

Sustainable Management of Water Resources in the Time of Digital Transformation

مدیریت پایدار منابع آب در زمان تحول دیجیتال

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Innovation Campus Bonn*

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- **Bonn Alliance for Sustainability Research**
- **Introduction to Sustainability Concept and 2030 Agenda**
- **Water SDG and targets**
- **Water Security as a concept**
- **Digital Transformation**
- **Digitainable Matrix**
- **Capacity-building for Digital Water Education**
- **Serious Games**
- **Concluding Remarks**



The Bonn Alliance for Sustainability Research

2017

Foundation in the context of the UN Climate Change Conference (23) on November 15, 2017 in Bonn, Germany

Partners:

- **BICC** (Bonn International Center for Conversion)
- German Development Institute / Deutsches Institut für Entwicklungspolitik (**DIE**)
- United Nations University, Institute for Environment and Human Security (**UNU-EHS**),
- Hochschule Bonn-Rhein-Sieg, University of Applied Sciences (**H-BRS**),
- **University of Bonn** with Center for Development Research (**ZEF**)

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Common Goal: Establishment of the Innovation Campus Bonn (ICB)



ICB Research Priorities

digitainable 



Digitalization
and Artificial Intelligence

Bonn Alliance Research Project "Digitainable": Digitalization and Sustainability

The project "Digitainable" investigates possible positive and negative impacts of the rapid progress in digitalization and artificial intelligence on sustainable development. For this purpose the project will map the different aspects of digitalization and artificial intelligence systemically onto the more than 200 indicators of the UN Agenda 2030 (and national sustainability strategies derived from the Agenda 2030). The results of the projects should support and objectify the discussions on the relation between digitalization and sustainability.

This project is funded by the Federal Ministry of Education and Research (BMBF).



Sustainability – How it all began (1713) ?

- The term sustainability has been coined in connection with forestry.
- Hans Carl von Carlowitz, member of the Royal Council and mining administrator, addressed the question in 1713.

Question: How one can manage wood cultivation and usage in a way that forests can be maintained in a good condition?

Solution: no more trees should be taken from the forest than can grow back – this is sustainable forest use.



Hans Carl von Carlowitz

<https://www.forstwirtschaft-in-deutschland.de/forstwirtschaft/nachhaltigkeit/hans-carl-von-carlowitz/>



Brundtland Report 1987 (UN)

In 1987, **Brundtland Report**:

As chair of the World Commission on Environment and Development, Gro Harlem Brundtland developed a broad concept of sustainable development:

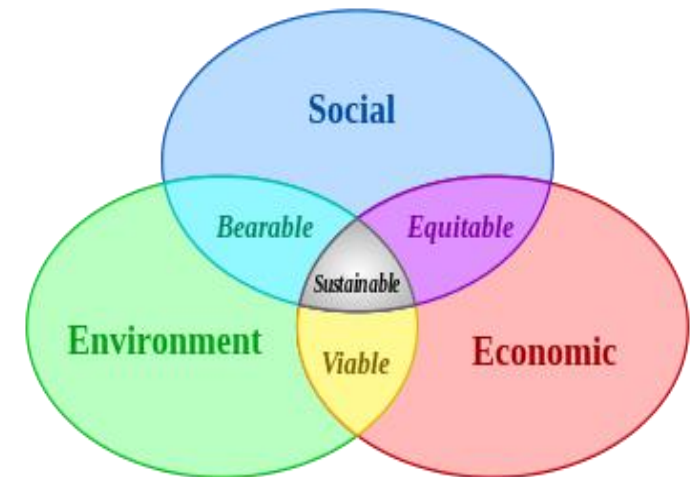
“Sustainable development is development that meets the needs of the **present** without compromising the ability of **futures generations** to meet their own needs.”

- It addresses three key dimensions of sustainability: **social**, **economic** and **environmental**.



gspeakers.com

Gro Harlem Brundtland

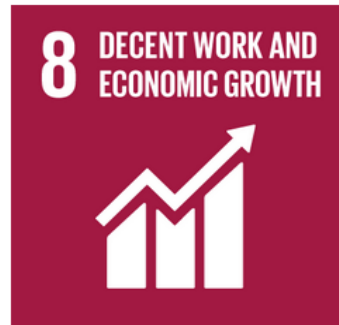


Adams, W.M. (2006). "The Future of Sustainability: Re-thinking Environment and Development in the Twenty-first Century." Report of the IUCN Renowned Thinkers Meeting, 29–31 January 2006.



