technical paper
Integrated Urban Water Management

water e-journal
Online Journal of the Australian Water Association
ISSN 2206-1991
Volume 1 No 2 2016
http://dx.doi.org/10.21139/wej.2016.016

UNDERSTANDING INTEGRATED URBAN WATER MANAGEMENT AS AN IDEOLOGY, METHOD AND OBJECTIVE

AN INVESTIGATION INTO INDUSTRY PERCEPTIONS OF IUWM AND ITS IMPLEMENTATION IN MELBOURNE

C Furlong, S De Silva, L Guthrie

ABSTRACT

The authors have sought to test the hypothesis that industry perceptions of Integrated Urban Water Management (IUWM) include elements pertaining to an ideology, method and set of objectives. In order to assess this, a survey was conducted that received responses from 34 industry experts.

Survey responses show a wide variety of perspectives on IUWM, ranging from specific processes to broad, all-encompassing and vague descriptions. According to the results the specific methods most commonly associated with IUWM are: stakeholder engagement; coordinated planning; holistic option assessment; and integrated modelling. The objectives most commonly associated with IUWM are: diversification of water sources; environmental improvements; reduced cost; and improved liveability outcomes.

Preliminary examination of the current state of these methods and objectives has shown that, so far, not all of the methods result in achievement of these objectives. We propose that the water sector re-evaluate its perception of IUWM, mentally separating its meaning into an ideology, objectives and a variety of methods that can then be independently scrutinised. The value of IUWM appears to be in promoting communication between organisations and well-structured stakeholder engagement, rather than large-scale and highly detailed "integrated" plans or complex option assessment methods.

INTRODUCTION

IUWM, also known as Integrated Water Management, has been popular in Australia's water sector for approximately the last decade. The shift from traditional segregated and reactive approaches to integrated and proactive approaches was prompted by Australia's Millennium Drought and has been adopted most whole-heartedly in Melbourne (Fam *et al.,* 2014).

Adoption of the IUWM ideology has resulted in changed mental attitudes within Melbourne's water sector, attempts at "integrated planning", and the construction of alternative water source and WSUD infrastructure assets of various sizes (Ferguson *et al*., 2013).

There has been a long-held view that implementing IUWM will result in better community outcomes. The Office of Living Victoria (OLV) at one point claimed that IUWM would save Melbourne $6 billion, while also improving both environmental and social outcomes (Office of Living Victoria, 2013).

Our team at RMIT University has been investigating IUWM in Melbourne for the last three years. We began this research by studying the international evolution of integrated approaches to water management and compared differing traditions (Furlong *et al.,* 2015).

After this we developed a planning framework (Furlong *et al*., 2016), which was used to assess eight Melbourne water reuse projects. We found that the projects that were implemented relied on targets and grants for funding and approval, rather than the planning approaches that are generally associated with IUWM (Furlong *et al*., in press).

We then considered the changes in water sector governance structures within Melbourne between 1990 and the present to see how these have affected the implementation of integrated planning, reuse and WSUD projects. We found that the most systematic, detailed and integrated planning approaches have not resulted in the construction of actual projects (Furlong *et al.*, 2015 (2)).

These results prompted us to begin questioning some assumptions about the nature of IUWM. From this vantage point we developed the hypothesis that the industry perception of IUWM includes elements pertaining to an ideology, method and a set of

objectives. We are using the term ideology here to mean "a belief system that exists in a particular culture".

In order to test this hypothesis and stratify IUWM's conceptual components, the team at RMIT has conducted an industry survey that asked experts:

1. What does IUWM mean?
2. What specific steps/methods/ actions does IUWM involve?
3. What are its objectives?
4. How relevant is IUWM as an ideology now, and in the future?

This paper will discuss the results of this survey, and then attempt to relate these results back to the hypothesis.

METHOD

The team at RMIT has, for three years now, undertaken wide-ranging literature reviews, face-to-face industry consultation with 40+ experts, assessment of eight infrastructure project case studies, and nine strategy case studies.

