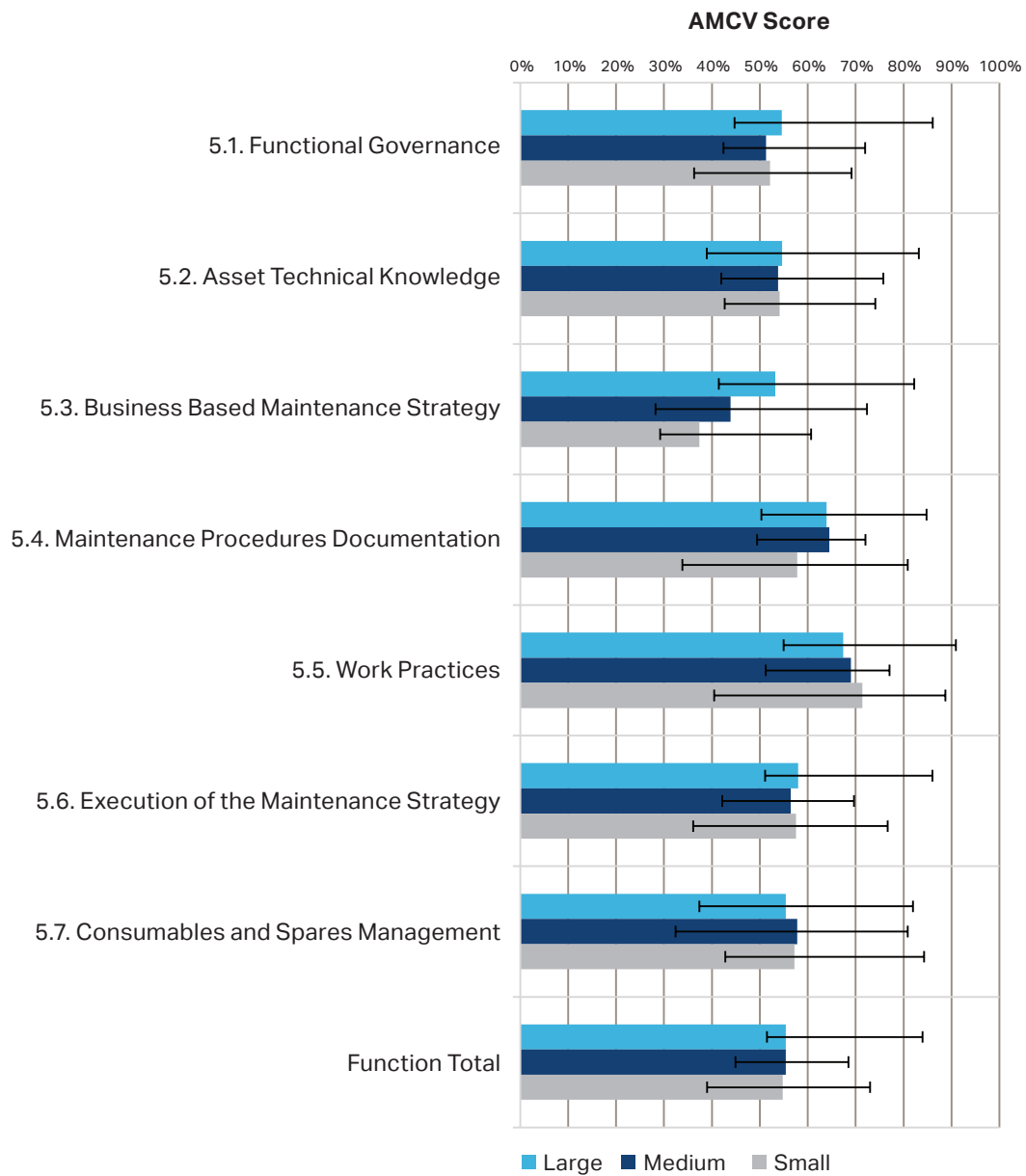


Figure 25: Peer group asset management maturity comparison by participant size for function 5 at process level

