

## Qualified professionals are a must for sustainable water management

By Tapio Sakari Katko\*, Jarmo J. Hukka\*\*, Pekka E. Pietilä\*\*\*, Osmo T. Seppälä\*\*\*\*

\*Adjunct Professor, DSc (CivEng)

Tampere University of Technology, PO Box 541, FIN-33101 Tampere, FINLAND

e-mail: tapio.katko(at)tut.fi; [www.cadwes.org](http://www.cadwes.org)

\*\* Principal Water and Sanitation Engineer, African Development Bank: j.hukka(at)afdb.org

\*\*\* Senior Research Fellow, TUT: pekka.e.pietila(at)tut.fi

\*\*\*\* Managing Director, Espoo Water: osmo.seppala(at)espoo.fi

### Abstract

This article argues that more holistic and systematic water and sanitation policies and strategies are needed for sustainable development. It also asserts that whatever our emphases, adequate human resources and professionals will always be required. Furthermore, water services-related education and research should be expanded to include management, financial administration, ownership policy, strategies and good practices and their development. More interaction would also be useful between water services and water resources management experts representing various professional and educational disciplines.

**Key words:** capacity building, water management, water services, leadership, management, futures

### Introduction

Several studies on global processes and sustainable development show that issues related to water supply, protection of waters and water resources, on the local, national and international level, are the key development challenges and areas for mankind. If the present trend is allowed to continue without essential improvement, up to two-thirds of the global population is expected to suffer from chronic water scarcity and polluted waters in 2050. The challenge is particularly pressing in developing economies as noted by the Human Development Report 2006 (UNDP 2006).

Water and sanitation are also one of the key elements in relation to the Millennium Development Goals. An international 'best in medical breakthrough' poll by the British Medical Journal revealed that the sanitation and clean water measures instituted since 1840 are considered a more important development than advances in DNA research and vaccines ([The Times](#), Jan. 19, 2007). As for the futures, climate change will be a challenge in terms of heavier rainfall patterns and higher seasonal variations that our infrastructures have not traditionally been designed for.

According to the World Water Development Report 2006 covering 24 United Nations bodies, many of the solutions to water problems lie in better governance. Yet, few lower-income countries consider water a key feature in national planning and budgets. Only a minority of local authorities and water associations have the resources necessary to carry out the responsibilities delegated by the central governments (United Nations 2006).

The huge challenges faced by water management, especially in developing economies but also in more developed ones, will require improvements at all levels. That necessitates building the

capacities of key stakeholders at various levels. The capable sector professional obviously plays a key role, although capacity building and education should also apply to other stakeholders including the final beneficiaries and end-users of water resources and services – the citizens.

The views expressed in this paper are largely based on the experiences of the authors that are members of the Capacity Development of Water and Environmental Services (CADWES) group at Tampere University of Technology who cooperate with other Finnish universities and partners in other Nordic countries, Europe, North America, and Southern Africa. The group members have wide international experience from developing and transition economics.

In 2004 CADWES defined as its mission “*to produce usable knowledge based on trans-disciplinary research on the evolution and development of sustainable use of water services and water resources in a wider institutional context: organisations, management, legislation and policy including formal and informal institutions*”. The values inspiring the CADWES group are the following: Global responsibility, Problem orientation, Innovativeness, Social effectiveness, Interaction, Multi- and trans-disciplinarity, Openness and encouragement, Importance of history and futures, Equity and equality. ([www.cadwes.org](http://www.cadwes.org))

## **2. Goals and methods**

At first this paper of synthesising nature discusses the concepts of capacity building and institutional development from the perspective of the New Institutional Economics theory. That is followed by the introduction of the path dependence theory which is especially relevant for long-term strategic thinking and planning of infrastructure systems. Then it explains the positivistic and hermeneutic research approaches in the context of sustainable water management and its requirements.

The paper also presents some of the key findings of a survey named “Water services education and research and the sector's societal impact”. That survey was implemented mainly as a questionnaire study to chart the views of key interest groups on how university-level water services education and research and the sector itself affect society and how they should be developed in future. The questionnaire was directed to the four key interest groups in Finland: managing directors of waterworks (8), consultants (8), officials, municipalities and governmental organisations (8), and researchers and educators (10) – a total of 34 experts.

Finally, some suggestions and approaches for building capacities for water management are presented and discussed followed by conclusions.