Critical reflection on these research outcomes led us to the research hypothesis. In order to test this hypothesis we conducted an industry survey that has received 34 responses. The survey was sent to the group of more than 40 experts whom we consulted previously, with the request that it also be circulated to some of their colleagues. Details of the respondents are shown in Figures 1 and 2.

The survey received responses from a variety of organisational types, the largest being from consultants, retailers, bulk suppliers and councils. Analysis so far has not attempted

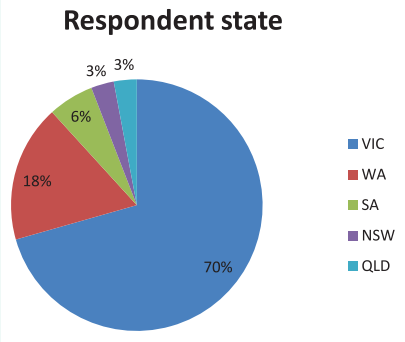

Figure 1. Respondent state.

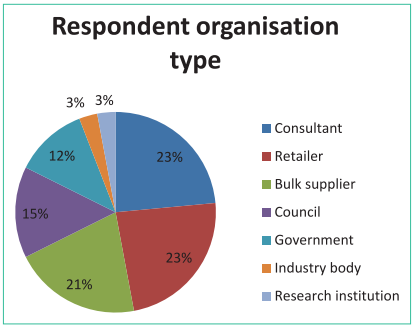

Figure 2. Respondent organisation type.

to compare the difference between states and organisational type, but this will be considered at a later time.

The survey asked for short answers from respondents. These answers were qualitatively analysed to draw out themes, and then again to see how many of the respondents mentioned each theme. These results have been provided in a table format (Table 1) to show the top responses to each question. Survey responses provided four substantive IUWM methods and four objectives.

We then considered the current state of these methods and objectives using previously collected data and findings. All of these information sources have been combined in order to use Melbourne as a holistic and broad case study on IUWM implementation. By comparing the current state of the objectives and methods we were able to determine how closely linked they are to each other in practice.

SURVEY RESULTS

The first question that was given to the experts asked them to describe what they thought IUWM was.

The results show that the majority of respondents are in agreement about IUWM involving consideration of the whole water cycle and coordinated planning. The next highest responses were that IUWM involves holistic option assessment, and that it improves community outcomes.

One notable disparity between responses was whether IUWM implies the installation of alternative water projects, or whether it does not.

In the second question experts were asked about the specific actions involved in IUWM.

The top responses were:

1. Stakeholder engagement and involvement;
2. Coordinated/collaborative planning;
3. Holistic option assessment;
4. Integrated modelling.

A wide variety of responses were given. Many of these actions are not specific to the water sector, are something that all planners should do, and pre-date the advent of IUWM as a concept. This shows how broad and varied industry perceptions of IUWM are, once specific methods are discussed rather than overall meaning.

Thirdly, experts were asked what they thought were the objectives of IUWM. Again the responses show a lack of consensus. However, these results are interesting for a number of reasons. The most common response was that the objective of IUWM is achieving a more integrated approach – in other words, that IUWM was an

Table 1. Top survey results for "What does IUWM mean?".

Theme	Mentioned by
Consideration of the whole water cycle through a coordinated and collaborative planning regime	68%
Holistic option analysis (cost-benefit analysis or multi-criteria assessment)	32%
Improved community outcomes	29%
Environmental protection	21%
Alternative water sources/fit-for-purpose water use	15%
Stakeholder engagement and involvement	12%
Liveability, amenity, water-sensitive cities	9%
Long-term view including population and climate	9%

Table 2. Top survey results for "What are the specific steps/methods/actions involved in IUWM?".	
Theme	Mentioned by
Stakeholder engagement and involvement	53%
Coordinated/collaborative planning (e.g. between utilities and with urban planning)	50%
Holistic option assessment (non-market cost-benefit analysis and multi-criteria assessments)	28%
Integrated modelling	28%
Cost and responsibility apportionment	25%
Strategic planning/policy development/leadership	22%
Wide-ranging option identification	19%
Objective/goal setting	16%
Post-project evaluation and learning from mistakes	16%

