Document from the 7th Africa Water Week, held in Libreville, Gabon, 29 October – 2 November 2018

A knowledge asset of the African Ministers' Council on Water

This material is shared as a learning resource to promote awareness and good practice in the provision, use and management of water resources for sustainable social and economic development and maintenance of African ecosystems.

How Smart Water Management technology can contribute to SDGs

Bitna Lee
UNESCO i-WSSM Programme Specialist

United Nations Educational, Scientific and Cultural Organization

International Centre for Water Security and Sustainable Management

Contents

1. Paradigm Shifts of water issues
2. Concept of SWM
3. Research framework
4. Case study – Paju Smart Water City
5. Conclusion

Paradigm shifts of water issues

Securing proper water and stable allocation is the hot discussion topic to the whole global humanity,

Global Agenda

water crisis & water security

Clean Water

1970s

'Water Quality"

Sustainable Development

1980s

'Environment'

Development of Water Resources

1990s

'Water Crisis'

Stability of Water Allocations

2000s~

'Water Security'

Smart Water Management

United Nations Educational, Scientific and Cultural Organization

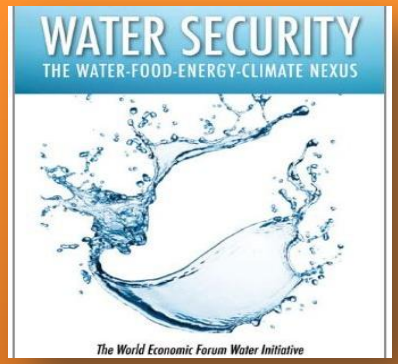
i-WSSM International Centre for Water Security and Sustainable Management

SWM for Better Water Management

Global challenges are integrally related to Water Management

Climate Change

Water-Energy-Food Nexus



Sustainable Development

SUSTAINABLE DEVELOPMENT GOALS

Common subject for All

Smart Water Management

United Nations Educational, Scientific and Cultural Organization

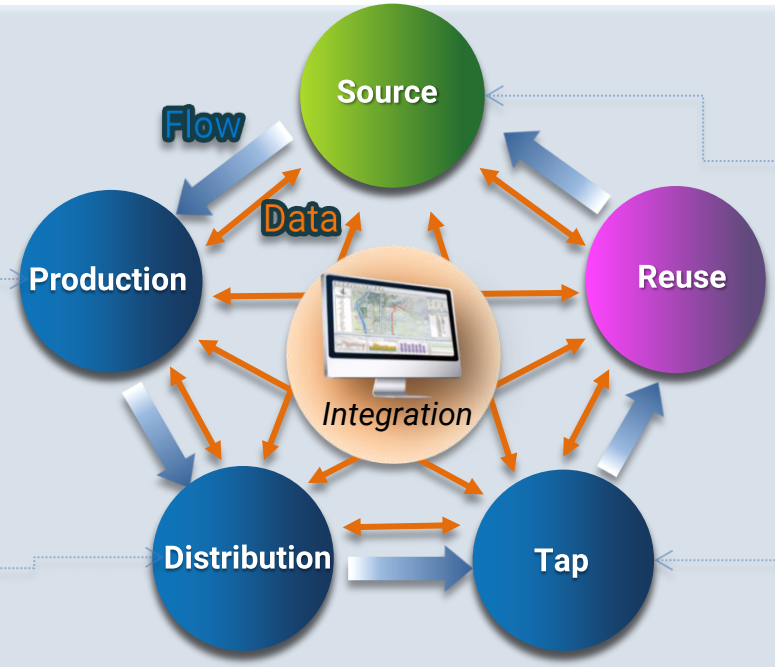
i-WSSM International Centre for Water Security and Sustainable Management

Concept of SWM

Traditional Management

- Getting feedbacks from users are not an option when water flows are in one direction

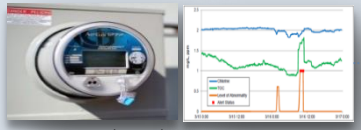
Smart Management

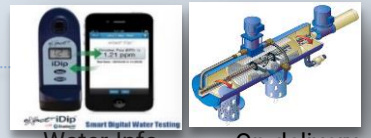



River Flow (ADCP) W.Q Sensors


Rainfall Remote sensing


Rainwater reuse Reuse plant


Metering (AMI) Water use info.


Water Info. On-delivery Treatment

- With smart devices and solution programs, each water node can communicate and feedback the water information in terms of water quantity & quality

* ICT based real-time decision support system with using multi-directional water and information flows as well as diverse sources

UNESCO United Nations Educational, Scientific and Cultural Organization

i-WSSM International Centre for Water Security and Sustainable Management

Introduction of Research

- Analyze social, technological, economic, environmental, and political aspects of SWM
- Measure the level of SDGs implementation
- Identify the importance and role of SWM

United Nations Educational, Scientific and Cultural Organization

i-WSSM International Centre for Water Security and Sustainable Management

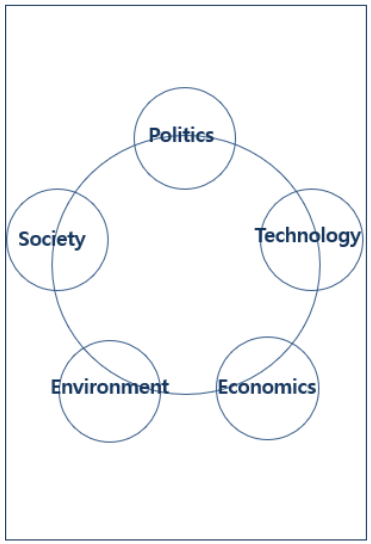
Research Processes

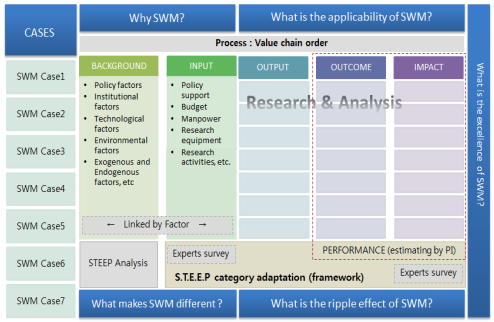
Design STEEP-based Analysis Framework

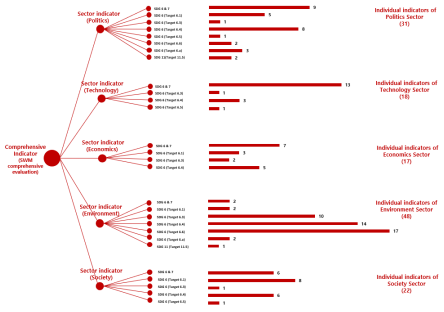
Develop 5W-Track Analysis Framework

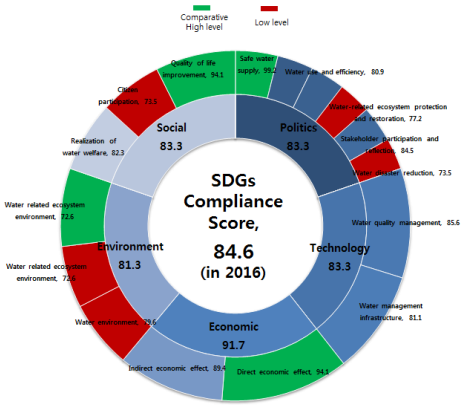
Develop SWM Comprehensive Performance Indicator System