## **3. Capacity building and institutional development**

### Concept of capacity building

UNDP states that “*Capacity is the ability of individuals, groups, institutions and organizations to identify and solve development problems over time*”. According to the 1991 Delft Declaration “*Capacity building involves developing institutions, their managerial systems, and their human resources, which in turn require favourable policy environments, to make the sector effective and sustainable*”. Such capacity implies the ability to *understand, to act, and to learn*. Yet, proper knowledge may remain ineffectual if policies and regulations, or politically inspired preferences, preclude its application (IHE –UNESCO 2007).

Human resources development consists of three classical elements – knowledge, skills and attitudes – that should all be remembered. Unfortunately the current discussion on knowledge and information societies pays attention only to the first one. Furthermore, a large portion of the knowledge possessed by an organisation can be tacit – something that exists but is not adequately recorded.

Based on her in-depth study of a water utility, Sandelin (2006) suggested that water utilities should pay more attention especially to capturing tacit knowledge, and sharing it with new employees. In fact, tacit knowledge seemed to be valued so highly that only a few of those possessing it wanted to share it. Forty per cent of the interviewees of the survey were also going to retire within the next five to ten years. A similar trend affects many other western countries where the baby boom generation born after WWII is reaching retirement age posing a major challenge. The tacit knowledge should be captured and recorded in some manner before it literally walks out of the workplace. It was suggested that the efficiency of sharing tacit knowledge could be increased by formalised mentoring or master-apprentice systems and utilisation of audio-visual methods. In many developing economies the population pyramid is probably inverted posing its own challenges for education and knowledge creation.

From June 13-15, 2007 UNESCO-IHE hosted the International Symposium entitled *Water for a Changing World: Enhancing Local Knowledge and Capacity*, in Delft, the Netherlands. The symposium made the following recommendations on capacity building (IHE-UNESCO 2007): (i) Prioritize the local actors –Build on existing local Knowledge; (ii) Raise awareness –teach water literacy; (iii) Promote integrated approaches; (iv) Transform organisations to make them more effective; (v) Reform the water sector; (vi) Build learning networks; (vii) Target and encourage leaders and champions; (viii) Share information and knowledge. These recommendations are easy to agree with.

The symposium also made the following five policy recommendations that are commented below based on the authors' experiences:

*(i) Capacity and Knowledge Development require long-term time horizons.*

In regard to water infrastructure and WSS systems, this is particularly relevant since e.g. the lifetime of networks may be over 100 years. As George Santayana (1863–1952) noted: *“Those who cannot remember the past are condemned to repeat it”*. Indeed, we should actively seek ways to analyse and utilise accumulated knowledge and combine this with strategic and visionary thinking about possible, plausible and preferable futures (Kaivo-oja et al 2004, Seppälä 2004).

We have dramatic examples of what can happen when “assumed new innovations” are introduced overlooking long-term lessons, as in the case of the “reinvention of privatisation” by international financial bodies in the 1990s. Now, a decade later, even representatives of the World Bank are starting to admit that the expectations were highly unrealistic. As Annez (2006), among others, states *“The private financing mobilized for urban PPI has been quite limited and undeniably disappointing in relation to the high expectations prevailing in the 1990s. ... But experience shows that financing urban infrastructure through PPI has not proven to be ‘low hanging fruit’. Indeed it appears to be a fairly unpredictable source of finance, given the number of problems encountered with even the relatively limited number of transactions completed.”* Considering the historical lessons learnt from such experimentations a century earlier in many western countries, one may ask on what grounds did the donors try so eagerly to reinvent the wheel in that case. The reading of related historical documents would have sounded warnings if the issue had been approached with sufficient professional seriousness. Should we thus conclude that each generation, or every second or third, is bound to repeat similar experiments? Or could our approaches be more broad-based?

*(ii) Developing countries must become more independent in their own problem-solving.*

Water services, including sanitation but also to a large extent water resources management, are highly dependent on local conditions –from the natural environment to administrative traditions, etc. Indeed, this dependence and the need to understand the ontology – the special features of services like water and sewerage – should be the starting point (Pietilä 2006, 217-226). It is important to have a 100-year or even longer perspective in the development and upgrading of infrastructure while remembering the lessons of the pasts.