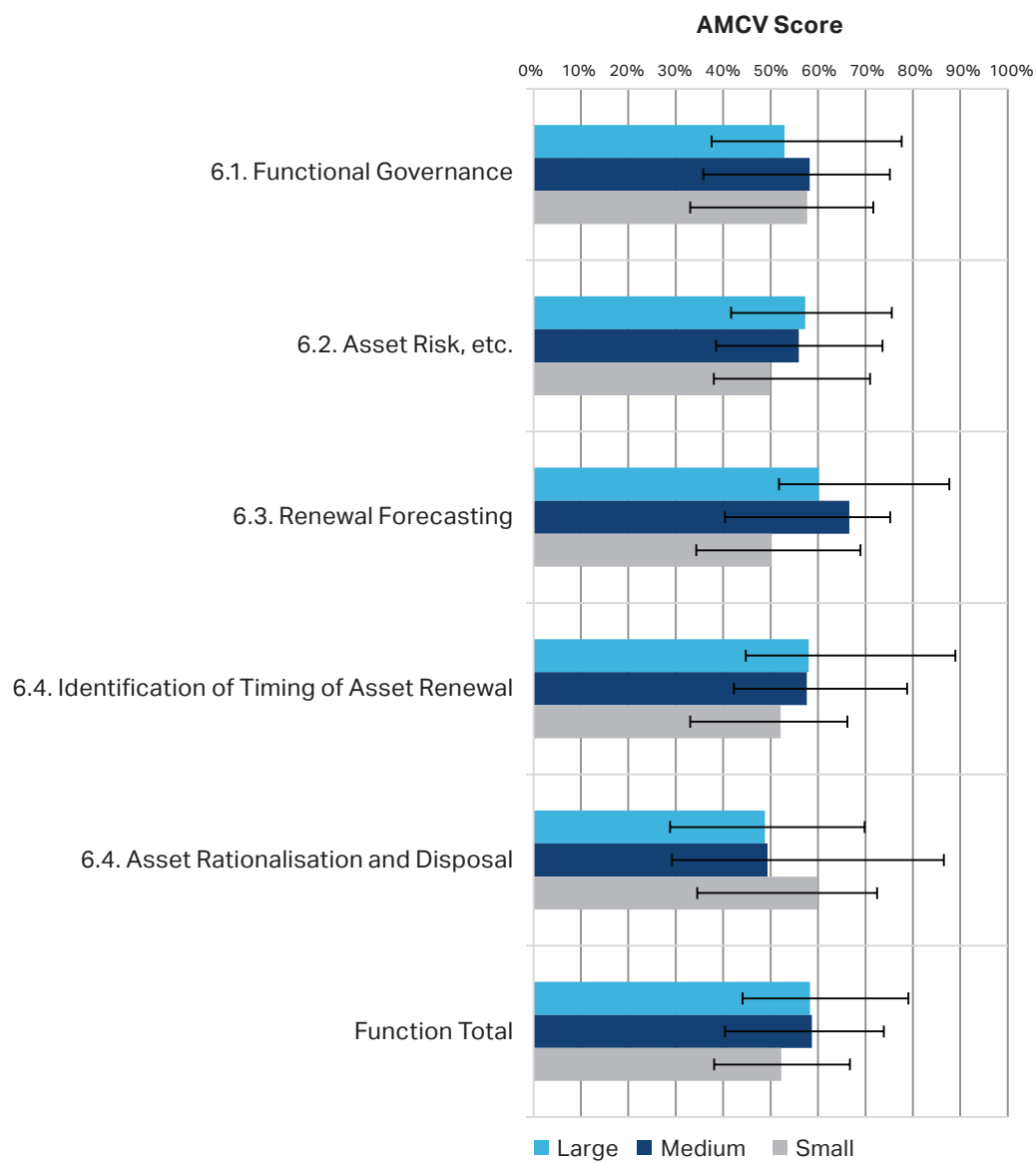


Figure 26: Peer group asset management maturity comparison by participant size for function 6 at process level

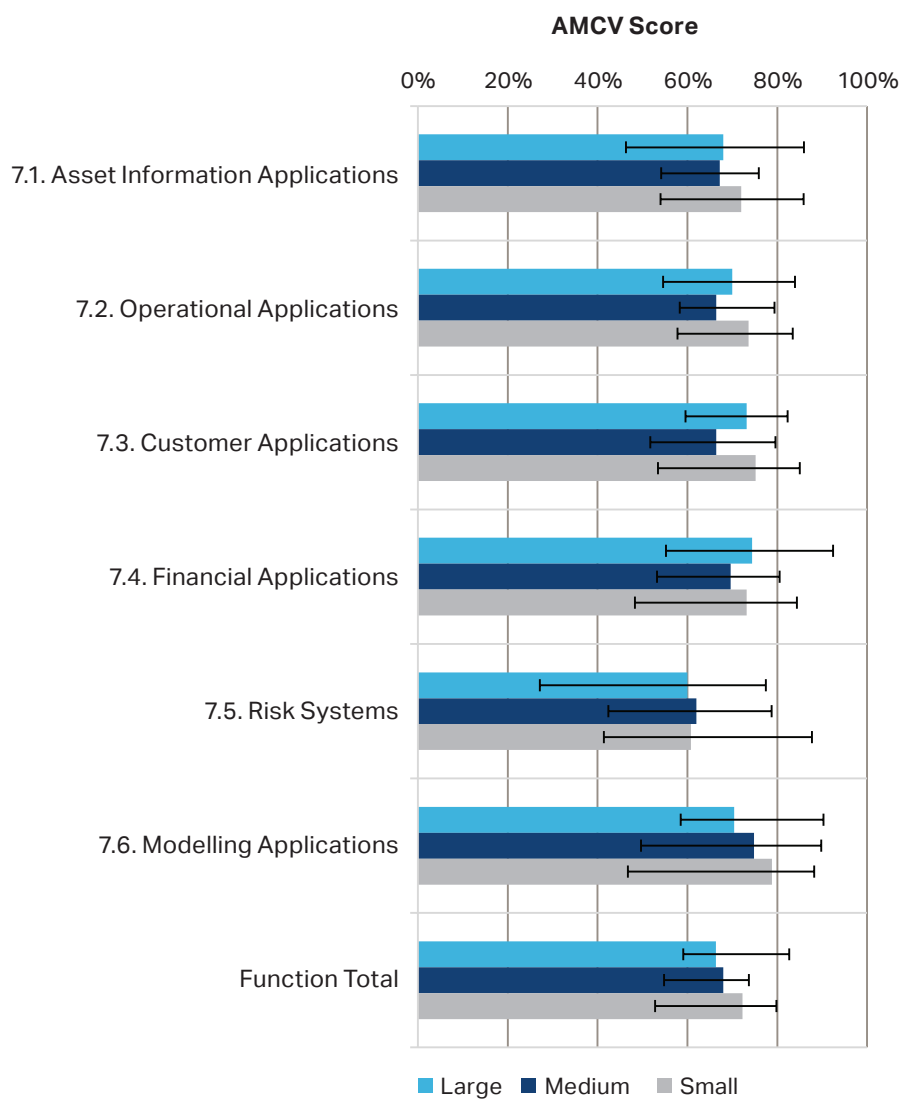


Figure 27: Peer group asset management maturity comparison by participant size for function 7 at process level