Conduct SWM Case Analysis





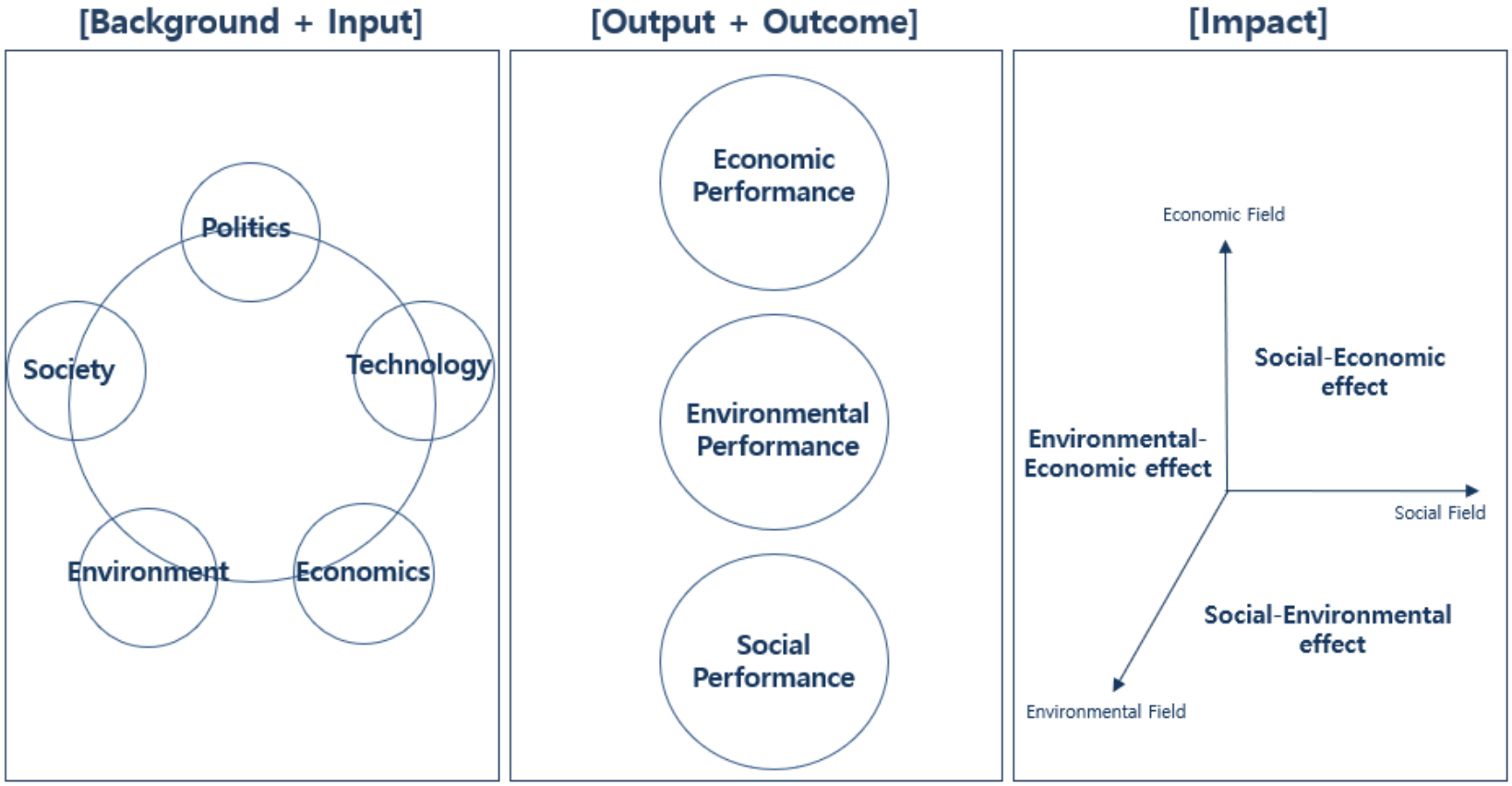




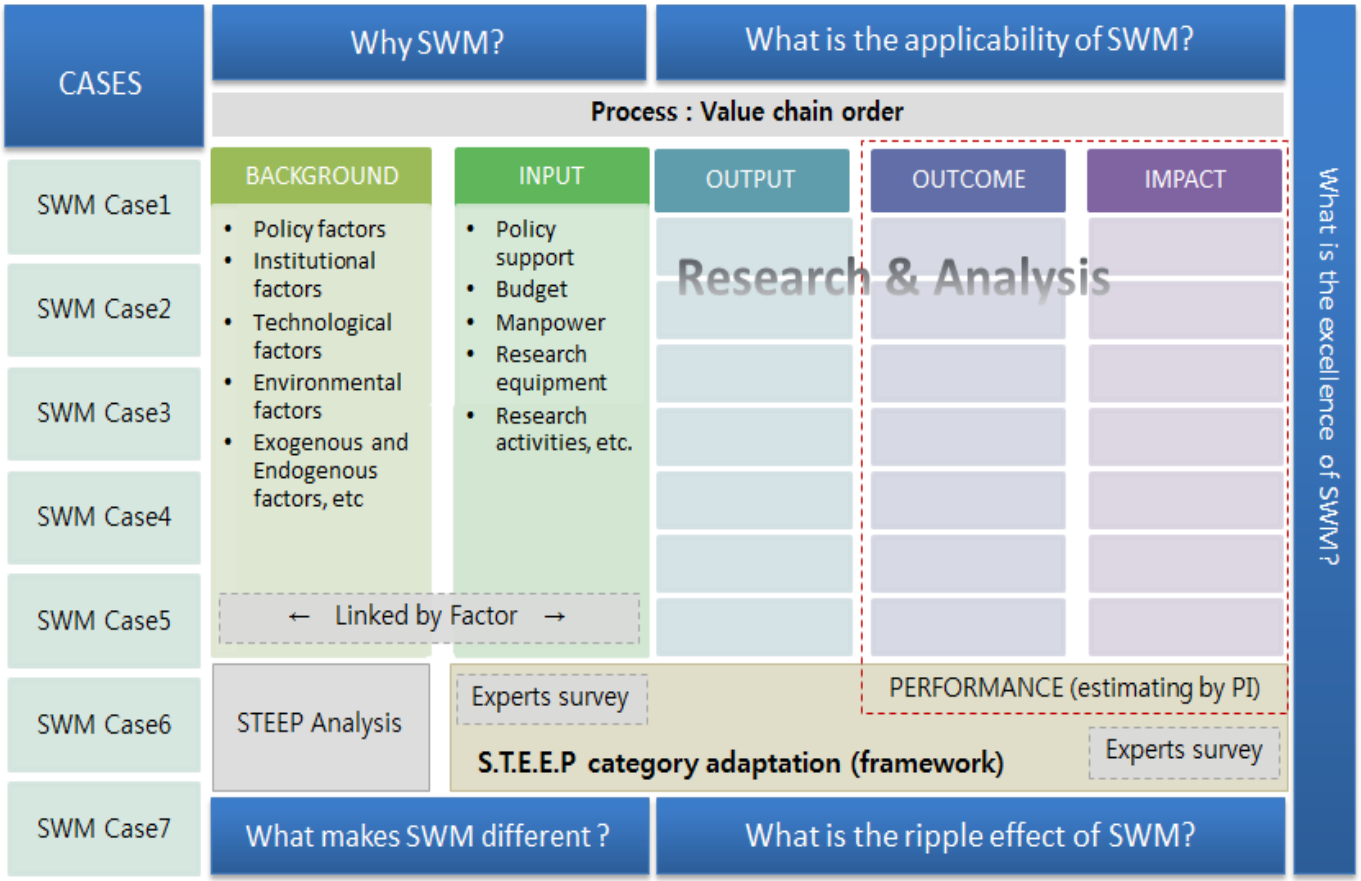
United Nations Educational, Scientific and Cultural Organization

i-WSSM International Centre for Water Security and Sustainable Management

Design STEEP-based Analysis Framework



Development of 5W Track Analysis Framework



- Developed on the basis of value chains like the comprehensive analysis framework, structured to produce results for 5 questions (5W) through the results of each domain
- Structuring SWM comprehensive analysis framework considering STEEP structure and SDGs goals