TOWARDS A SUSTAINABLE FUTURE

17 Goals, **169** Targets, **232** Indicators and **15** years:
for people-planet-prosperity-peace-partnership





SDG6



29%



55%



40%



35%



64%



60%

SDG6 is linked directly to environmental, economic and social dimensions of sustainable development

Dedicated Water Goal



Directly Related



Indirectly Related





SDG 6 : Clean Water and Sanitation for All



Water is key for **society, economy** and **environment**



90% of the **global economy** depends on water



75% of **jobs** depend on water



Water crises among the **top 5 global risks** in terms of impact

Source: Water Europe - 2019

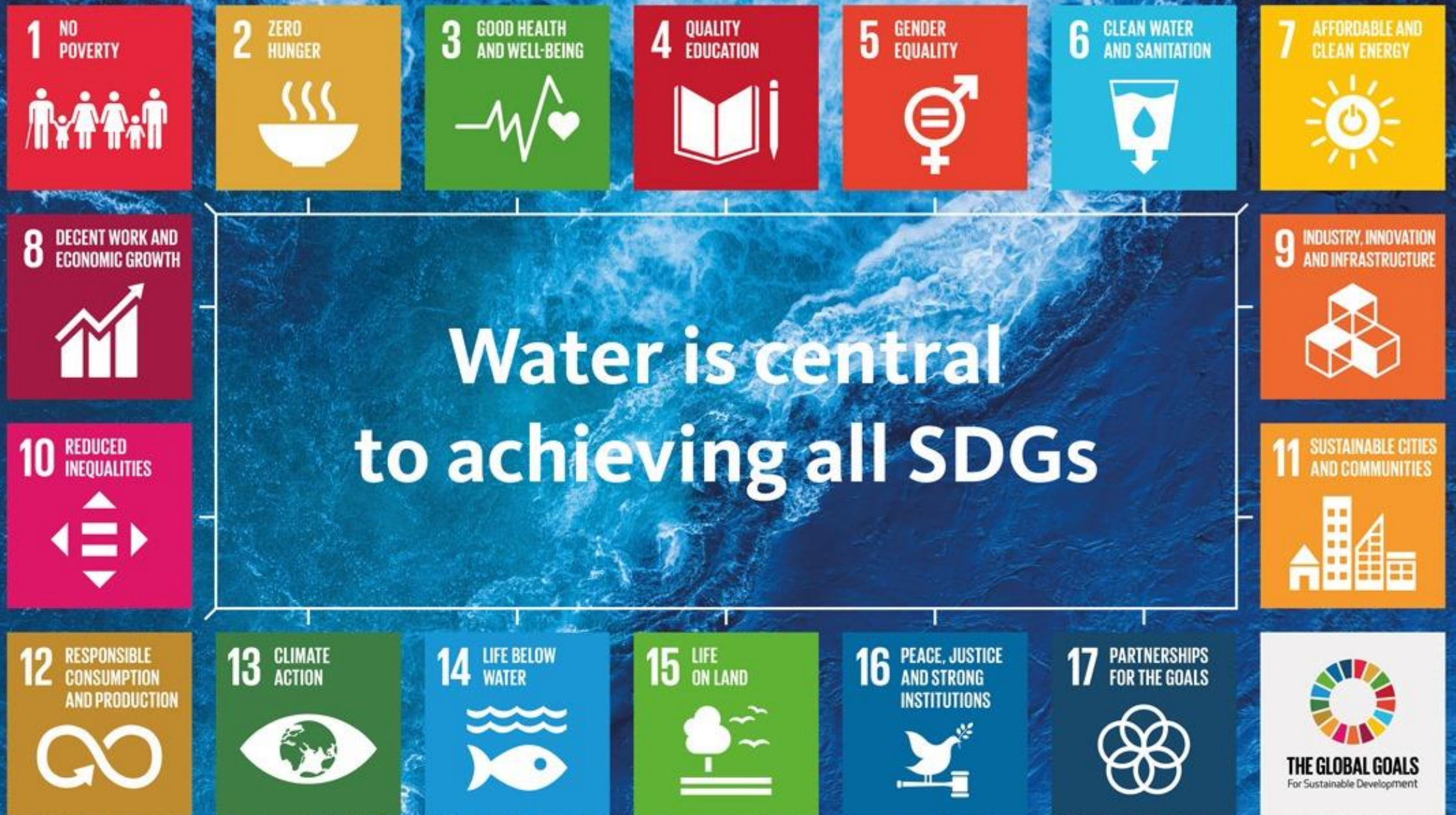
Water for Different Uses

- Agriculture (70% of global withdrawal)
- Industry (20%)
- Domestic uses (9%)
- Environment (approx. 1%)