*(iii) Capacity and knowledge development is a goal in itself, not just a tool.*

It is quite surprising how many donors have ignored in their development policies the obvious fact that building capacities and human resources development at all levels are a key to development. For instance, Finland was considered a backwater of Europe a century and a half ago, but the systematic efforts to educate the population at all levels by various means turned it into one of the most developed ones. Nykänen (2008) notes that *“it is quite easy to argue that the extensive work done for technological education in Finland has had a crucial effect on the country’s development. It took about one hundred years of systematic work before the breakthrough took place”*.

*(iv) Start early: At primary school and beyond.*

The symposium argued that the importance of good water management and sanitation should be taught at primary and secondary levels. In many countries medical doctors and public health engineers championed the first water and sanitation systems while nowadays hardly any medical doctors are interested in such “non-clinical“ issues. Perhaps they should be, since all the problems have not been solved yet.

*(v) Make knowledge and capacity development more effective: understand how it works.*

Making the importance of knowledge better understood is a challenge for decision making. For instance, to what extent should water sector professionals and researchers be involved in the dissemination of research results to decision makers, even to the public, instead of staying in the background and only informing attendees of scientific forums?. Often even the latter are not informed adequately.

### Institutional development

Fig. 1. presents a graphical framework for institutional development of water supply and sanitation services. At the utility level, we need operative technology, appropriate organisations and adequate cost recovery. In most countries local governments play a major role as the owner of the public systems in charge of services provision if not production, while central government policies guide sectoral development. Customers, consumers, or rather citizens, should be seen as the ultimate owners and beneficiaries of these systems. The operational requirements of utilities may include feasible forms of public and private cooperation; education, research and development; as well as the need for international cooperation and knowledge sharing.

The second basis of the institutional development of water services is the concept of New Institutional Economics where organisations are actors through which institutions come into existence. Institutions provide the ‘playground and rules’ for the responsible organisations to manage services successfully. As summarised by the Nobel Laureate D.C. North (1990), using a soccer analogy, institutions are the rules of the game while organisations are the players. Such an approach seems to be quite appropriate for understanding the needs of water supply and sanitation – a typical natural monopoly and service of necessity – that have to be managed based on local conditions.

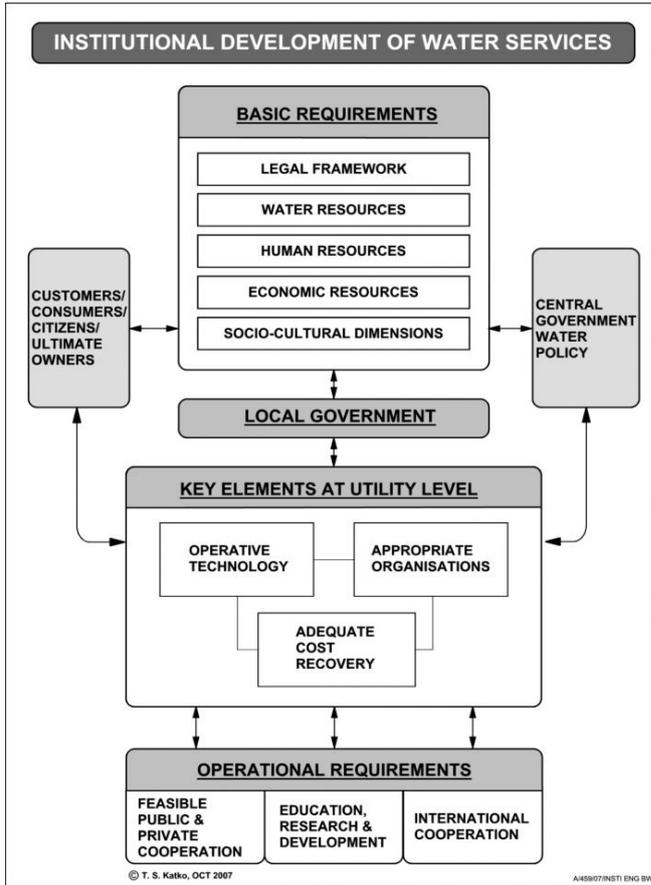


Fig. 1. Framework for institutional development of water services.