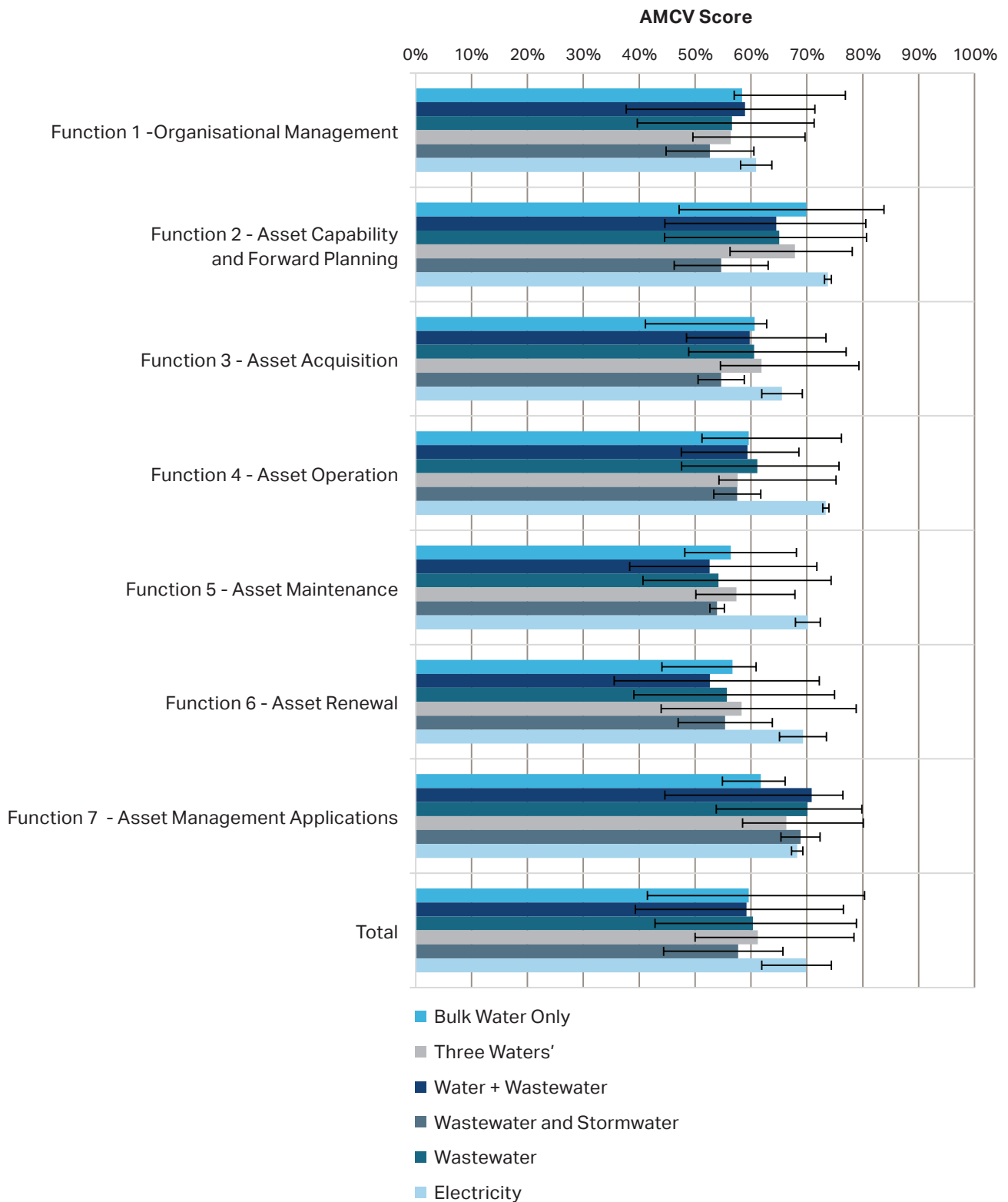


Figure 28: Peer group asset management maturity comparison by services provided at function level



Figure 29: Peer group asset management maturity comparison by services provided at process level

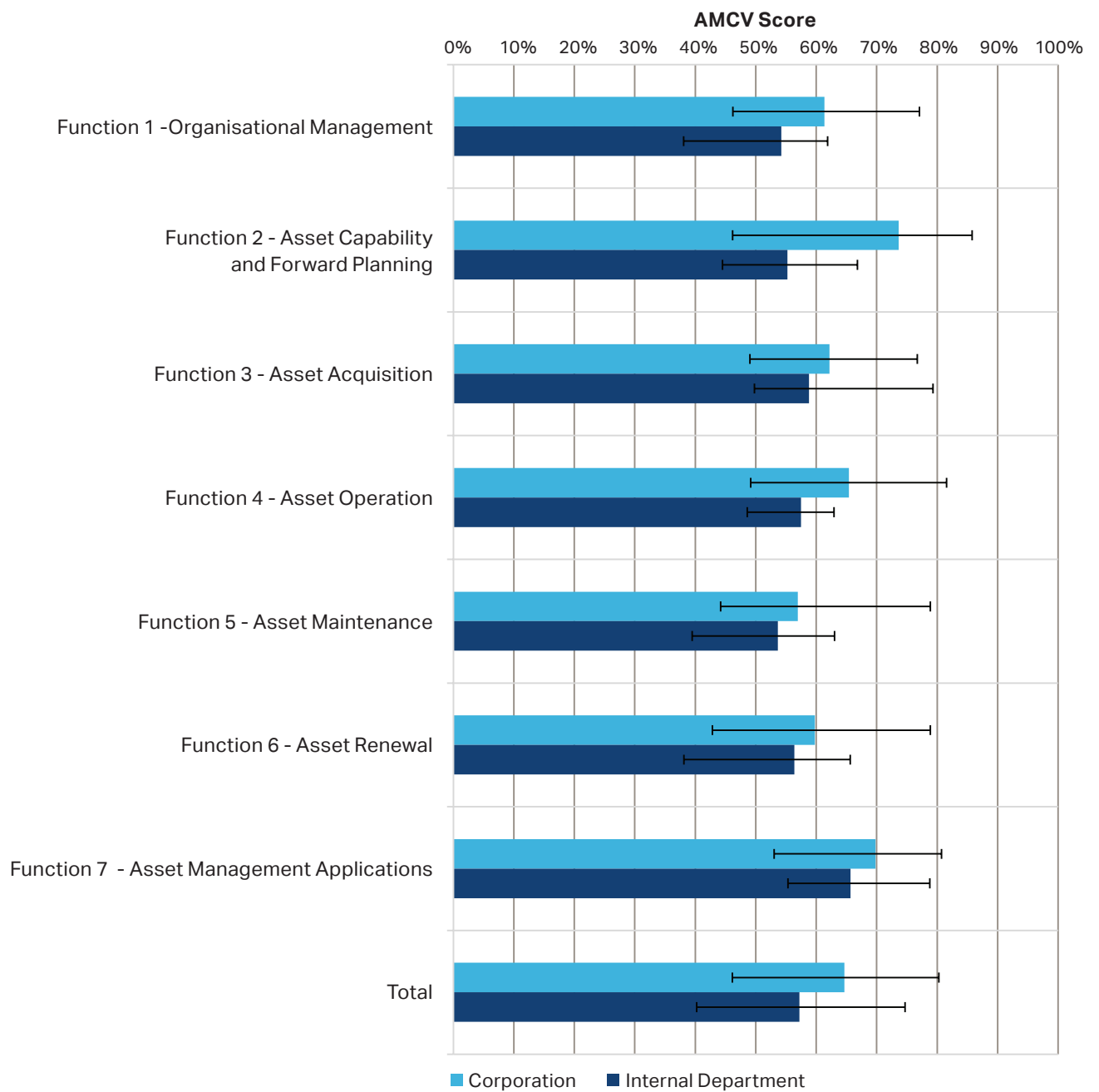


Figure 30: Peer group asset management maturity comparison by services provided at function level