Quality and Quantity Aspects

While the quality of water is vital for drinking water, the quantity aspect is predominant in the agricultural sector

Source: UN Water 2018 10





“The **capacity** of a population
to safeguard **sustainable access**
to **adequate quantities** of **acceptable quality** water
for **sustaining livelihoods**, **human well-being**,
and **socio-economic development**,
for ensuring protection against water-borne **pollution**
and water-related **disasters**,
and for **preserving ecosystems**
in a climate of **peace** and **political stability**.”



Sustainable Development

Water Security





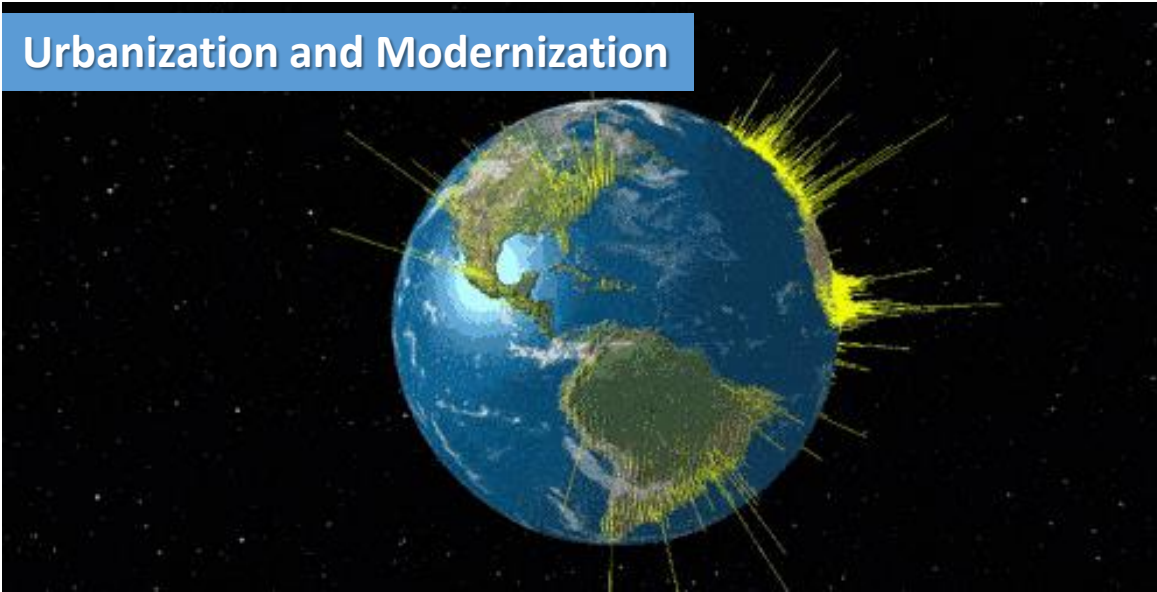
SUSTAINABLE COMMUNITIES AND LIVELIHOOD



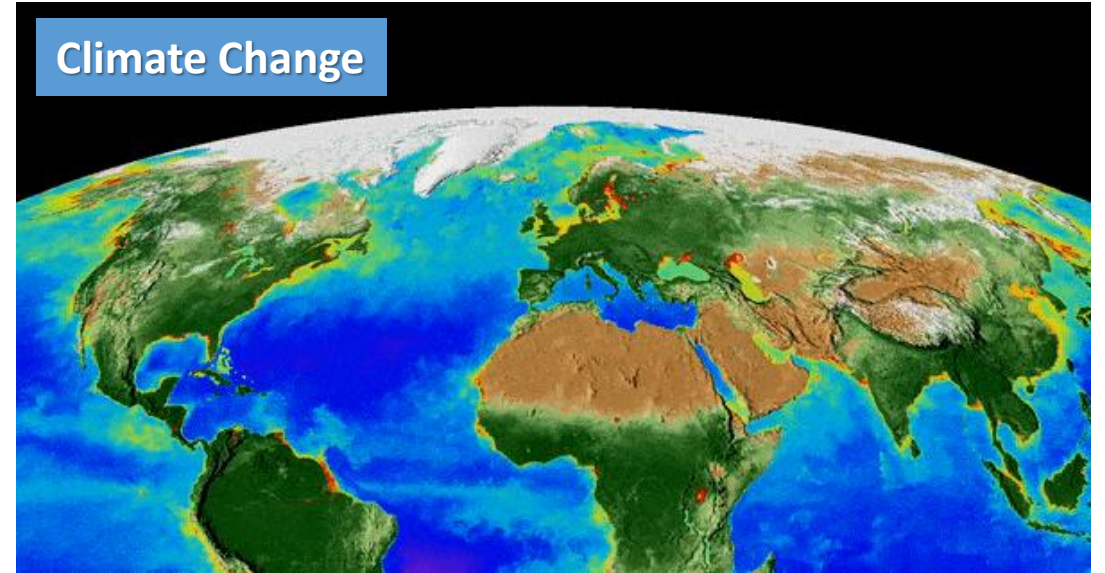


GLOBAL CHANGE DRIVERS

Urbanization and Modernization



Climate Change



Population Growth and Rising Expectations



Digitalization





SDG 6: GLOBAL CHANGE DRIVERS

- Socio-demographic changes:
 - *population growth, movement and age structures*
- Geo-political changes and realignments
- Economic changes:
 - *trade and subsidies*
- Technological changes
- Environmental changes:
 - *climate change*

A glowing blue sphere, resembling a globe, is composed of binary code (0s and 1s). The sphere is set against a background of radiating blue lines, creating a sense of depth and digital connectivity. The text "WE LIVE IN A DIGITAL WORLD" is overlaid on the sphere in a white, sans-serif font.