Table 3. Top survey results for "What are the objectives of IUWM?".	
Theme	Mentioned by
Achieving a more integrated approach	50%
Alternative water sources	35%
Best overall outcomes	26%
Environmental protection	26%
Reduced cost and social equity	18%
Liveability and greening	15%
Site/context specific	12%
Stakeholder collaboration	12%
Fit-for-purpose use	12%

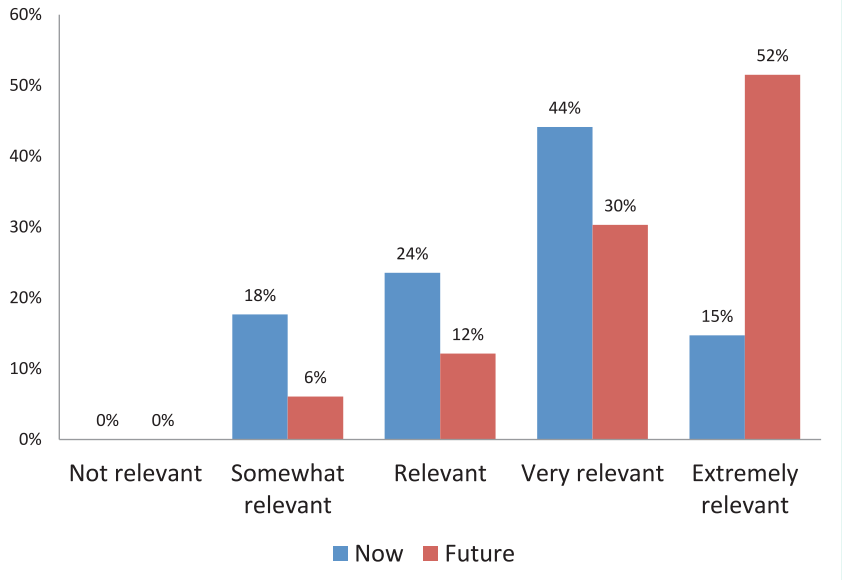

Figure 3. Survey results for "What is the relevance of IUWM now and in the future?".

end in itself. This response is likely due to the mental association between IUWM and improved community outcomes shown in Table 1.

Leaving aside "a more integrated approach", and "best overall outcomes", the top responses for the objectives of IUWM were:

1. Alternative water sources;
2. Environmental protection;
3. Reduced cost;
4. Liveability and greening.

Finally, experts were asked about the relevance of IUWM to the water sector, now and in the future.

Experts were also given the option to select "not relevant"; however, none of the experts selected this answer. Results show that experts generally believe IUWM to be "very relevant" now, moving to "extremely relevant" in the future.

USING MELBOURNE AS A CASE STUDY TO ASSESS THE CURRENT STATE OF IUWM

Now that the concept of IUWM has been separated into its commonly associated methods and objectives, it is possible to explore how closely linked they are to each other in practice. In order to give specific and practical examples, this will be explored in relation to planning efforts in Melbourne over the past decade.

This period has included a number of different eras: government intervention during drought, the "golden age of recycled water" following the end of the drought, the establishment of the Office of Living Victoria (OLV) as an oversight body, and the current era following this oversight body being absorbed back into government (Furlong *et al.*, 2015 (2)).

CURRENT STATE OF THE IUWM METHODS

Stakeholder Engagement And Involvement

Engagement with stakeholder organisations and the wider community has been increasingly promoted as a tool for achieving improved community outcomes. The practice of stakeholder and community engagement is not specific to the water sector, and there are a number of resources that exist to help planners in undertaking engagement, such as the IAP2 framework.

In the water sector, practices for stakeholder and community engagement are considered to be well understood, and the typical premise of existing water sector reports is that "more is better" (Office of Living Victoria, 2013). However, extensive industry consultation conducted by RMIT has revealed another perspective.