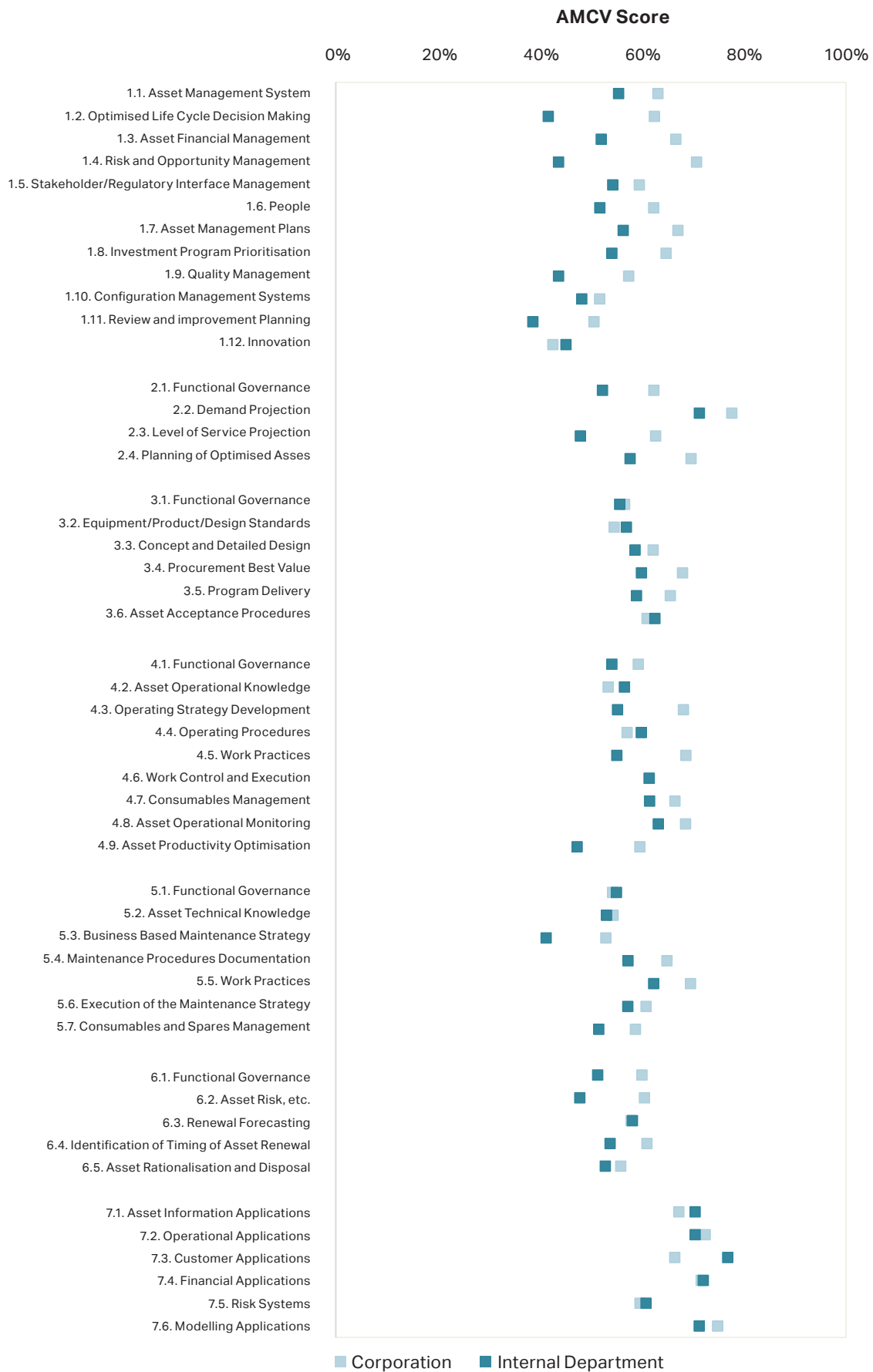


Figure 31: Peer group asset management maturity comparison by operational structure at process level

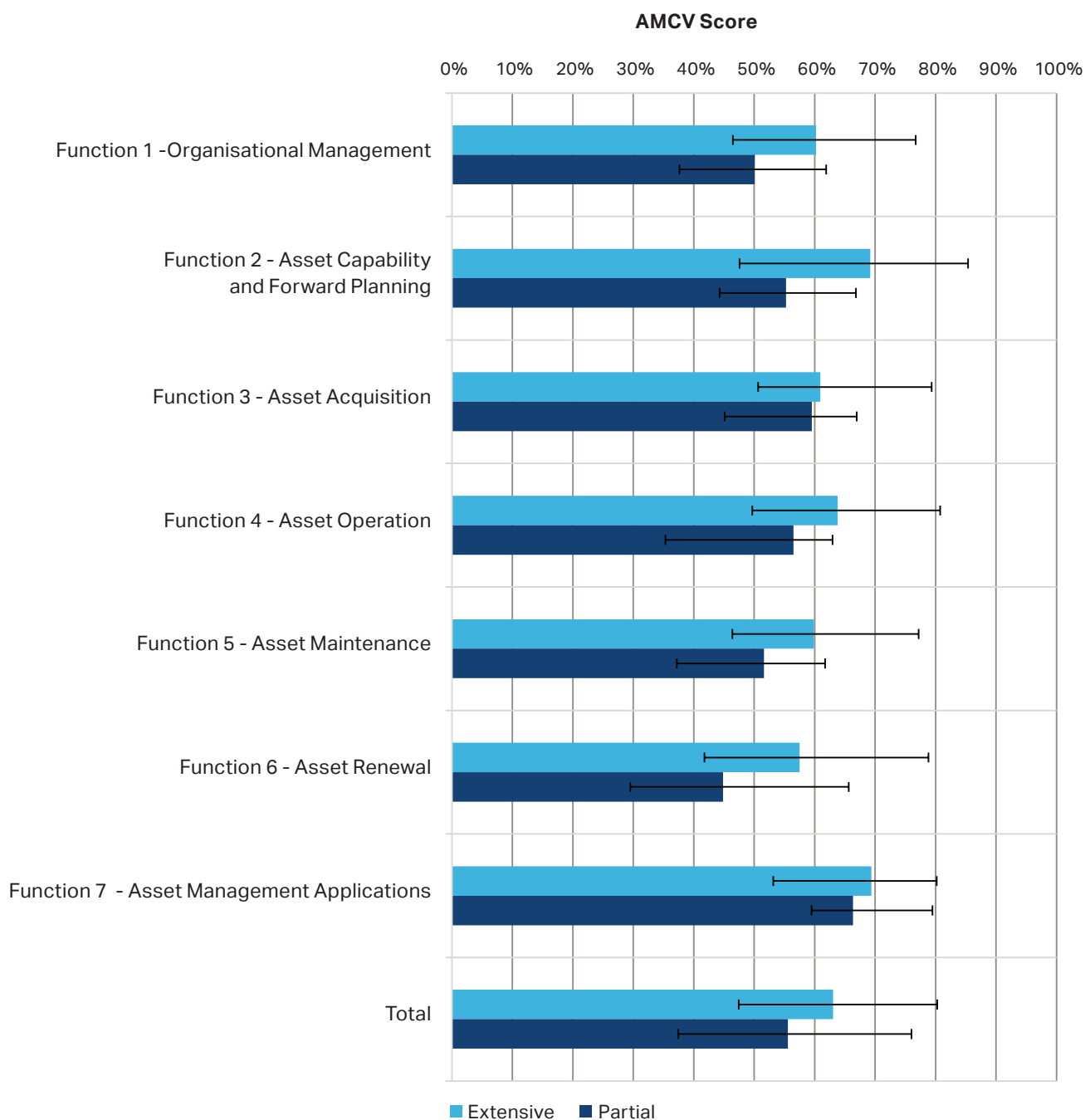


Figure 32: Peer group asset management maturity comparison by level of regulation at function level