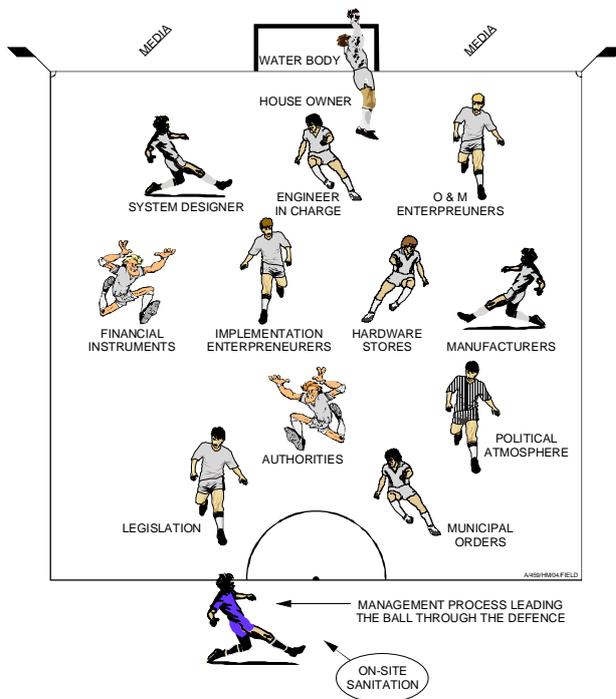


Fig. 2. New Institutional Economics explained by a soccer analogy (Mattila 2005, 83).

The third framework (Fig. 3) related to capacity building and institutional development of WSS is the path dependence theory. As North (1990, p. vii) points out, history matters as “time and context”. His understanding of history, however, is seriously deficient in two closely related aspects. On the one hand, despite their allowance for path dependence, the models and concepts used are too often ahistorical, asocial, timeless, and universal. Although path dependence is commonly interpreted as lock-in or something “negative” in economics, some strategic decisions on technology selection can be highly positive and far reaching, such as metering-based billing and abandoning of lead pipes. Such decisions may be postponing, limiting or binding by nature. In any case, path dependence results in water infrastructure systems limiting the potential, desirable and plausible futures.

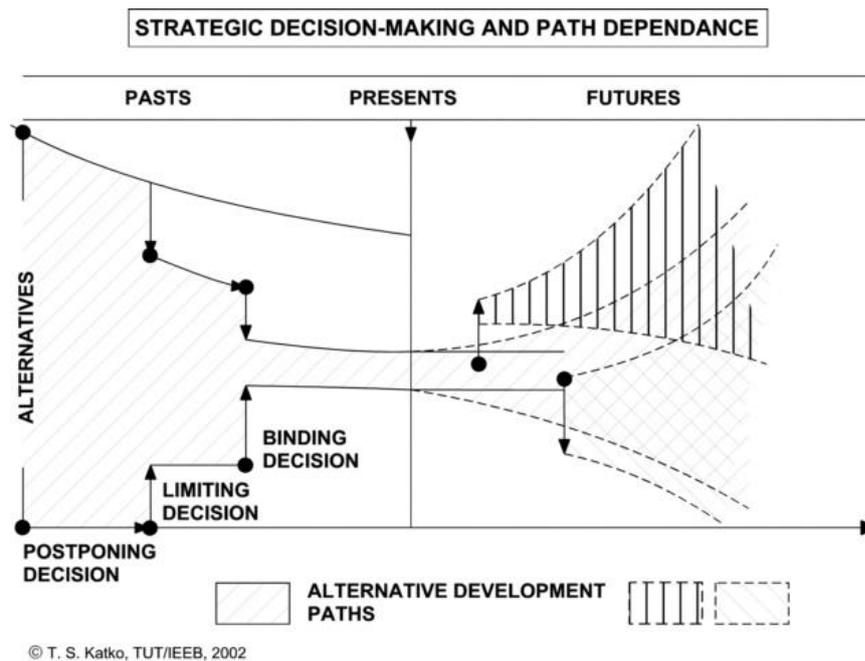


Fig. 3. Path dependence and related decision-making related to pasts, presents and futures (Kaivo-oja et al 2004, 536)

As for research, we have two clearly different traditions. Table 1 shows a comparison of the traditional positivistic and hermeneutic traditions by Andersson (1982). The positivistic tradition emphasises the similarity between physical and social phenomena, explaining, universality, abstraction, simplification, differentiation between facts and values as well as emotion and reason, and objectivity.