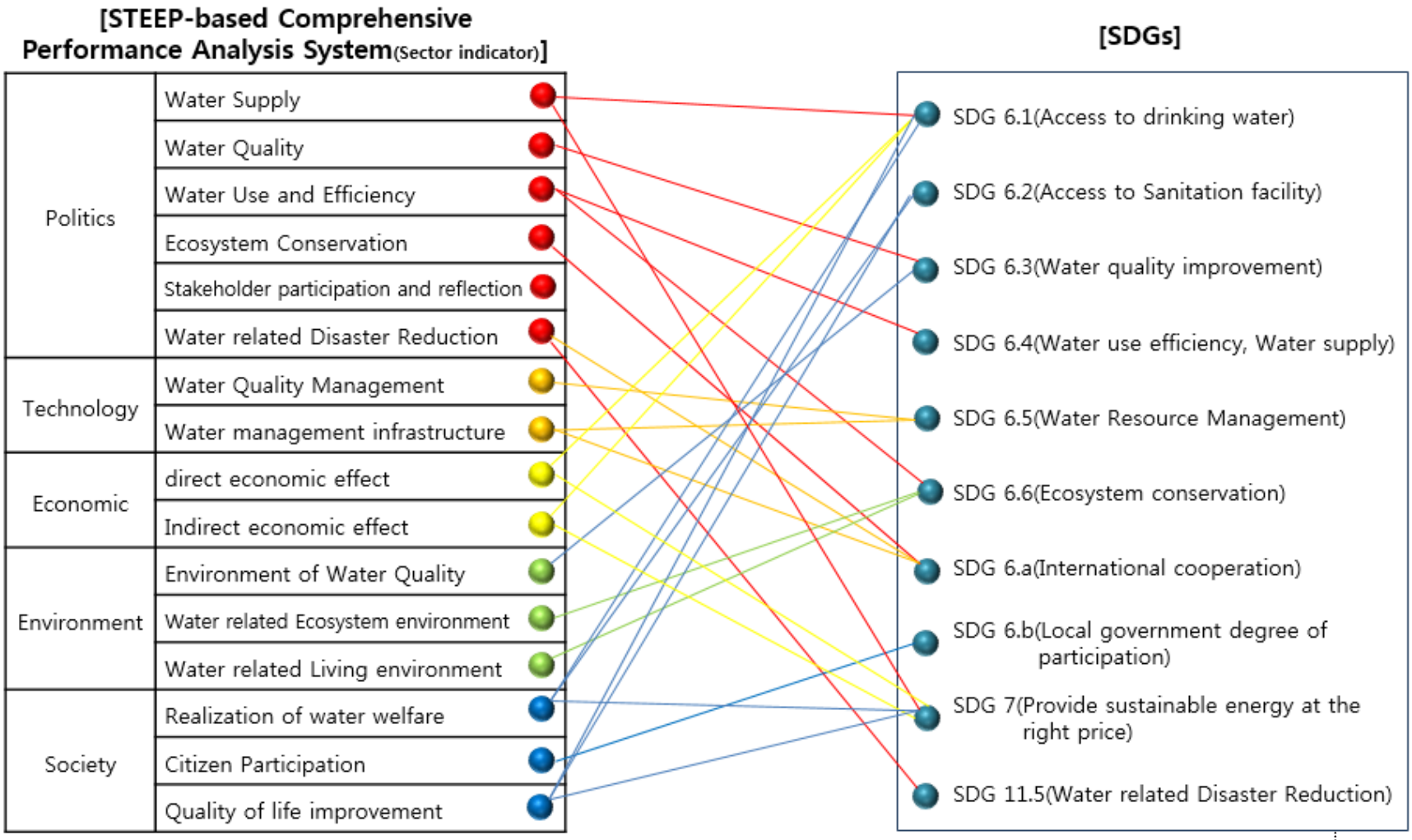
UNESCO United Nations Educational, Scientific and Cultural Organization

i-WSSM International Centre for Water Security and Sustainable Management

SWM Comprehensive Performance Indicator System (1/3)

	Objective	Issue Category**	Indicator**
SWM	Changes in social structure and recognition	Social	· Water supply population growth
			· Number of Job Creation in the water industry
			· Reflection degree of social needs
			· Quality-of-life Improvement
			· Comprehensive Evaluation Index(100 point Max)
	Applied Technology	Technological	· Drinking rate of water
			· Rate of water purifier installation
			· Rate of water sales
			· Reduction of leakage quantity
			· Comprehensive Evaluation Index(100 point Max)
	Rate of change of ecosystem about Water Management	Environmental	· Quality of water index*
			· Number(Kind) of Inhabitant
			· Kind of bird
			· Riparian Environment
			· Comprehensive Evaluation Index(100 point Max)
	Changes(Effects) in economic structure/condition of the water industry	Economic	· Increasing number of water-related industry
			· Reducing social costs
			· The estimated amount of benefits
			· Consignment fee
			· Cost estimating of value
			· Market competition
			· Decreasing rate of Budget Waste in the water industry
			· Comprehensive Evaluation Index(100 point Max)
	Policy and administrative changes about Water Management	Policy	· Number of legislation compared to developed countries
			· Number of National issues about water industry
			· Implementation ratio of water related policies
			· Comprehensive Evaluation Index(100 point Max)

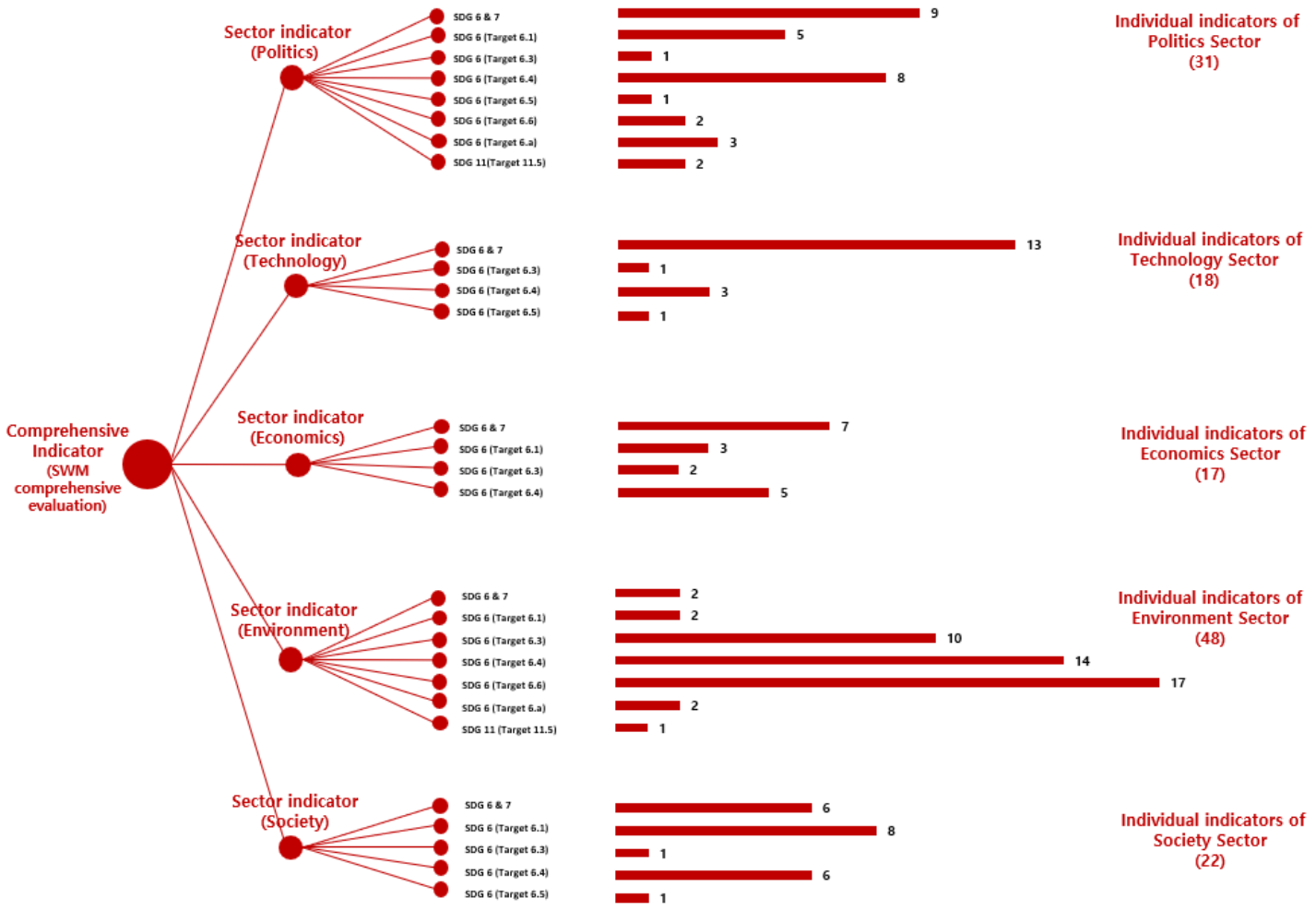
SWM Comprehensive Performance Indicator System (2/3)