WE LIVE IN A DIGITAL WORLD



THE GLOBAL GOALS For Sustainable Development





‘BUSINESS AS USUAL’ IS NOT WORKING FOR DIGITALIZATION NOR SUSTAINABILITY

1. Digital revolution – domination of digital technologies and services in the economy - 60% by 2022

- Private choices in algorithms affect our collective values
- How to catalyze global digital cooperation for effective governance?

2. Institutional revolution – power is shifting in many directions simultaneously

- Tech is moving faster than our ability to govern it and cope with it.
- Many public sector functions and services are moving into private sector hands
- Asymmetries are growing in power, expertise, and capacity
- Who holds the master switch ? Who is controlling the digital architecture ?

3. Social revolution – digitalization of humanity

- Digital divide and magnification of inequality
- Gig economy and deterioration of labor rights and protections
- Algorithms influencing human agency
- Digital polarization and misinformation
- How to achieve consensus and empathy in the digital age?





COMPARATIVE ANALYSIS OF DIGITAL RISKS AND DIGITAL OPPORTUNITIES

Opportunities of digitalization

- Cheaper, faster, enhanced, data...
- More participatory, information-based decisions
- Do things not possible before, reduces human error...

Risks of digitalization

- Traditional jobs becoming out-of-date
- Changes in decision making, Access
- Privacy, Cyber-security, inequality...