During the mammoth effort involved in the development of the OLV's 'Whole-of-Water Cycle' sub-regional plans, many meetings and workshops were held to bring together water utilities, councils, government departments and consultants.

A number of experts expressed dissatisfaction with the number and process used in the engagement. One expert expressed frustration at the cost in time and effort and the lack of produced value. Another did not feel that it was appropriate to commence planning processes by bringing stakeholders together and asking them what they want, saying that this resulted in small and large issues being given equal weight. For example, a council keen to improve park amenities was given equal weight to a water utility having to manage frequent sewer overflows (Furlong *et al.*, 2015 (2)).

Some experts have proposed a change in perspective from the idea that "more engagement is better", towards the view that engagement should be appropriately targeted and structured.

Coordinated/Collaborative Planning

It is almost universally acknowledged within the water sector that planning approaches should be coordinated and collaborative. This concept extends to coordination of:

- Water services, including water supply, sewerage and drainage;
- Different water utilities, and departments within utilities;
- Urban planning, together with councils and state government;
- Local, sub-regional and regional plans coordinated across scales.

In comparison to a decade ago, water planning in Melbourne has become far more collaborative in the sense that water utilities, councils and government now have substantially more contact with each other than they used to. Experts have expressed a view that this increased willingness to collaborate is useful, and some examples can be pointed to where positive outcomes have been achieved through collaborative planning, such as in growth areas in the Barwon Water region.

However, in regard to the coordination across planning scales and different water services there have been some serious difficulties. The development of the OLV's sub-regional plans was hampered by an assortment of problems relating to linking planning efforts at different timing and spatial scales.

Precinct Structure Plans (PSP) – master plans for local communities – were being developed at the same time as large-scale modelling and analysis, making the linking of the two extremely difficult. Also, it was difficult to scope what issues should be considered at which scales. This has prompted one consulted expert to question: "Does every issue need to be managed at every scale?" (Furlong *et al*., 2015 (2)).

Integration of all water sources/ services, at multiple timing and spatial scales, together with the changing political and intuitional landscape, proved to be an insurmountable challenge, with the sub-regional plans not having been released after three years of effort.

Therefore, efforts aimed at integrating the planning of all water services at a large scale have not yet been successful in Melbourne. Previous planning efforts in Melbourne have been achievable because they focus either on: (a) one water service at a large scale; or (b) multiple water services, but only at a suburb or growth area scale.

Holistic Option Analysis

Water industry experts have been discussing the need for holistic option assessment methods for a long time. These assessments generally take the form of either non-market Cost Benefit Analysis (CBA) or Multi-Criteria Assessment (MCA). Both of these relate to trying to capture the full spectrum of costs and benefits that arise from infrastructure options (WSAA, 2014).

For a number of years MCAs were popular. They were used in many planning processes that looked at the best water servicing strategies for growth areas up until 2012. These assessments were influenced by the personal views of water planners and consistently suggested that growth areas should be serviced by some form of alternative water such as recycled water, rainwater collection or stormwater harvesting, together with WSUD. However, there was always a lack of confidence in the results of these MCA assessments. The water industry across Australia, including experts in Melbourne, Sydney and Perth, had begun making efforts to develop non-market CBA assessments that were seen to be more objective and defensible.

Therefore, when the OLV was created it made a high priority of developing a CBA methodology for use in selecting the preferred option in servicing strategies. Unfortunately, the OLV CBA assessment experienced the same hurdles that the water industry has been experiencing for years: no-one has yet successfully and consistently quantified the non-market benefits and costs of IUWM in a way that garners widespread agreement. This includes benefits such as eco-system protection, liveability and health.

Although many studies have been conducted into both consumer willingness to pay and how these benefits and costs should be tallied up, no system has been widely implemented and accepted. Even in relation to benefits created through the deferral of other infrastructure assets there has been disagreement.