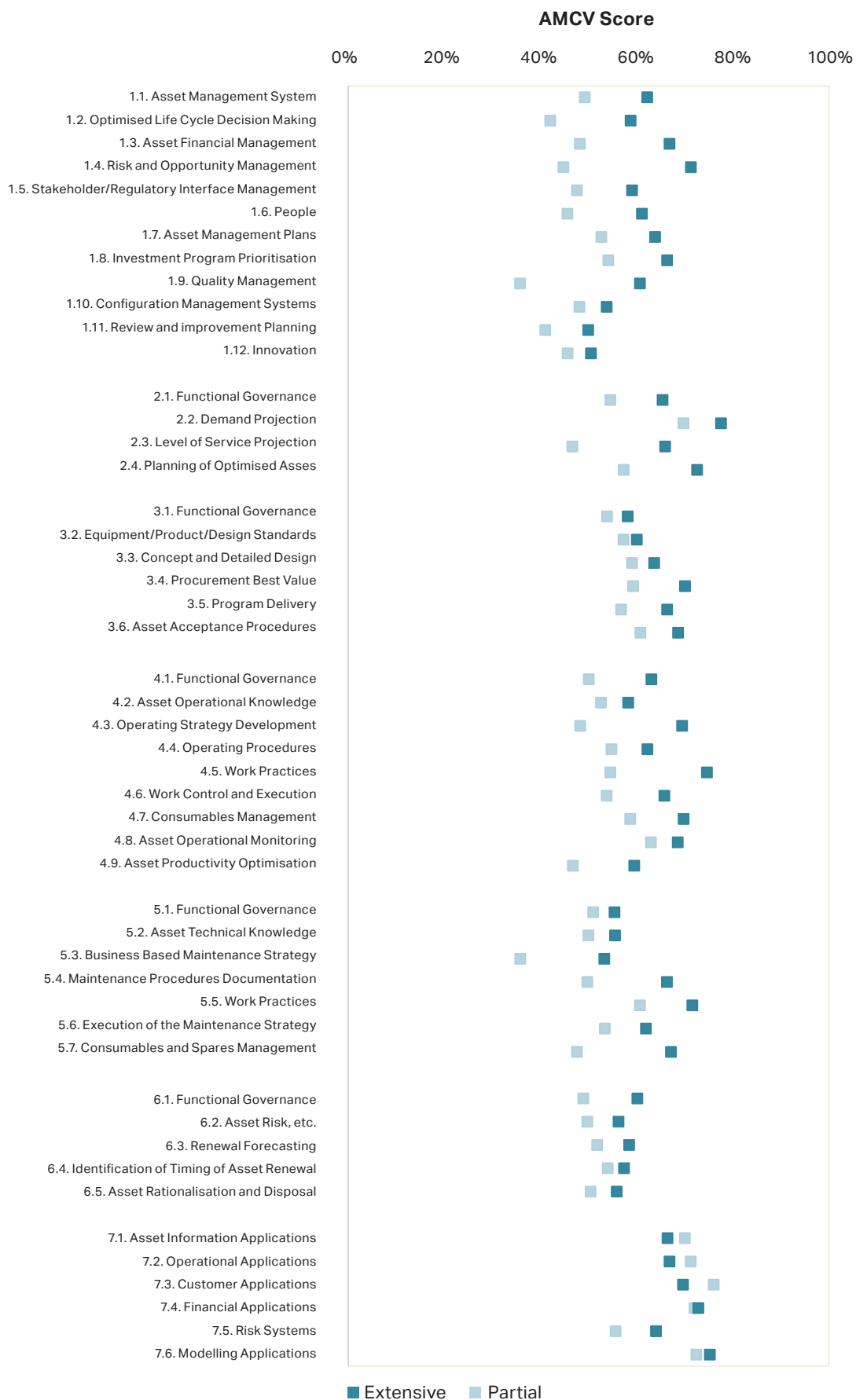


Figure 33: Peer group asset management maturity comparison by level of regulation at process level