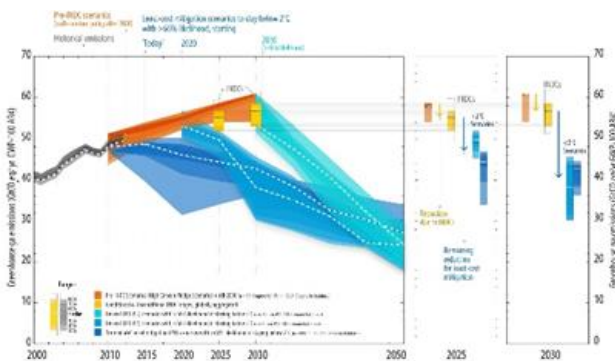
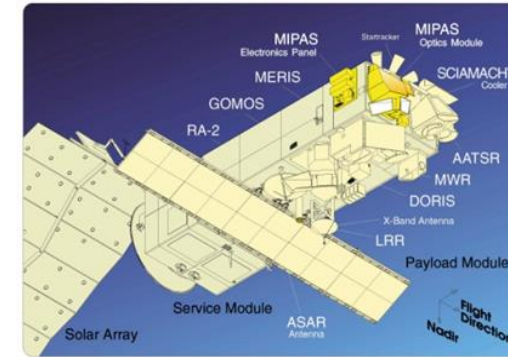
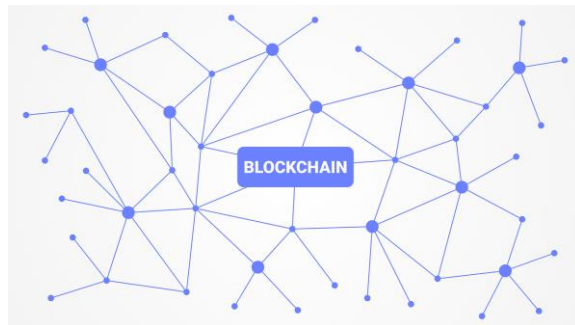
As for all technologies, it should be viewed as a tool to achieve your goals, not as the goal in itself



DIGITALIZATION AND SUSTAINABLE WATER MANAGEMENT

Digital solutions all leverage the latest in enabling technologies in water sector:

Cloud computing, Blockchain, Mobile apps, intelligent infrastructure, Smart sensors, Communication networks, and big data.













"TOWARDS OUR COMMON DIGITAL FUTURE"

Digitalization is the integration of digital technologies into everyday life



Data Driven			Analytics Driven			Design Driven	
							
Mobile internet technologies App	Block chain	IoT Digital twin technologies	Big data	Cloud computing Edge computing	AI Machine learning Deep learning Design thinking	Virtual/ augmented reality technologies	Adaptive manufacturing 3D printing



Shaping two Fundamental Transformations:

- Digitalization*
- Sustainable Development*

Sustainability
in the Digital Age

Collaborative Action for Digital Solutions

MISSION: Leverage the digital age to drive transformative system changes for a climate-safe, sustainable, and equitable world.

- Research & Innovation
- Training & Networks
- Policy, Standards, & Best Practices
- Collective Foresight & Intelligence



Capacity development
and education



“ENABLING CONDITIONS”