The hermeneutic tradition, on the other hand, points out the differences between physical and social phenomena, understanding, concretion, problematisation, interpretation, similarity between facts and values as well as emotion and reason, and subjectivity. In reality, research related to institutional development and policy is likely to cover both aspects or various combinations of them. In any case, the conventional positivistic approach alone cannot explain the complexity of water management (Hukka et al. 2007).

Table1. Positivistic and hermeneutic research approaches by Andersson (1982).

<b>POSITIVISM</b>	<b>HERMENEUTICS</b>
NATURAL SCIENCE TRADITION	SOCIAL SCIENCE TRADITION
SIMILARITY BETWEEN PHYSICAL AND SOCIAL PHENOMENA	DIFFERENCE BETWEEN PHYSICAL AND SOCIAL PHENOMENA
EXPLAINING	UNDERSTANDING
MATERIAL	SOCIOMATERIAL
UNIVERSALITY	TOTALITY
ABSTRACTION	CONCRETION
SIMPLIFICATION	PROBLEMITISATION
DESCRIPTION	INTERPRETATION
DIFFERENTIATION BETWEEN FACTS AND VALUES	SIMILARITY BETWEEN FACTS AND VALUES
DIFFERENTIATION BETWEEN EMOTION AND REASON	SIMILARITY BETWEEN EMOTION AND REASON
DISTANT OBSERVATION	ENGAGEMENT
OBJECTIVITY	SUBJECTIVITY
PREDICTABILITY	CHANGE
DIFFERENTIATION BETWEEN SCIENCE AND PERSONALITY	SIMILARITY BETWEEN SCIENCE AND PERSONALITY
DIFFERENTIATION BETWEEN SCIENTIFIC AND UNSCIENTIFIC KNOWLEDGE	SIMILARITY BETWEEN SCIENTIFIC AND UNSCIENTIFIC KNOWLEDGE

#### 4. Research related to capacity building

The survey on Finnish water services education and research indicated clearly that there is and will remain a shortage of master's-level water services engineers. Today's education that focuses merely on technical systems and the basic features of treatment technologies must be re-evaluated. It appears natural that education should adapt to the change, at least to some extent.

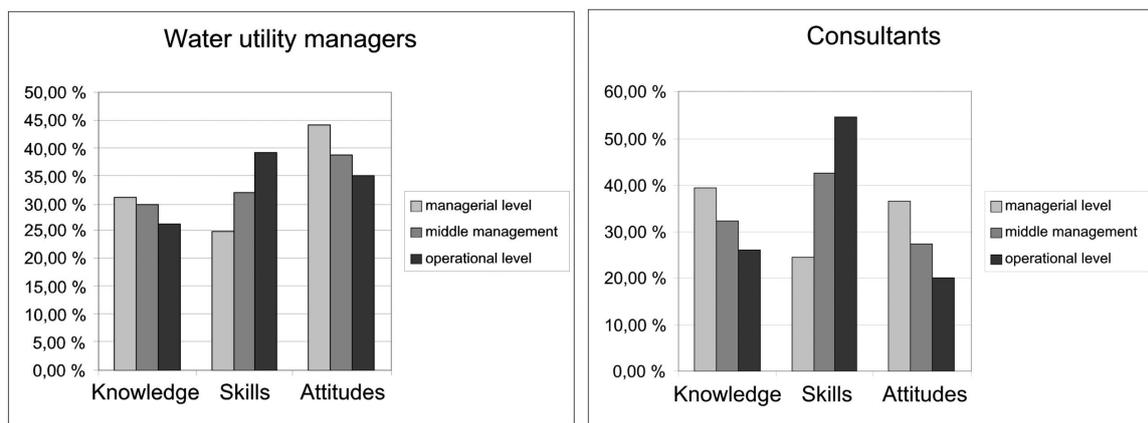
The present environmental engineering-oriented programmes were found to serve water services inadequately. Yet, environmental engineering programmes as such were not being evaluated here, only their beneficiality to the operation of water and sewage utilities. Environmental engineering programmes are probably important as such since the graduates seem to be able to find jobs in the sector at least in today's situation. However, it is obvious that there is more potential need and markets for infrastructure-oriented, and particularly management-oriented, programmes.