Frequently the use of non-market CBA has resulted in one of two fates. The first is that benefits are not comprehensively included, and the BAU approach receives a higher Net

Present Value (NPV) than the IUWM options. Sometimes, in this case, planners then reject the BAU option because it is "not integrated".

The second fate, which is applicable to large projects, is that the CBA shows an IUWM option to have the highest NPV, and the responsible organisation then creates a business case around this CBA assessment, only to have the CBA results rejected by the state government on the basis that either: (1) the benefits are inflated; (2) the risks are not effectively considered; or (3) beneficiaries are not willing to contribute.

As there is no agreed methodology, or means of creating one, it must be considered that the water sector, at least in Australia, is a long way from achieving holistic option assessment.

Integrated Modelling

Some modelling software has been created that is capable of considering water supply, recycled water, sewerage, drainage and stormwater treatment simultaneously. One notable example is Urban Developer, created by eWater, the developer of MUSIC. These new software tools are not currently in use by the water sector at any large scale, but are being used by some planners to answer specific questions. For example, they are used in early planning stages such as option identification, but not to do detailed modelling and designs.

As part of the creation of Melbourne's Water Future, the OLV used an integrated model of Melbourne's network, and it was this model that produced the claims that IUWM would save Melbourne $6 billion. This model has been described by some experts as a "black box", the failings of which were hidden from the public gaze.

However, when the OLV moved on to the creation of the sub-regional plans, problems arose from the lack of appropriate software programs. The hydrologic and hydraulic tools that were used were designed to model only one aspect of the water cycle. Using separate tools doesn't necessarily give poor information, although it becomes difficult to optimise models across the water cycle, particularly at linkages between models (Furlong *et al.*, 2015 (2)).

It is difficult to judge if, and when, fully integrated and functional software will be developed and then adopted by the water sector, because of the complexity involved in integrating multiple water services at multiple spatial scales.

CURRENT STATE OF THE IUWM OBJECTIVES

Alternative Water Sources

Historically, Melbourne had only one water supply source, which was its dams. The protected catchments and dams system in Melbourne provides one of the cleanest and best municipal water supply sources in the world, and current Melburnians owe a great debt to the foresight of Melbourne's founding fathers.

Up until the Millennium Drought these sources proved sufficient. During the drought, which lasted approximately from 1997 to 2007, Melbourne's water storage levels continued to drop to the point where Melbourne's water sector was operating in crisis mode. The state government intervened to implement both the largest desalination plant in Australia and the North-South Pipeline. The desalination plant is capable of supplying approximately one-third of Melbourne's water needs.

In addition to this, Melbourne has implemented substantial recycled water activities. Melbourne achieved its 20% recycling target by 2010, predominantly through the use of recycled water for agriculture. Over 100 small-scale stormwater harvesting schemes also exist in Melbourne (Ferguson *et al.*, 2013).

Melbourne has thus achieved a substantial diversity of water sources. But what proportion of this water source diversity can be attributed to stakeholder engagement, coordinated planning, holistic option assessment and integrated modelling? The North-

Photo courtesy of Melbourne Water

Urban wetland at Dockland Park, Melbourne Docklands.

South Pipeline and desalination plant planning involved none of these methods, as they were knee-jerk reactions to the Millennial Drought. The major recycled water projects implemented out of Western Treatment Plant, Eastern Treatment Plant and other smaller sewage treatment plants such as Boneo also pre-date major efforts in the IUWM methods considered here, although it was imprecisely recognised that these schemes provided multiple benefits.

A case may be made that some of these recycled water decisions were coordinated as part of the Central Region Sustainable Water Strategy and other large-scale planning efforts. While this is true, these projects were able to be implemented primarily because of the Victorian Government's 20% recycling target, and Department of Sustainability and Environment grants.

If one was to take a broad view of IUWM, then perhaps these targets and grants could be considered to be part of IUWM. However, IUWM is typically associated with cost sharing under a beneficiary pays model. Targets and grants are typically associated with the "traditional", pre-IUWM paradigm.