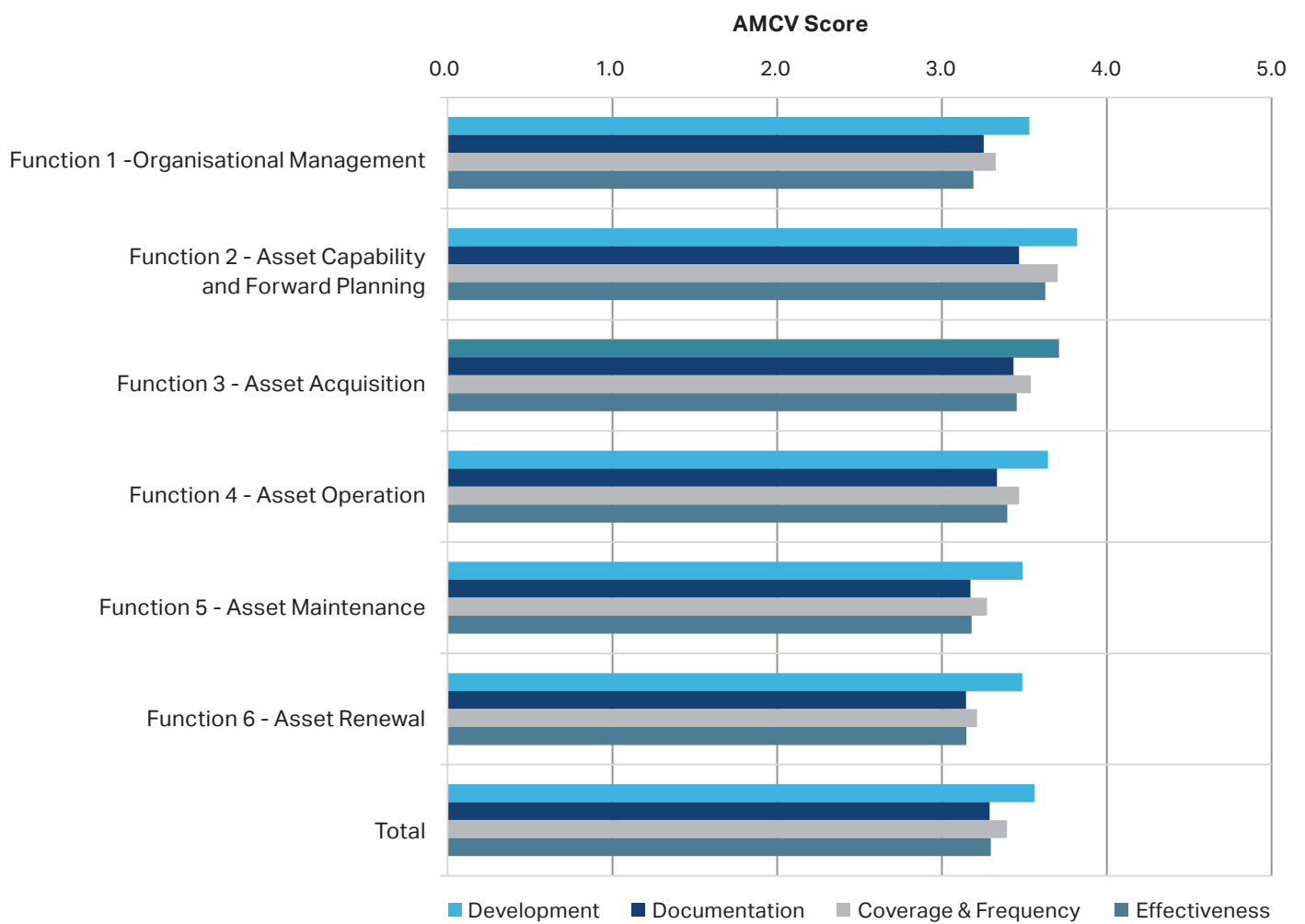


Figure 34: Average aggregate scoring component comparison (Functions 1-6) for all participants



Appendix E

2012 to 2016 Results Comparison

Appendix E:

2012 to 2016 Results Comparison

Changes in Scoring Methodology Since 2012

The 2016 AMCV framework is significantly improved from the 2012 Aquamark framework and likewise there were also improvements between the 2008 and 2012 versions. These changes include:

- Review against the ISO55001 requirements showed one-to-many relationship between each ISO 'shall' statement and one or more AMCV measures. 44 new measures were added to the AMCV assessment tool to cover the gaps between AMCV and ISO55001:2014.
- The following sub-processes were completely new in the 2016 assessment:
 - 1.1.4 – Organisational Management, Asset Management System, Leadership and Culture
 - 1.5.1 - Organisational Management, Level of Service and Stakeholder/Regulatory Interface Management, Stakeholder Engagement
 - 1.5.5 - Organisational Management, Level of Service and Stakeholder/Regulatory Interface Management, Outsourcing
 - 3.6.8 – Asset Acquisition, Asset Acceptance, Post Acceptance Review
 - 4.6.3-4.6.8 – Asset Operation, Work Control & Execution, Resource Competency and Benchmarking, Training, Planning and Scheduling, Data capture and Verification, Operations Strategy and Reporting and Audit and Review
 - 4.7.4 – Asset Operation, Consumables, Purchasing Strategy
- The following functions were renamed:
 - Corporate Policy and Business Planning was renamed Organisational Management
 - Business Support Systems was renamed Asset Management Support Applications
- Some processes, sub-processes and measures were renamed and/or re-defined.
- Relative weightings across functions and between processes, sub-processes and measures may have changed.
- The 18 systems in the 2012 Business Support Systems function were replaced with 6 application groups in the 2016 Asset Management Support Applications function.

Refinement of the AMCV survey measures with a decrease from 752 to 506 measures.

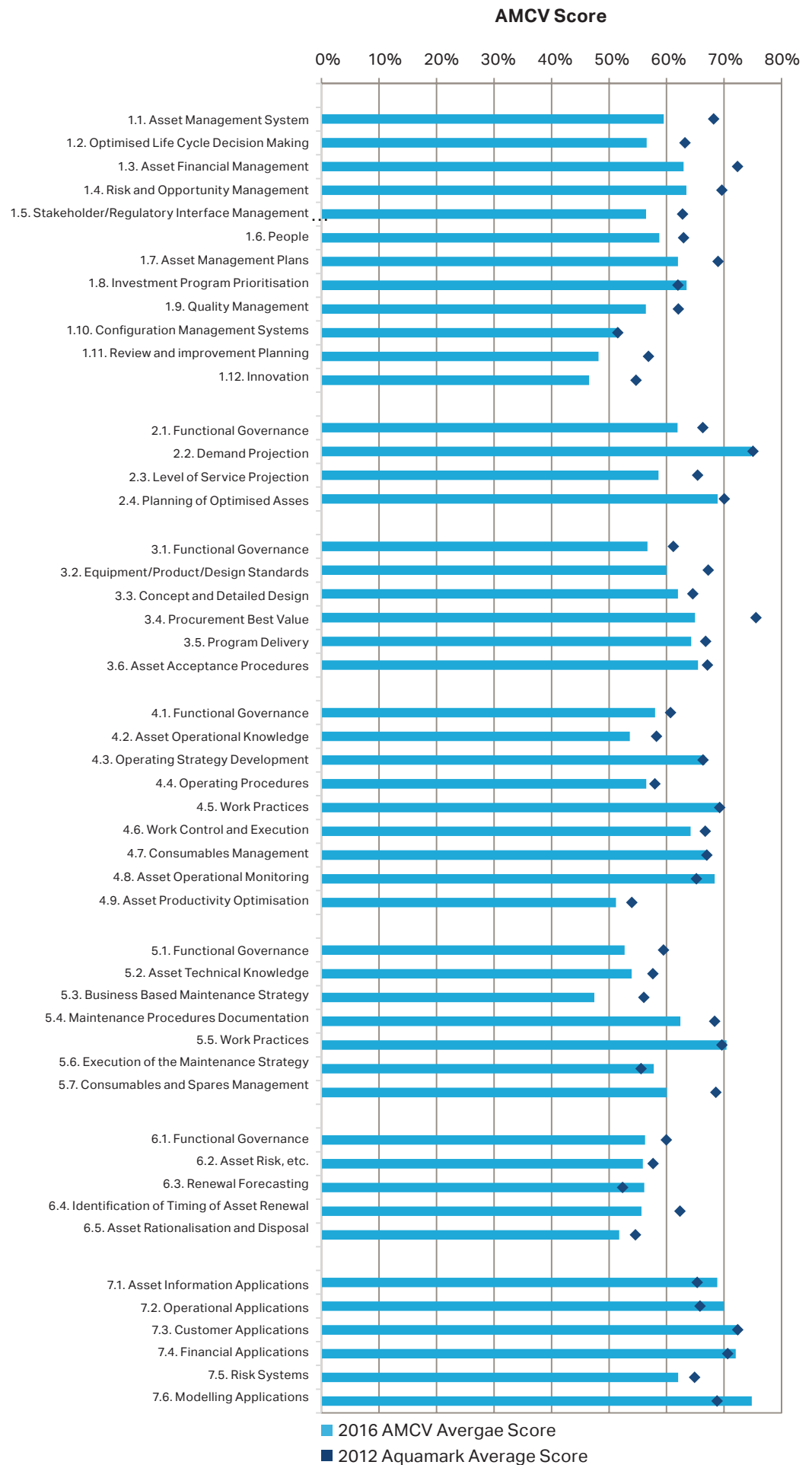


Figure 35: 2012 to 2016 Process Results Comparison (for repeat participants)



Appendix F

Leading Practices Selection Process

Appendix F:

Leading Practices Selection Process

This Appendix sets out the approach to the identification of the Leading Practices and Leading Practice Themes the details of which can be found in the Leading Practices Compendium.