United Nations Educational, Scientific and Cultural Organization

i-WSSM International Centre for Water Security and Sustainable Management

SWM Comprehensive Performance Indicator System (3/3)

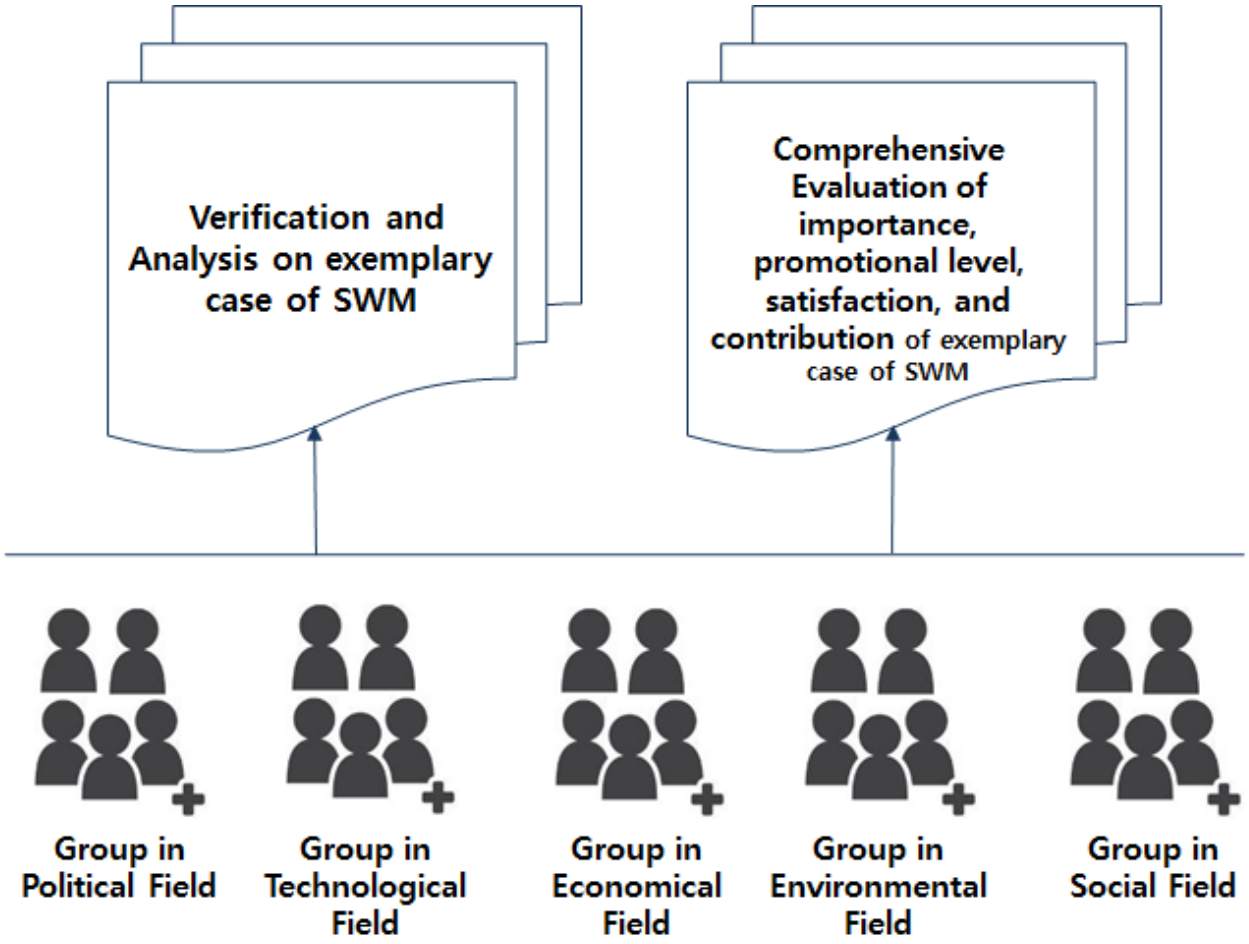


- Developed as STEEP-based core-sector-hierarchical structure of individual indicators
- Five sector indicators, 16 small sector indicators, and 136 individual indicators

United Nations Educational, Scientific and Cultural Organization

i-WSSM International Centre for Water Security and Sustainable Management

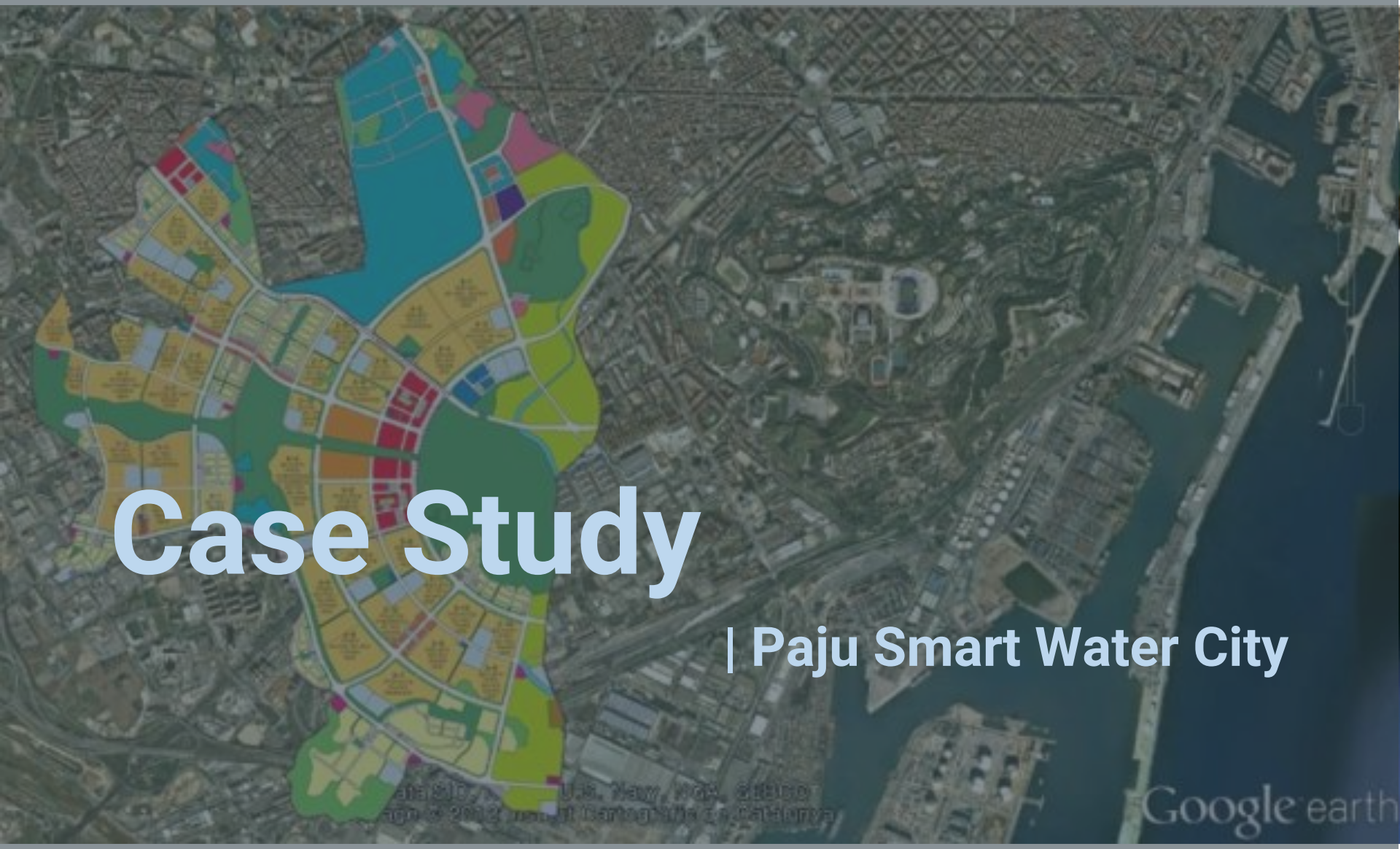
Five Core Expert Groups Review & Evaluation



- Experts' survey to review the performance and effect of SWM.