The most important future tasks of water services engineers with MSc degrees were expected to be especially in management and financial administration. In most cases the graduates fairly soon shift towards management-type duties after initially performing conventional design and

planning duties. The various groups believed that most of the engineers would move to management-type positions in 5–10 years. Should this be considered somehow in the current programmes and curricula?

The survey suggested placing more emphasis on the following areas: futures thinking and visionary leadership, cooperation with other sectors, policy issues, management & leadership, risk management, asset management, project management and strategic planning. In the future, according to the experts, the following fields of expertise will require special attention: strategic planning, leadership, risk management, organisational and economic issues, network repairs and rehabilitation as well as preparations for climate change.

The fundamental nature of water supply and sanitation services was clearly revealed by the assessment of the required knowledge, skills and attitudes at the three levels of utilities – management, middle-management and operational. Fig. 4 shows the relative importance of knowledge, skills and attitudes as seen by utility managers and consultants. The former group considers attitudes most important while the latter values knowledge. Yet, it is obvious that all three dimensions are needed. It is a challenge to build educational programmes that incorporate them. Group work and other participatory activities between various disciplines already in connection with the educational programmes could probably create positive attitudes towards experts with different backgrounds. In this respect at least the Finnish, discipline-based curricula probably differ from those available in Anglo-American universities.



*Fig. 4. Relative importance of knowledge, skills and attitudes for viable water services management at three levels as seen by utility managers (n=8) and consultants (n=8).*

The survey also touched on societal effectiveness. Researched, well-grounded and insightful knowledge about water services is to be produced for decision making especially as regards major policy decisions and solutions in principle. Research results should be presented widely in all possible forums – trade journals, periodicals, newspapers, radio and television. At the same time, a more active culture of dialogue could also be promoted. Traditional thinking in water services has been that, for instance, international experience and doctoral studies are primarily a handicap for anyone applying for the post of managing director of a waterworks. Fortunately, the attitudes are changing.

## 5. Suggested approaches to water sector capacity building

Integrated Water Resources Management (IWRM) has been identified as one of the basic water-related policy approaches in recent environment and water sector international forums such as the Johannesburg Summit in 2002 and World Water Forums in 2003 and 2006 (Varis

2005). In Europe, the EU Water Framework Directive provides a useful instrument for integrated water resource management in river basins. IWRM calls for the management of water resources based on larger geographical areas than the typical water services areas. River basins are often shared by neighbouring countries and may even extend over several countries while water services are typically operated and managed locally at the municipal level.

On the other hand, the subsidiarity principle, which is also established in EU law by the Treaty of Maastricht, and the Dublin principle of 1992 both stress that water should be managed at the lowest appropriate level (UNCED 1992). Thus, broadly speaking, water services management is largely a regional, national and even international issue while water resources management is more of a local one (Fig. 5). Integrated Water Resources Management aims at interlinking the two – both are needed and interdependent (Pietilä 2006).

Water services in this context include also sewerage services and sanitation. As for water resources management, particularly the issues of transboundary waters, integrated water resources management, and priorities of water use purposes are emphasised. More interaction between water services and water resources management would probably be beneficial.

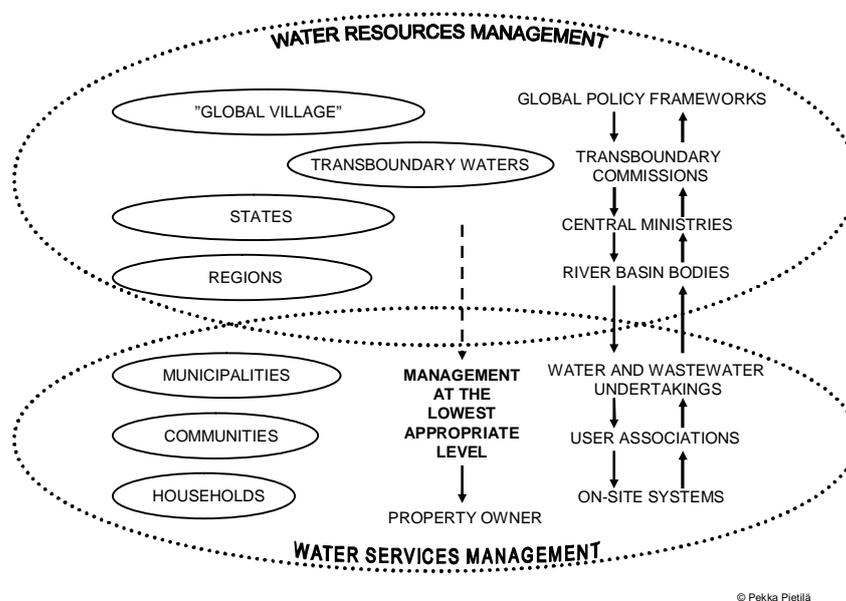


Fig. 5. Framework for water services and water resources management and their interactions at various levels (Pietilä 2006, 30).