1. Principles for Leading Practices selection

Identify practices that:

- Have potential to deliver significant change
- Appeal to participants and their collective business drivers
- Align to the AMCV project , which in 2016 revolves around the central theme of asset management delivering customer value
- Are innovative
- Have ability to remain relevant as external business drivers change (i.e. 'classic' approaches that will remain relevant over time)

Represent the current context:

- Map Leading Practices against AMCV processes and demonstrate links to key drivers/themes emerging from 2016 Business Drivers Survey

Ensure representation and coverage:

- Ensure representation of all AMCV Functions and, as far as practical, Processes
- Ensure representation of all participants, so covering all regions and utility types/sizes (i.e. recognising what is leading in different contexts/ environments).

2. Nomination and Identification of Leading Practices

- Direct nominations by the utilities in the Business Profiling Surveys
- AMCV evaluated and finalised scoring – utility “top scores” by weighted score and by % score in all functions, and, as far as practical, processes
- Identification of processes and sub-processes “high scores” that align with Business Driver Survey outcomes. This demonstrates those areas that the industry has indicated are important at the present time and so where there will be an interest to understand what other utilities are doing well to address these themes.
- Experience of verifiers, industry knowledge, verification process.

3. Method for Leading Practices evaluation and short-listing

- Development of a common template for recording Leading Practice candidates and for mapping against AMCV processes to which the practice relates
- Evaluation of nominated Leading Practices by independent industry representatives and the AMCV Steering Committee
- During independent verifications of the participant self-assessments specific practices were identified and nominated for consideration as a "leading practice". These nominations were assessed by an independent industry committee affiliated with the AMCV delivery partners and by the AMCV Steering Committee (*i.e.* WSAA member representatives) with regard to: (i) how they related to the most important business drivers as determined by the participant survey; (ii) demonstrated positive outcomes for the organisation and/or high maturity as reflected in AMCV benchmarking scores; (iii) ability to be applied in different settings and contexts; and (iv) level of innovation.

4. Developing Leading Practice Themes for showcasing at the AMCV Conferences

The Leading Practice and Conference themes for 2016 emerged from a review of the long and short-listed Leading Practice nominations and from the Business Driver Survey results



Appendix G

Leading Practices Conference Agenda

Appendix G: Leading Practices Conference Agenda

AMCV Project
Asset Management Customer Value

2016 North American Conference

Time	Day 1: 29 November, 2016	
08.00 - 08.30	COFFEE	
8:30 - 8:45	Welcome Greg Ryan / Scott Haskins	
8:45 - 9:00	Greeting from LA Water Mayor's Office	
9:00 - 9:30	Overall AMCV Project Report Ryan Signor / Greg Ryan	
9:30 - 10:00	North American Region Project Report Scott Haskins	
10.00 - 10.30	BREAK	
10:30 - 12:00	State of Asset Management Panel Discussion	
12.00 - 1:00	LUNCH	
1.00 - 2.30	Session 1	Session 2
1.00 - 1.20	Region of Peel – Asset management framework	Haskins/ Ryan – AMCV Process Review/Next Steps
1.20 - 1.40	Portland – Asset management plans	MCES – Integrated Resource Planning
1.40 - 2.00	Rancho – Asset management plans framework/pilot	LA – 'One Water'
2.00 - 2.30	Question and answer session	Question and answer session
2:30 - 3:00	BREAK	
3:00 - 4:30	Session 3	Session 4
3:00 - 3.20	Toho – Best Value Procurement	ABCWUA – Linking Performance and Benchmarking
3.20 - 3.40	Vancouver – Contract Selection and Management	Peel – QMS/Configuration Management
3.40 - 4.00	ActewAGL – Asset Plans and Renewal Timing	Sydney Water – Operational Optimization
4.00 - 4.30	Question and answer session	Question and answer session
4.30 - 5:00	Close out/Feedback Greg Ryan/ Scott Haskins	
5:00 - 6:00	END OF DAY	
6:00	Dinner at Sausal	

Time	Day 2: 30 November, 2016	
08.00 - 08.30	COFFEE	
8.30 - 10:00	Session 5	Session 6
8.30 - 8.50	DC Water – Innovation planning	Toho – Workforce management
8.50 - 9.10	LA – By-product reuse	MCES – Employee engagement
9.10 - 9.30	Rancho – MyWaterTracker	Portland – Communication conduit
9.30 - 10.00	Question and answer session	Question and answer session
10:00 - 10:30	BREAK	
10:30 - 12:00	Session 7	Session 8
10:30 - 10:50	DC Water – Strategic planning	Portland – Risk
10:50 - 11:20	ABCWUA – Customer engagement	LA – CIP Prioritization
11:10 - 11:30	Yarra Valley Water (Australia) – Customer levels of service	Vancouver – BCE
11:30 - 12:00	Question and answer session	Question and answer session
4.30 - 5:00	Close out/Feedback Greg Ryan/ Scott Haskins	
12:00 - 1:00	LUNCH	
1:00 - 2:15	Hyperion Wastewater Treatment Plant Tour	
2:15 - 2:45	BREAK	
2:45 - 4:15	Networking	
4:15 - 4:30	Workshop close Greg Ryan/ Scott Haskins	
4:30	END OF CONFERENCE	