United Nations Educational, Scientific and Cultural Organization

i-WSSM International Centre for Water Security and Sustainable Management



Case Study

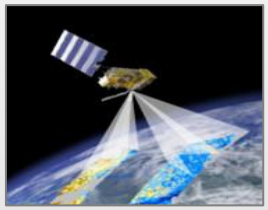
| Paju Smart Water City

Smart Water City (SWC)

❖ **Paju SWC is based on a combination of smart devices, smart solutions (technology), and smart services**

Smart Devices

- Re-chlorination device
- Automatic flashing device
- Pipeline flushing device
- Pipeline diagnosis device
- Water quality sensors
- Smart meters

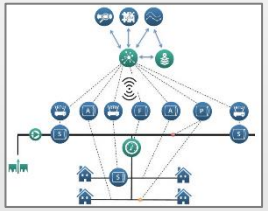



Smart Solutions

- Water-NET
  - water network monitoring system
- Remote leakage monitoring system

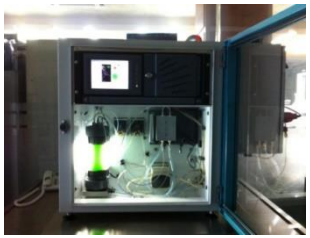

Smart Services

- Real-time water quality information system
- Reflecting consumer's needs



Smart Water City (SWC) – Paju City

- **For healthy tap water supply and water quality's reliability, adapt ICT techniques through all water supply process(Paju city)**



<water quality monitoring, chlorine control system>

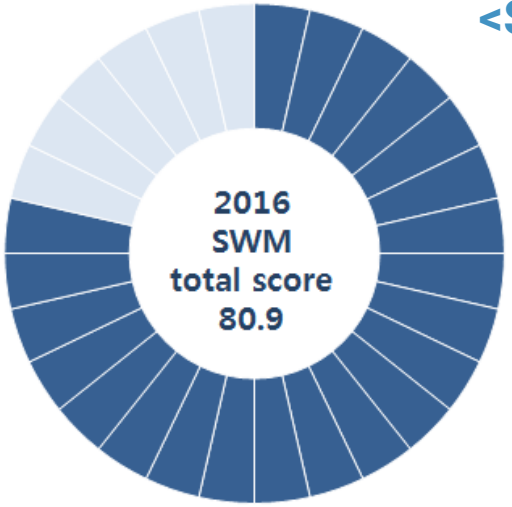
<Water works washing and Automatic flushing>

<Customer Satisfaction program with Mobile app.>

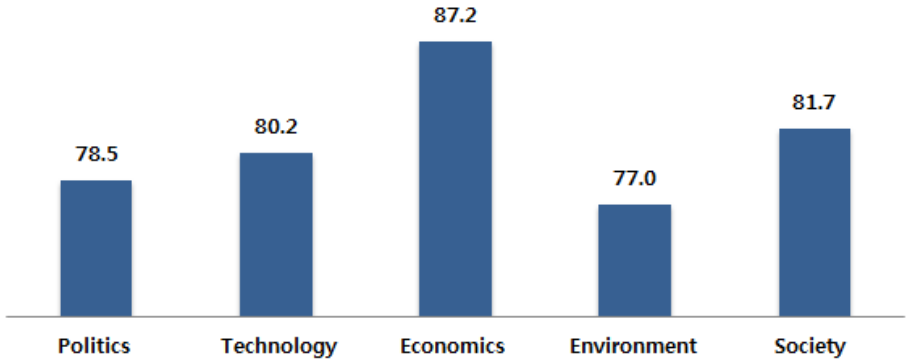
Result

- **Direct drinking Tap-water rate** improved significantly (1.0% → **24.5%**)
- Improve **quality and service satisfaction** of Tap-water (55.0% → **92.3%**)
- Chlorine equivalent rate improved from 24.3% to 36.4%
- Significantly reduced Tap-water quality complaints (4.5 → 1.3 times/month)