## 6. Discussion

This paper has presented some approaches and thoughts on building capacities for better water services and resources management. It has pointed out the need for institutional development, the relevance of New Institutional Economics, and the path dependence affecting the management of water infrastructure systems.

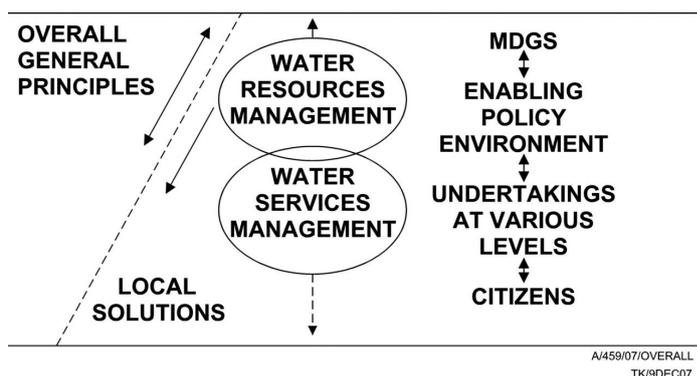
It is obvious that the bias in favour of a positivistic approach and natural sciences in water research prevents finding more appropriate answers to wider water governance challenges. Thus, water research should be expanded to include diverse multi-, pluri-, cross-, inter- and multi-disciplinary approaches, while individuals could be encouraged to strive for transdisciplinarity. The complexity of water management means that it is impossible for a

single discipline or approach to cover all research needs. Therefore, we need a variety of theories, approaches, methods, and strategies. All of this has to be considered seriously in education and curriculum development.

The recent questionnaire on education, research and the social effectiveness of water and sanitation services shows that while the emphasis has so far been almost entirely on treatment technologies, current curricula should be expanded to cover also management, leadership, economics, policies, strategic thinking and best practices. Furthermore, the results indicate that present education and research do not provide sufficient answers to the socially significant questions posed by water services. The overall management of water services is at issue: it is not comprehensive enough presently. We need better research-based knowledge for developing our water management systems and policies. This requires dissemination of research results to all possible forums. Academic institutions also need incentives to get involved in such broad-based dissemination in addition to publishing in scientific journals and the like.

In addition to formal education at various levels, the principle of life-long learning should be kept in time. For instance, the utility of Espoo Water has recently defined the following as its strategic goal: to achieve a high level know-how competence. For achieving this the number of days used annually for training and education should be around five or six per person as an average, while at higher levels it is even more.

Water services and resources face various types of challenges at various levels. Water resources management tends to occupy a higher hierarchical level than water services management. The latter includes sewerage or sanitation and should be managed at the lowest appropriate level. At the global level, the Millennium Development Goals and water play an important role. At the national, and to some extent also on the international level, such as the EU, an enabling policy environment is needed whereas water undertakings produce services at the local level. As for sustainable water management, we should continuously ask and consider which general overall principles may be valid and which practices and strategies are mostly needed at the local level.



*Fig 6. The interconnections of overall principles and local solutions related to water resources and water services management at various levels.*

## 7. Conclusions

The following general conclusions can be made as regards the future challenges to water services education and research:

- (i) A more holistic approach to water policies – both water services and water resources – should be pursued while striving towards sustainable development.

- (ii) In any policy and institutional framework qualified professionals will be the basic requirement of development.
- (iii) Water research should be expanded to include more diverse multi-, pluri-, cross-, inter- and multi-disciplinary approaches.
- (iii) Current curricula in water and sanitation services should be expanded to cover such areas as strategic planning and thinking, institutional and management issues, policies and best practices.

We have a good reason to believe that more interaction would be useful between expert of water services and water resources management over various professional and educational disciplines. They should also together improve the communication with the politicians and the decision-makers in order to better get their professional arguments heard.

## 8. Acknowledgements

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