Time	Day 1: Monday, 5 December 2016		
08.00 - 09.00	Welcome coffee and registration		
9.00 - 10.30	Master of ceremonies: Greg Ryan (WSAA) Conference opening: Pat McCafferty (Yarra Valley Water) Welcome: Adam Lovell (WSAA) and Ian Pitcher (AECOM) Industry Insights + Leading Practices overview: WSAA, AECOM + CH2M		
10.30 - 11.00	Morning tea		
11.00 - 12.30	Session 1 - Events Centre	Session 2 - AECOM Boardroom	
	Industry choice Facilitator: Neville Pearce	Industry choice Facilitator: Miles Dacre	
	Sydney Water - Operational optimisation using BI and data analytics	South East Water -Testing and application of supporting technologies	
	SA Water - Customer Service Levels: developing a clear and robust line of sight with capital planning decisions	Water NSW - Capital investment strategy developed with Asset Data Bank	
	South West Water (UK) - Applying whole life cost modelling to low-value high-volume infrastructure (unmapped and unattributed assets)	Christchurch City Council (NZ) – Natural disaster response and recovery	
	12.30 - 13.30	Lunch	
13.30 - 15.00	Session 3 - Events Centre	Session 4 - AECOM Boardroom	
	Research and innovation - the benefits of public and private sector collaboration Facilitator: Ryan Signor	Getting accredited - <i>interactive working session on ISO 55001 accreditation</i> Facilitors: Frederic Blin and Tony Urquhart	
	Wannon Water - “Wannovate”	Gladstone Area Water Board and Sendai City – ISO 55001 accredited; Water NSW and ActewAGL - advanced in seeking ISO 55001 accreditation	
	Coliban Water - Innovation program		
	Yokohama (JPN) – Public and private sector collaboration on R&D		
	DCWater (USA) - Innovation program		
	15.00 - 15.30	Afternoon tea	
15.30 - 17.00	Session 5 - Events Centre	Session 6 - AECOM Boardroom	
	Program planning, policy and processes Facilitator: Matthew Bower	Asset renewal investment and accuracy Facilitator: Darren Smith	
	City West Water – Human resources	ActewAGL – Automating asset specific plans and renewals timing	
	Yarra Valley Water – Improving integration and commissioning of new assets	City West Water – Asset failure forecasting and renewal investment	
	Seqwater – Program delivery project manager induction	Melbourne Water – Timing of asset renewal	
	Toowoomba Regional Council – Succession planning policy and processes	South West Water UK – Distribution network renewal and maintenance planning model that uniquely considers all relevant performance measures	
	17.00 - 18.00	Speed networking session (hosted in downstairs area, drinks to be served/available from bar)	
	Unity Water – Asset acquisition processes	Managing a design panel to produce efficient design – Panel arrangement with reduced team design	MidCoast Water – Asset management customer applications
	Sydney Water – Critical water mains replacement/renewal	Auckland Stormwater (NZ) – Organisational alignment	Icon Water – Resource planning: novel approaches to long-term resource planning and understanding the value of stored water
	Dunedin City Council - Security of supply strategy for metropolitan Dunedin	Gippsland Water – Involving all stakeholders in asset acquisition and renewal	Power & Water (Remote Operations) Optimising resources in a constrained environment (TBC)
	Goulburn Valley Water – Capital program prioritisation	East Gippsland Water – Asset management system leadership and culture	Power & Water (Power) – Mobility and maintenance: focus on non-linear infrastructure (TBC)
	Auckland Stormwater (NZ) – Capital investment ‘gateway’ process		
18.30	Conference Dinner: Harbour Kitchen, 800 Bourke St		

Time	Day 2: Tuesday, 5 December 2016		
08.00-09.00	Welcome coffee		
09.00 - 10.30	Session 7 - Events Centre		Session 8 - AECOM Boardroom
	Asset life prediction, planning and modelling Facilitator: Peter Gould		Customer service and engagement Facilitator: Mal Spears
	Barwon Water – Water and sewer main renewal planning		Albuquerque (USA) - Customer interactions
	Water Corporation – Modelling for future integrated water supply scheme services		Icon Water – Customer inclusive levels of service
	Yarra Valley Water – Maintenance service linked to Yarra Valley Water 2020 Strategy		Barwon Water – Customer interactions: your say on what you pay
	Hunter Water – Operational resilience		Yarra Valley Water – Determination of acceptable levels of service to customers
10.30 - 11.00	Morning tea		
11.00 - 12.30	Session 9	Session 10	Tours
	Technological advancements within the water industry Facilitator: Steve Appleby	Integrated system planning and invesment prioritisation Facilitator: Andy Gibson	11.00 - 12.00
	Rapid mobile application for meter replacement design – Use of mobile computing + Maximo	Sydney Water – Integrated system planning	National Australia Bank Social Media Centre
	Queensland Urban Utilities – Qhub access	Unity Water - Asset criticality	
	South East Water – Prioritisation and traceability of maintenance work	DC Water (USA) - Linking strategic planning to process improvement	
	Auckland Stormwater (NZ) – Use of rainfall radar to predict system performance in real time	Icon Water – Investment prioritisation and decision-making process (IPAD)	
12.30 - 13.30	Lunch		
13.30 - 15.00	Session 11 - Events Centre	Session 12 - AECOM Boardroom	Tours
	Strategic planning and demand forecasting Facilitator: Amanda Lewry	Strategic asset management Facilitator: Tony Urquhart	14.00 - 15.00
	Seqwater – Asset portfolio master plan	SA Water - Assessing AM maturity: using AMCV, ISO 55001 and IAM 39	National Australia Bank Social Media Centre
	Hunter Water – Maintenance productivity strategy	LA Water (USA) - “One water” management	Telstra Innovation Lab “Gurrawa”
	Seqwater – Annual operating strategy	TasWater - Strategic asset management planning when several utilities form a new organisation	MetroTrains Control Centre
	Unity Water – Demand forecasting	Melbourne Water – Portfolio, project and program planning	
15.00 - 16.00	Project wrap-up and next steps		
15.30 - 16.30	Greg Ryan (WSAA), Frederic Blin and Ryan Signor (AECOM), Scott Haskins (CH2M)		
	World Cafe feedback session: “What are the industry opportunities for 2016 - 2020?” A chance to seek feedback on the AMCV 2016 journey and address two key questions: 1. What is the future for asset managment? 2. How can the AMCV program adapt to keep up and meet the needs of WSAA members and participants?		
16.00	Conference close and afternoon tea		
Time	Day 3: Wednesday, 7 December 2016		
8.00	Meet at Collins Square Events Centre, TowerTwo, 727 Collins Street, Melbourne to depart for a tour of the site of Lang Lang Water Treatment Plant		
12.00	Lunch at Wonthaggi		
13.30	Site tour of the Victorian Desalination Plant		
18.00	Arrive back at Collins Square. Note, arrival time may vary depending on traffic conditions. Please keep this in mind when booking return travel arrangements.		

All site visit attendees will need to wear **long sleeved shirts, long pants and steel-toe safety shoes**.

There will be some climbing of stairs. A no alcohol policy will be in place. Hard hats, hi vis vests and safety glasses will be provided.

Attendees must register to attend the Leading Practices Conference.

<https://www.eventgate.com.au/Event/5868/Leading-Practices-Conference---Australia>

Quality Information

Document Industry Report



Ref 60446910

Date 22-Feb-2017

Prepared by R Signor, A Hadfield, A Spark, T Urquhart, J Latham

Reviewed by R Signor, F Blin

Revision History

Revision	Revision Date	Details	Authorised	
			Name/Position	Signature
0	2-12-2016	Draft for Review	Frédéric Blin Project Manager	
1	22-02-2017	Final Report	Frédéric Blin Project Manager	

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