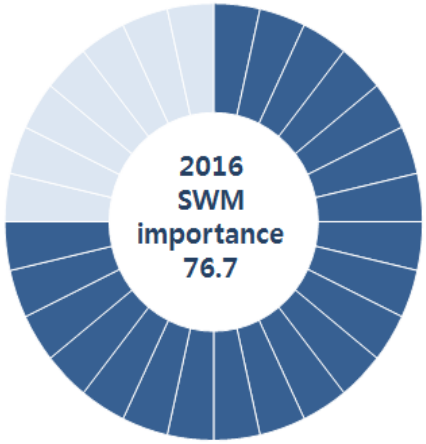
Result | SWM Comprehensive Performance

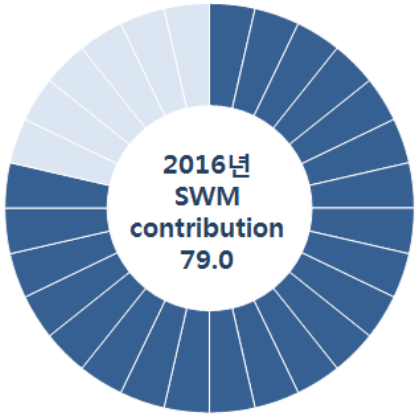


<SWM Comprehensive Performance on STEEP fields>

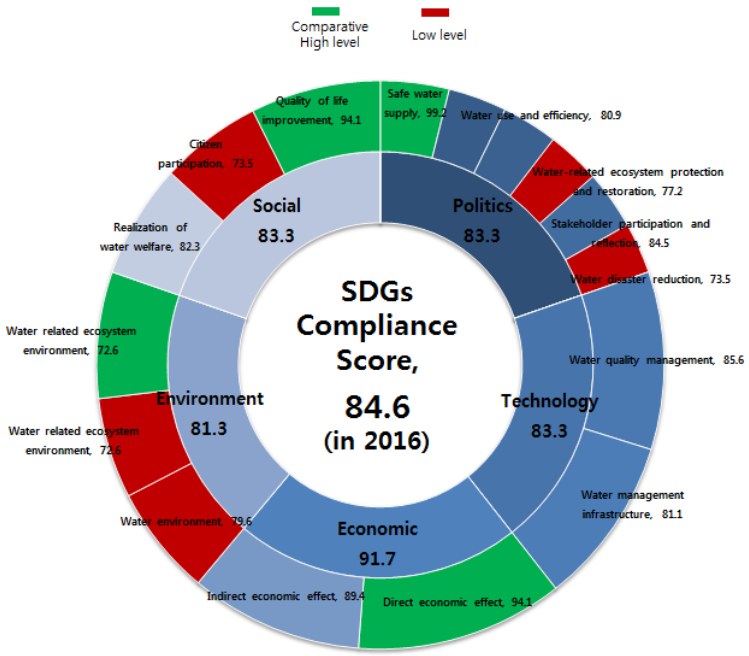


<Four SWM Comprehensive Performance Levels>

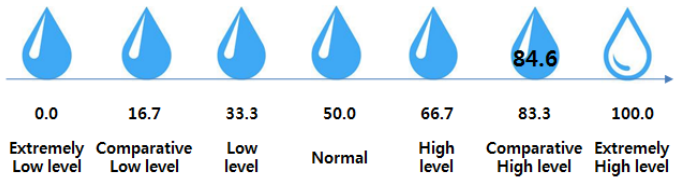




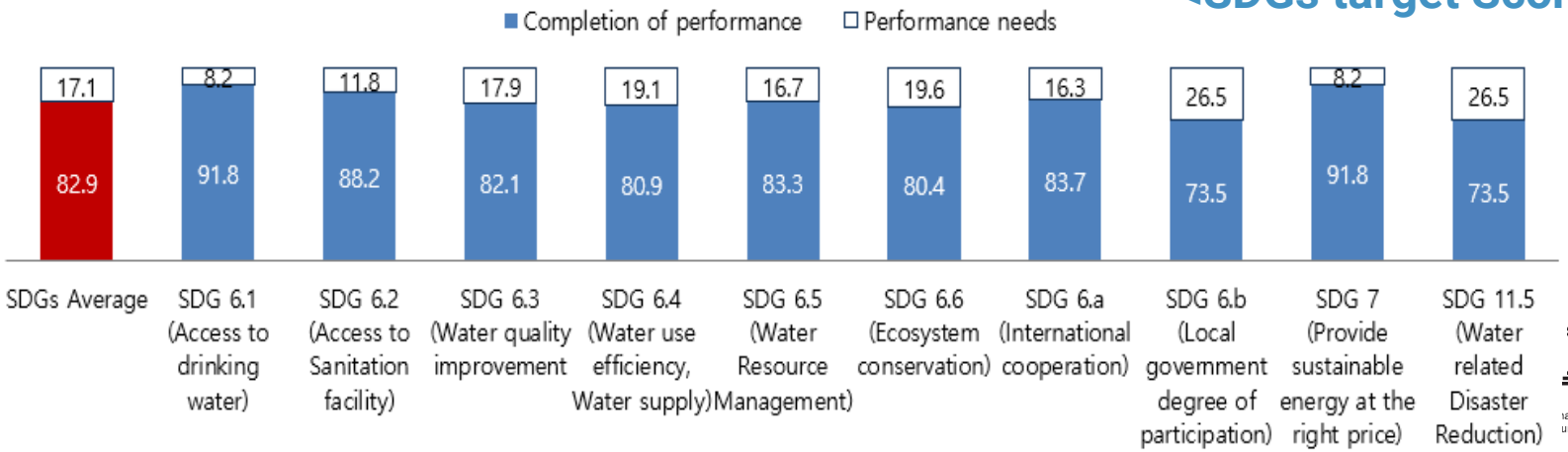
Result | Contribution of Paju SWC to SDGs



<SDGs Compliance Score of Paju SWC case>



<SDGs target Scores>



United Nations ıal, Scientific and ural Organization

i-WSSM International Centre for Water Security and Sustainable Management

Conclusion

- Basic research for global sustainable use of water suggesting the introduction of SWM in the water management field
- Draws the level of implementation of SDGs as numerical value and performance result through study on SWM exemplary case.
- Low-cost SWM can be realized even in underdeveloped countries, and it will provide strategies and guidelines to encourage SWM application.



United Nations Educational, Scientific and Cultural Organization

International Centre for Water Security and Sustainable Management

Thank you

UNESCO i-WSSM (http://unesco-iwssm.org/)
Ms. Bitna Lee (blee@unesco-iwssm.org)



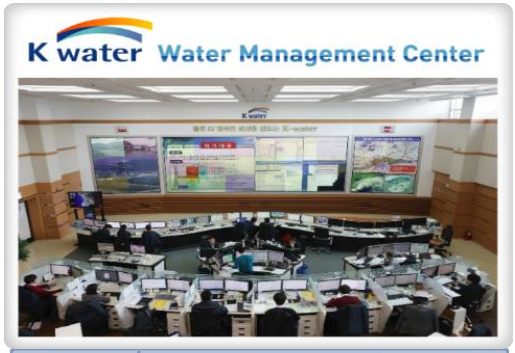
Case Study 2

| Integrated Water Resource Management System

IWRM Project

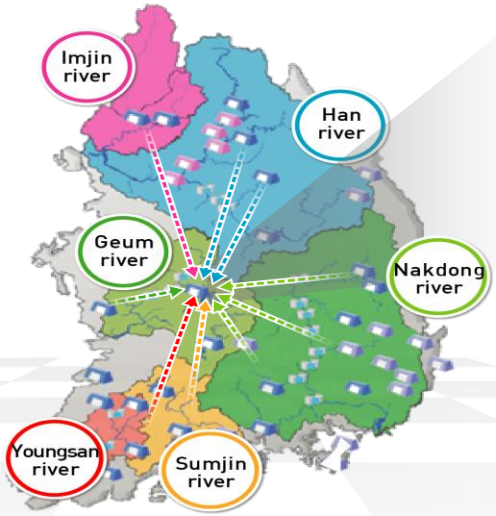
Water Management Forecasting & Decision-Making Technologies

WROC(Water Resources Operations Center) functioning as a hub for IWRM practices



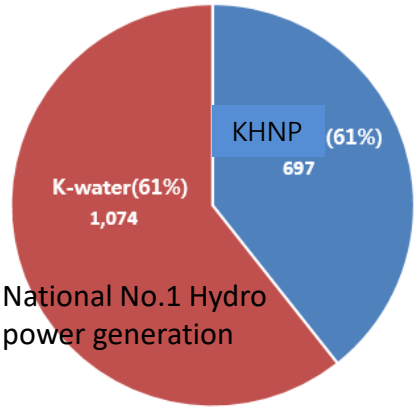
Major Works

- Remote Dam-weir management
- Weather analysis & prediction
- Flood control. Water supply
- Hydro power generating

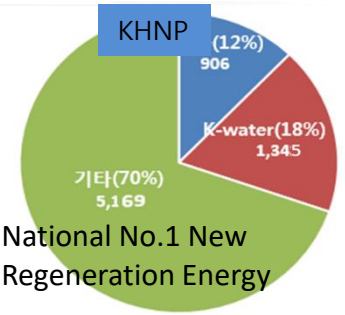


Integrated Dam Operation

- 49 dams & weirs
- 25 hydropower plants
- 446 Gauging Stations
- 186 Warning Stations