Melbourne now has a substantial number of alternative water sources, but these have not been facilitated by the IUWM methods considered in this paper. They have been achieved through traditional, reactive, top-down planning approaches such as government targets, grants and interventions.

Environmental Protection

In recent decades many efforts have been made to protect Melbourne's waterways and bays. Major efforts towards environmental protection in Melbourne's water sector have involved regulatory instruments around pollution, usually required by the Environmental Protection Authority (EPA). EPA regulations and other government directives have resulted in the upgrading of sewage treatment plants, water recycling, ensuring water allocation for rivers, and the installation of raingardens and wetlands for the treatment of urban stormwater (Brown and Clarke, 2007).

In recent times, Melbourne's planning agencies are taking serious steps to ensure the protection of upstream waterways in growth areas. This issue has been taken seriously in the planning of both the Sunbury and Northern growth areas.

There have also been massive improvements in Port Phillip Bay water quality because of Melbourne Water's efforts to upgrade the Western Treatment Plant and increase water recycling, as well as the construction of over 200 wetlands and the stormwater offset program for new developments.

EPA regulations, and Melbourne Water actions, have evolved since 1965, mostly in response to: (1) a growing amount of community environmentalism; and (2) an increasing body of scientific knowledge from the Port Phillip Bay study, National Water Quality Guidelines and CSIRO work (Brown and Clarke, 2007).

The EPA, Melbourne Water and the environmental department of the Victorian Government have collaborated over a number of decades in planning to determine appropriate regulations and actions. Improvements to environmental protection in Melbourne have, therefore, involved significant communication between some organisations.

Reduced Cost

Industry experts have shown that they believe IUWM, when implemented successfully, should save the community money. Logically this makes sense, although there is little evidence of this being achieved at present.

It is difficult to assess the costs and benefits of the IUWM methods explored in this paper. This is because this task would require highly detailed and technical data from water utilities outlining what staff and expenses are involved in stakeholder engagement, coordinated planning etc.

Stakeholder engagement increases costs in the short term, but may theoretically lead to cost savings through the identification of synergies between organisations, and from influencing public opinion, for example through persuading the public that potable recycling is safe.

Coordinated planning also should, in theory, save money on a whole-of-community basis. For example, through coordinated planning a utility may realise that implementing recycled water may defer a sewage treatment plant or pipeline upgrade, and also delay the need for another desalination plant, resulting in a cost saving to the community. In practice there have been some issues with this, such as: (1) cost sharing of water supply benefits is difficult to achieve; and (2) in several cases it has later been determined that the upgrade is required regardless, because of the seasonality and uncertainty involved in IUWM schemes, as well as uncertainties in growth estimates.

Holistic option assessment, in the same way as coordinated planning, should in theory save the community money, but has so far failed to do so. Assessments are generally conducted by consultants, costing the public money. In the case of the OLV sub-regional plans, many different pieces of work were completed by private consultants, with few actual outcomes achieved as the plans were never released.

Integrated modelling is still emerging and has not had a substantial cost, or cost saving, associated with it.

Attempting to quantify whether the IUWM methods have decreased or increased community costs would be a major research effort in itself and is beyond the scope of this paper. However, it can be stated that there is no empirical evidence of overall cost savings.

Another possible perspective on this issue is that once an effective non-market CBA is developed, and social and environmental benefits are included, the overall community cost savings associated with IUWM will become evident.

Liveability And Greening

As part of Melbourne Water's Living Rivers program, more than 633 WSUD projects have been constructed in Melbourne, adding greenery to Melbourne streets. Over 100

Photo courtesy of Melbourne Water

The Darling Street stormwater harvesting scheme is an example of a streetscape WSUD in Melbourne that has been co-funded by Melbourne Water's Living Rivers Program.

small-scale stormwater harvesting schemes operate within Melbourne, providing added water security for park irrigation, and as such also contributing to the greening of Melbourne (Ferguson *et al.*, 2013).

In some cases the planning of council schemes has involved a substantial amount of community consultation, such as four stormwater schemes implemented by the City of Melbourne.