Sustainability
in the Digital Age



THE MONTREAL STATEMENT ON SUSTAINABILITY IN THE DIGITAL AGE

futureearth

UN
environment
programme



Office for
Artificial
Intelligence

Umwelt
Bundesamt

OBSERVATOIRE INTERNATIONAL
SUR LES IMPACTS SOCIÉTAUX
DE L'IA ET DU NUMÉRIQUE

ELEMENT^{AI}

Mila

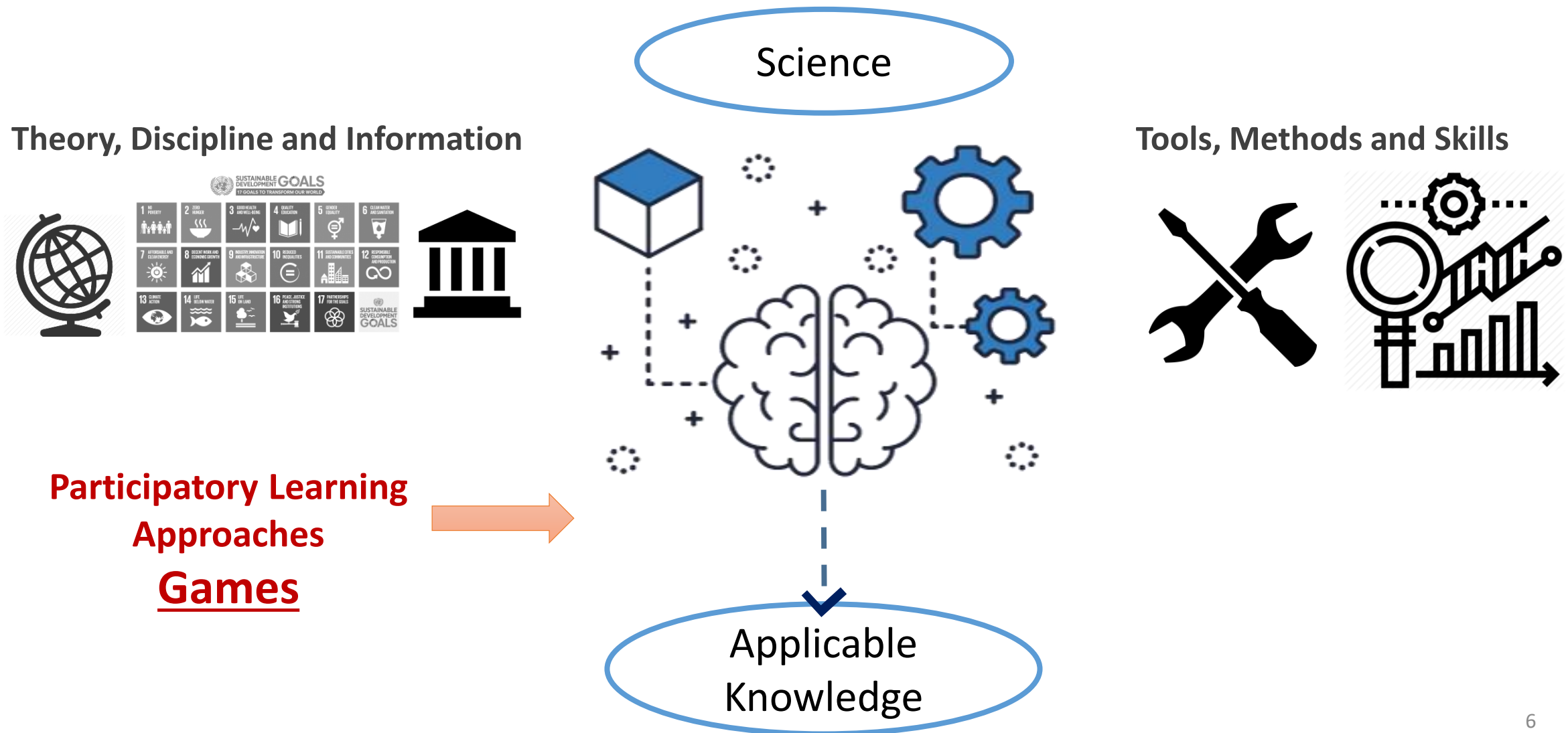
BSC
Barcelona
Supercomputing
Center
Centro Nacional de Supercomputación





CAPACITY DEVELOPMENT FOR PROCESSING CHANGES IN EDUCATION

Learning in Higher Education: Active Learning





HISTORY OF SERIOUS GAMES

- Playing with educational purposes
- Common way of teaching, learning, communicating & competing (Festivals, military, ...)

Science:

- For teaching, learning, mediating



Situation?
Dynamics?
Interests?
Conflict?



Knowledge-creation
Education



Exchange perspective
Communication
Collaboration



Oware game: Ashanti tribe of Ghana



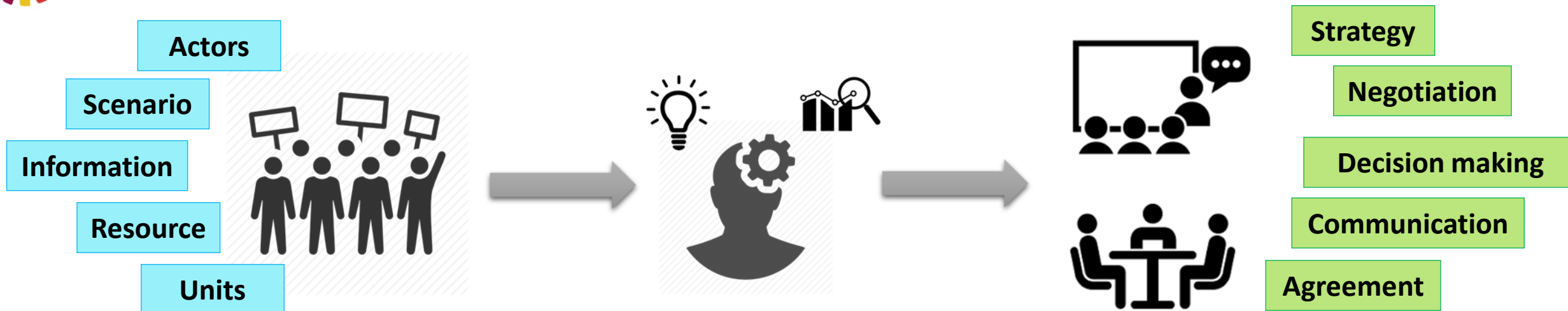
Aksum (Ethiopia)