National No.1 Hydro power generation



National No.1 New Regeneration Energy

Result

365 Days and 24 hrs., Water Disaster preparation and Integrating Dams and Weirs.

IWRM System for Local

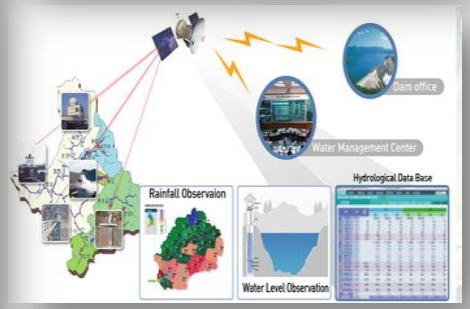
- **Implement to Local Governments**

United Nations Educational, Scientific and Cultural Organization

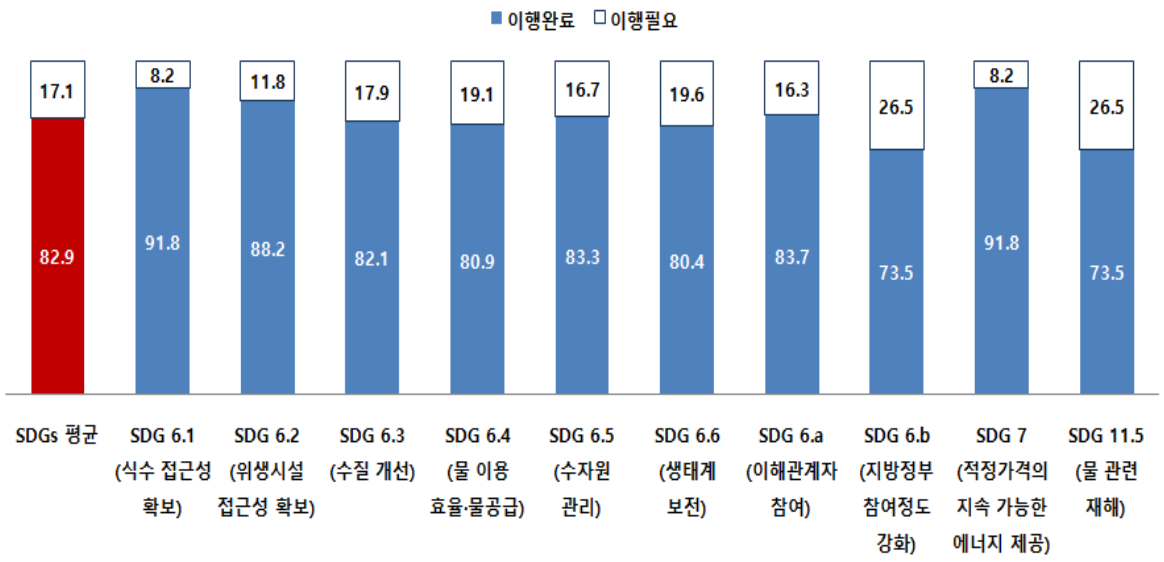
i-WSSM International Centre for Water Security and Sustainable Management

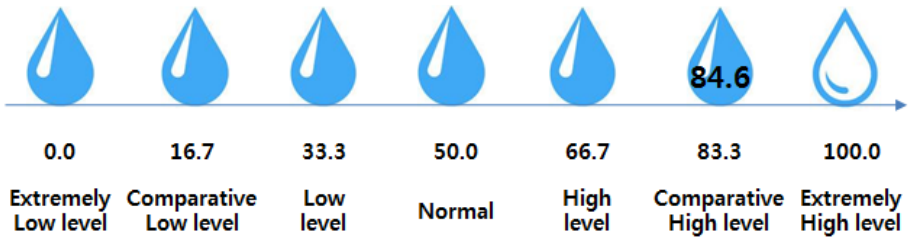
IWRM System for Abroad

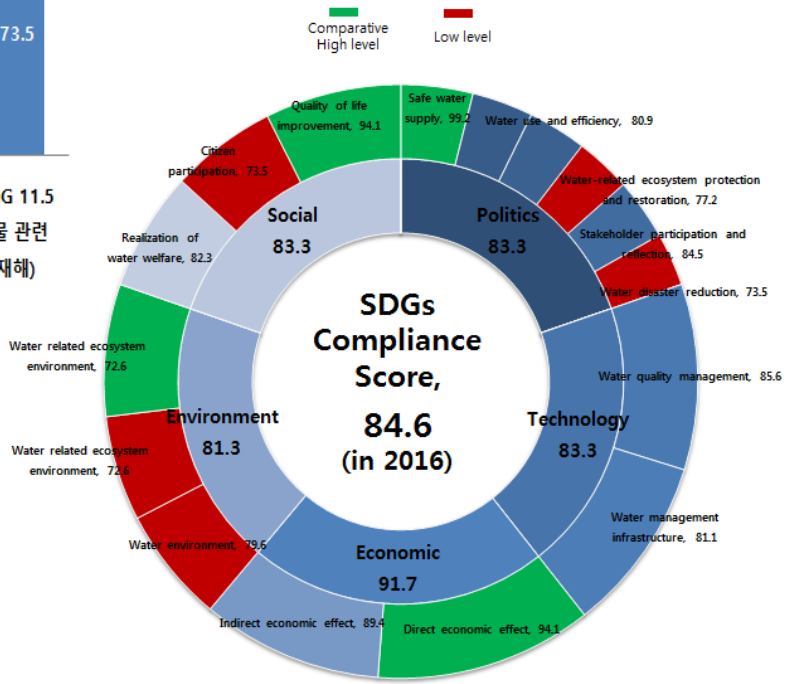
In ALGERIA



Result | Contribution of IWRM System to SDGs





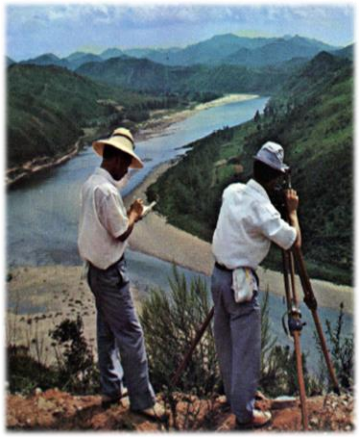
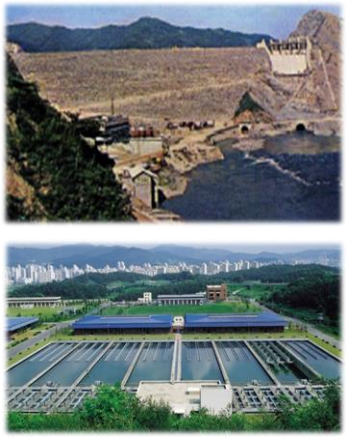
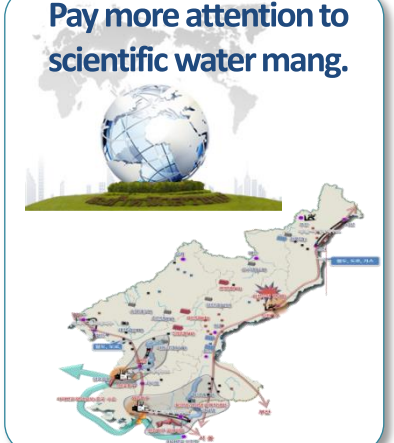


United Nations Educational, Scientific and Cultural Organization

International Centre for Water Security and Sustainable Management

What Korean have done

Pool country to Now

1960s	1970s-1990s	1990s-2000s	2010s ~
Planning	Construction	Digitalization	Intelligence
		# of Water disasters 	Pay more attention to scientific water mang. 
Investigation & Long-term Planning	Dams and water treatment infra.	ICT convergence	Global knowledge share & standardization

Now we have Water Resources

Constructing 38 dams with hydro power plants

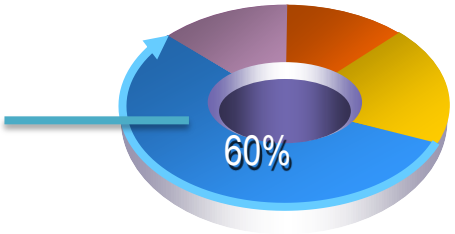
- Developing and managing multipurpose dams to prevent floods, provide water, and hydro power plants
- Building eco-friendly dams with minimal impact on surrounding ecology and boosting tourism of the neighboring areas

Developing and **operating** 38 dams, including the Soyang River Dam.