The WSUD schemes that are carried out through the Living Rivers program have involved some degree of holistic option analysis as part of prioritising for each round of funding, and coordination between councils and Melbourne Water.

Although this statement may be controversial, another large contribution to the protection of liveability and greenery in Melbourne is the desalination plant, which will, at least for some time, prevent the need for water restrictions. But this water security benefit came with a large community cost, and so far no water has been ordered.

Therefore, stakeholder engagement, coordinated planning and holistic option analysis have at least partially contributed to the liveability and greening of Melbourne.

DISCUSSION

Do IUWM Methods Lead To Its Objectives?

Other than reducing costs, Melbourne has come a long way towards achieving its objectives: alternative water sources; environmental protection; and liveability/greening.

But what role have the IUWM methods (stakeholder engagement, coordinated planning, holistic option analysis and integrated modelling) had in achieving these objectives? This investigation presents a mixed picture.

Diversification of water sources has occurred predominantly through government interventions of: (1) implementing the desalination plant; (2) the 20% water recycling target: and (3) grants for harvesting schemes. Government intervention, targets and grants are not typically associated with IUWM and have not been mentioned in survey responses.

Environmental protection, liveability and greening have been achieved through: (1) EPA and other government regulations, which limit pollution and mandate WSUD; (2) Melbourne Water programs and other government grant/subsidy initiatives that help councils fund projects; and (3) the desalination plant.

EPA regulations and Melbourne Water receiving water quality improvement actions have been planned collaboratively, but not as part of an "integrated" water plan such as was attempted in the OLV sub-regional plans. Attempts at large-scale plans that integrate water services have not yet been successful. The desalination plant planning did not involve any of the IUWM methods.

The evidence appears to suggest that the valuable aspects of IUWM involve promoting communication between organisations and well-structured stakeholder engagement. One expert said: "Bringing everyone to the table is the first step". Large-scale "integrated" plans, and high-detail non-market CBA, have not so far contributed to achieving the IUWM objectives.

Reflections On The Meaning Of IUWM

With the knowledge gained from this analysis it is possible to consider the survey responses, and the meaning of IUWM, in a new light.

The first point to note is that experts have a mental association between the concept of IUWM and the achievement of improved community outcomes. The implementation of IUWM has resulted in positive outcomes in some instances, but there is a lack of empirical evidence to suggest that IUWM has so far achieved a net positive community impact. This lends weight to the argument that, for some, IUWM is an ideology, or belief system.

Secondly, there is no agreement as to whether the concept of IUWM inherently includes alternative water sources such as recycled water and stormwater harvesting. Some experts mentioned it in their responses, and some did not. One expert expressed during an interview that "IUWM doesn't mean alternative water!" The IUWM planning processes conducted so far have almost invariably

recommended the construction of such schemes, sometimes excluding the BAU option entirely, because it is "not integrated".

Thirdly, the survey responses are in some cases very broad, general and/or all-encompassing. If IUWM means *everything*, then it means *nothing*. That is to say that, if IUWM means correctly doing governance, regulation, long-term planning, project planning, regulation etc., then IUWM does not mean anything other than "good water management".

Fourthly, there is a high degree of consensus that IUWM involves the consideration of water supply, sewerage and drainage in an integrated fashion. However, no large-scale attempts at this integrated and coordinated planning approach have so far been successful.

Biswas (2004) stated: "The definition of [Integrated Water Management] continues to be amorphous, and there is no agreement on fundamental issues like what aspects should be integrated, how, by whom, or even if such integration in a wider sense is possible." Twelve years later, attempts have been made, but little has been resolved.

The final noteworthy point is that experts consider IUWM to be "extremely relevant" in the future, which begs the question, how can the industry have so much faith in IUWM, when it is a nebulous concept that means so many different things?

CONCLUSION

Views on the meaning, methods and objectives of IUWM have some similarities but also have some differences. One of the clearest differences is whether IUWM implies the implementation of alternative water source and/or WSUD projects or whether it implies neither. Another clear difference is whether the meaning of IUWM is so broad that its methods effectively encompass all water sector actions, or if it involves only some specific methods.

It seems that the original hypothesis that the industry perception of IUWM includes elements pertaining to an ideology, method and a set of objectives has proven to be correct. From the survey responses the authors have identified four methods and four objectives that are discrete enough to allow investigation.

Exploration of these methods and objectives has found that Melbourne has achieved improvements in the selected objectives, but only some aspects of these methods have contributed towards achieving these improvements. The value of IUWM appears to be in "bringing everyone to the table" – not necessarily conducting large-scale water plans with integrated modelling and highly detailed economic assessment of options.

The authors recommend that the water sector re-evaluate its expectations of IUWM, separating its meaning into an ideology, aspirational objectives, and a variety of methods that can be further considered in isolation.

This paper was presented at the 2016 YWP Conference in Sydney.

ACKNOWLEDGEMENTS

The Authors wish to acknowledge the funding of RMIT University and Water Research Australia. We would also like to thank the industry experts who took part in the interviews and survey; without their help this research would not have been possible.

THE AUTHORS

Casey Furlong (email: casey.furlong@rmit.edu.au) is a PhD Student at RMIT University in Melbourne. Casey has worked in the water industry for over five years and is close to completing a PhD at RMIT University with the help of Water Research Australia. He has had four papers published in international journals, and presented at two international conferences.

Dr Saman De Silva is a Program Director and Senior Lecturer at RMIT University in Melbourne. He obtained his PhD from Melbourne University, specialising in structural engineering. His research interests are computational mechanics, sustainable built assets and reliability-based life-cycle assessments. Before commencing his academic career he worked as a Senior Civil/Structural Engineering Consultant in Australia and overseas.

Lachlan Guthrie is close to completing a PhD investigating Integrated Water Management strategic planning processes at RMIT University in Melbourne. Lachlan is also heavily involved in the WASH sector, working as the Risk Manager for Engineers Without Borders Australia and chairing the AWA WASH Specialist Network.

REFERENCES

Biswas AK (2004): Integrated Water Resources Management: A Reassessment. *Water International*, 29, 2, pp 248–256. http://dx.doi.org/10.1080/02508060408691775

Brown RR & Clarke JM (2007): Transition to Water Sensitive Urban Design: The Story of Melbourne, Australia. Melbourne, Australia: Facility for Advancing Water Biofiltration, Monash University.

Fam D, Mitchell C, Abeysuriya K & Lopes AM (2014): Emergence of Decentralised Water and Sanitation Systems in Melbourne, Australia. *International Journal of Water*, 8, 2, pp 149–165. http://dx.doi.org/10.1504/IJW.2014.060962

Ferguson BC, Brown RR & Frantzeskaki N (2013): The Enabling Institutional Context for Integrated Water Management: Lessons from Melbourne. *Water Research,* 47, pp 7300–7314. http://dx.doi.org/10.1016/j.watres.2013.09.045

Furlong C, De Silva S, Guthrie L & Considine R (2016): Developing a Water Infrastructure Planning Framework for the Complex Modern Planning Environment. *Utilities Policy*, 38, pp 1–10. http://dx.doi.org/10.1016/j.jup.2015.11.002

Furlong C, Gan K & De Silva S (2015) (2): Governance of Integrated Urban Water Management in Melbourne, Australia. Lisbon. Redrafting Water Governance Conference.

Furlong C, Guthrie L, De Silva S & Considine R (2015): Analysing the Terminology of Integration in the Water Management Field. *Water Policy,* 17, pp 46. http://dx.doi.org/10.1016/j.jup.2015.11.002

Furlong C, De Silva S & Guthrie L (in press): Planning Scales and Approval Processes for IUWM Projects. *Water Policy*.

Office of Living Victoria (2013): *Melbourne's Water Future* (consultation draft).

WSAA (2014): *Urban Water Planning Framework and Guidelines*.