Total Amt. of Water	13,072 million m³
Flood Controlled	5,066 million m³
Amt. of Water Provided	11,672 million m³
Amt. of Energy Generated	1,047,000 kW

<Responsible for over 60% of all electricity generated by general hydroelectric plants in Korea>

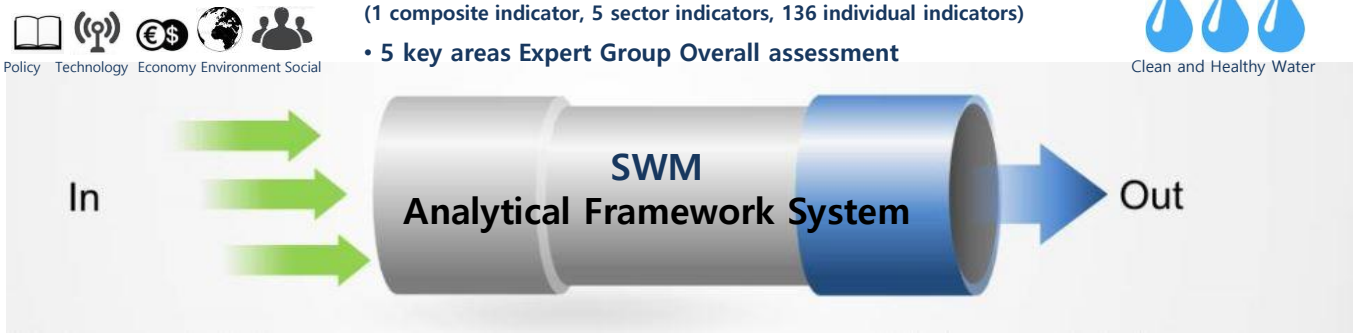
K water



- STEEP-based comprehensive performance analysis framework
- 5WTrack Analysis Framework
- SWM performance measurement system

(1 composite indicator, 5 sector indicators, 136 individual indicators)

- 5 key areas Expert Group Overall assessment



- SWM technology, policy, industrial environment
- Water management paradigm change
- Exemplary case related to internal and external environment
- Background and Results of Exemplary case

- Analysis results using indicators
- 5WTrack analysis framework analysis results
- Results of 5 core expert groups
- SWM comprehensive evaluation result
- Differentiation and excellence of SWM
- SDGs implementation level (implementation level and results)

United Nations Educational, Scientific and Cultural Organization

i-WSSM International Centre for Water Security and Sustainable Management

Why SWM? | **What is the applicability of SWM?**

Process : Value chain order

파주 스마트워터시티 시범사업

Background

- 미시는 물 패러다임 변화(풍부한 물→안전한 물→맛있는 물→건강한 물)
- 대한민국 수질지수는 122국가 중 8위(수돗물의 맛과 품질의 우수성 인정)
- 국내 물 전문가는 수돗물을 가장 안전하고 경제적인 물로 평가(2014년)
- 대한민국 수돗물 직접 음용률은 5%내도, 1/2 정도가 정수기 물을 이용하고 있고, 대한민국은 선진국(미국 56%, 일본 52% 등)보다 매우 저조한 음용률을 보임
- 대한민국 수돗물 직접 미음용 사유는 '물 탱크 및 수도관 부실(30.8%), 상수원 오염우려(28.1%), 이물질 및 냄새(24%)'로 확인됨
- 이에 한국수자원공사는 물 관련 패러다임의 변화 문제점을 인식하고 '건강한 물 공급 사업' 추진
- 한국수자원공사는 '취수원 수질관리, 정수처리 시스템 최적화, 지능형 관망 운영, 맞춤형 산업용수 공급 및 하수처리 운영 효율화'의 5개의 주요 목표를 실현하기 위한 시범사업 추진
- 시범사업 추진 대상지는 지역개선의 요건 분석이 용이한 한국수자원공사 수탁 운영 중인 지자체를 대상으로, 고도 정수처리 (활성탄) 공급을 위해 고도도입이 완료된 사업장, 구축기간을 고려해 블록 구축, 원격운영, 관망상태 등 운영수준이 양호한 블록, 전체 수돗물 공급시설에 대한 최적화가 가능하도록 이원화된 공급체계를 갖고 있는 지역의 3가지 조건을 충족하는 파주시의 교하지구를 1차 시범대상지로 선정

Input

- (정책)
  - 국토교통부는 2012년부터 5년간 스마트 물 서비스의 기술개발 및 상용화를 위하여 SWG 연구단을 구성하고 시행
  - 파주시는 「파주시 수도급수 조례」와 「파주시 물의 재이용 촉진 및 지원에 관한 조례」에 따라 급수설비공사, 공급조건, 위탁운영, 물관리 등 관련 법적제도를 갖춤
- (기술)
  - 파주시 상수도는 2008년 수자원공사와 위탁운영 협약을 체결하며 고도정수처리시설 도입 및 상수도 블록화 시스템 구축, 실시간수질관리 등의 노력을 진행해옴
  - 파주 SWC 사업의 투입 기술은 ICT기반의 water-NET을 구성하여 상수관망관리, 시각 호브 및 이상관로 검색, 펌프성능 분석 등
- (경제)
  - 우리나라 GDP는 2015년도 기준 세계은행이 조사한 조사대상 165개국 중 30위도 상위권
  - 파주시 GRDP는 경기도 GRDP 내에 3.9% 비중을 차지하며, 경기도 내 10번째로 큼
- (환경)
  - 파주시는 4개 국가하천과 30개 지방하천, 76개 소하천 등 풍부한 수자원 보유
  - 한강하류의 파주시점 수질은 2012년 기준 Ⅱ 등급, 임진강은, 2011년 기준 Ⅱ 등급으로 양호
- (사회)
  - 파주시 경제활동참가율은 60.9%이며 그 중 여성의 경우는 51.8%
  - 파주시는 소득 불균형 해소를 위해 다양한 일자리 창출사업과 여성의 사회참여 확대를 위한 사업 추진 중

Output

- 파주시 스마트 물 관리 기술 적용률 100% 달성 (2014년 0.0% → 2016년 100%)
- 파주시 상하수도 보급률 0.7% 증가 (2012년 95.8% → 2014년 96.6%)
- 파주시 건강한 수돗물 보급률 100% 달성 (2014년도 3만 7천명 → 2016년 파주시 전체 40만명)
- 파주시 상수도 통계 (출처:국가상수도정보시스템)

연도		[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
수도	2015년	[illegible]	96.6	171.4	96.3	4.3	564.4	[illegible]	76.5
	2016년	[illegible]	96.7	161.1	96.7	4.4	563.6	[illegible]	76.4

- 파주시 먹는물수질 수준 (출처:국가상수도정보시스템)

연도	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
기준	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
2015년 평균	1.0	1.0	6	7.3	6.64	6.44
2016년 평균	1.0	1.0	6	7.3	6.64	6.15

Outcome

- 파주시 수도꼭지 수질민도 평균 27.2% 개선 (2015년)
- 파주시 수돗물 직접 음용률 증가 (시범사업 적용 전 1% → 시범사업 적용 후 24.5%)
  - 실제 우리나라 국민 수돗물 직접 음용률은 5%
- 파주시 수돗물 음용률 변화

구분	스마트워터시티 조성 전	스마트워터시티 조성 후
[illegible] 음용률	1.0%	24.5%
[illegible] 음용률	36.3%	61.8%
[illegible]	33.3%	45%

- 임진강 하류 파주시 주변 유역 다수 어종 출현(파주시 주변 유역 출현 어종 56종, 전체 임진강 출현 어종 76종의 77.6%에 해당. 임진강보다 큰 대형하천인 한강 출현 어종 21종에 비해 다양한 어류 출현)
- 2016년, 파주 비무장지대에 멸종위기 1~2급 야생조류 출현
  - 멸종위기 1급 : 저어새(천연기념물 제199호), 검독수리(제243-1호), 참수리(제243-4호) 등 야생조류 3종
  - 멸종위기 2급 : 재두루미(제203호), 흑두루미(제228호), 독수리(제243호), 큰말똥가리, 큰기러기 등 야생조류 5종

Impact

- 파주시 수돗물 신뢰도 향상(수돗물 직접 음용률 증가, 시범사업 적용 전 1% → 시범사업 적용 후 24.5%)
- 파주시 수돗물에 대한 전반적 만족도 향상 (2014년 59.2% → 2015년 84.8%)
- 파주시 건강한 물 서비스 만족도 향상(2014년 80.7% → 2015년 88.2%)
- 파주시 물 관리 선진화 구축 실현(파주시 전역에, 취수원부터 수도꼭지까지 수질관리를 위한 수질수량기술 100% 도입)
- 파주시 시민 모두에서 평등한 물 복지 실현 (건강한 수돗물 공급률 100%)

What is the excellence of SWM?

What makes SWM different? | **What is the ripple effect of SWM?**