Backgammon – Roman period

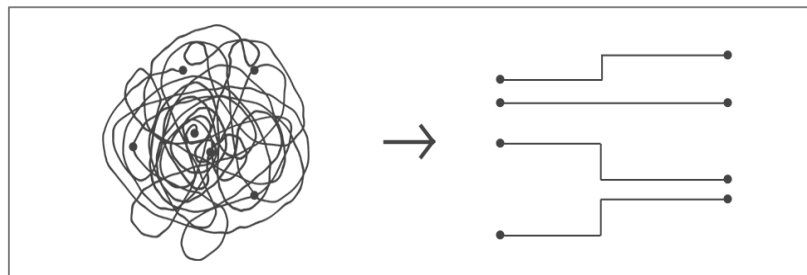


SERIOUS GAME: CHARACTERISTICS AND APPLICATIONS



- Simulation
 - ✓ Real-case-based games
 - ✓ Virtual/Fictional-case-based games

- Simplification



- Not real: experimental, fun, safe, practical





SERIOUS GAME: LEARNING OBJECTIVES

Learning purpose-based Serious Games Classification

Games for Research

Objective:

Collecting information, examining a hypothesis, validating scenarios and studying human behavior

Learning group:

Game designers and conductors

Game for Education

Objective:

Transmitting educational knowledge as part of curricula and putting the theoretical knowledge into practice

Learning group:

Game players

Games for Manifest

Objective:

Rising awareness, facilitate change by broadcasting a subjective, educational or informative message

Learning group:

Game players



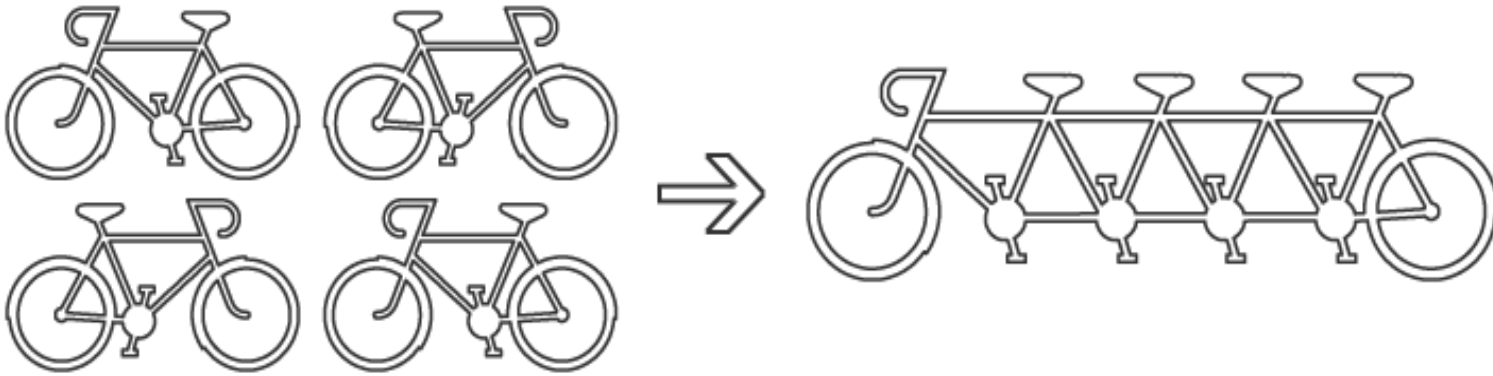
SERIOUS GAMES

Effective Learning = Participatory Learning

Participatory Learning = Engaging the Learners



Role Plays



Game environment is a space for co-creating solutions, exchanging, learnings, experience and collaborating to unleash the power of satisfaction by common action





SERIOUS GAME SPECTRUM

Role-play games help in:

- Developing interpersonal and communication skills
 - Team building
 - Negotiation Conflict resolution
 - Transdisciplinary nexus
 - Group decision making
 - Developing insight into one's own behavior and its impact on others
-

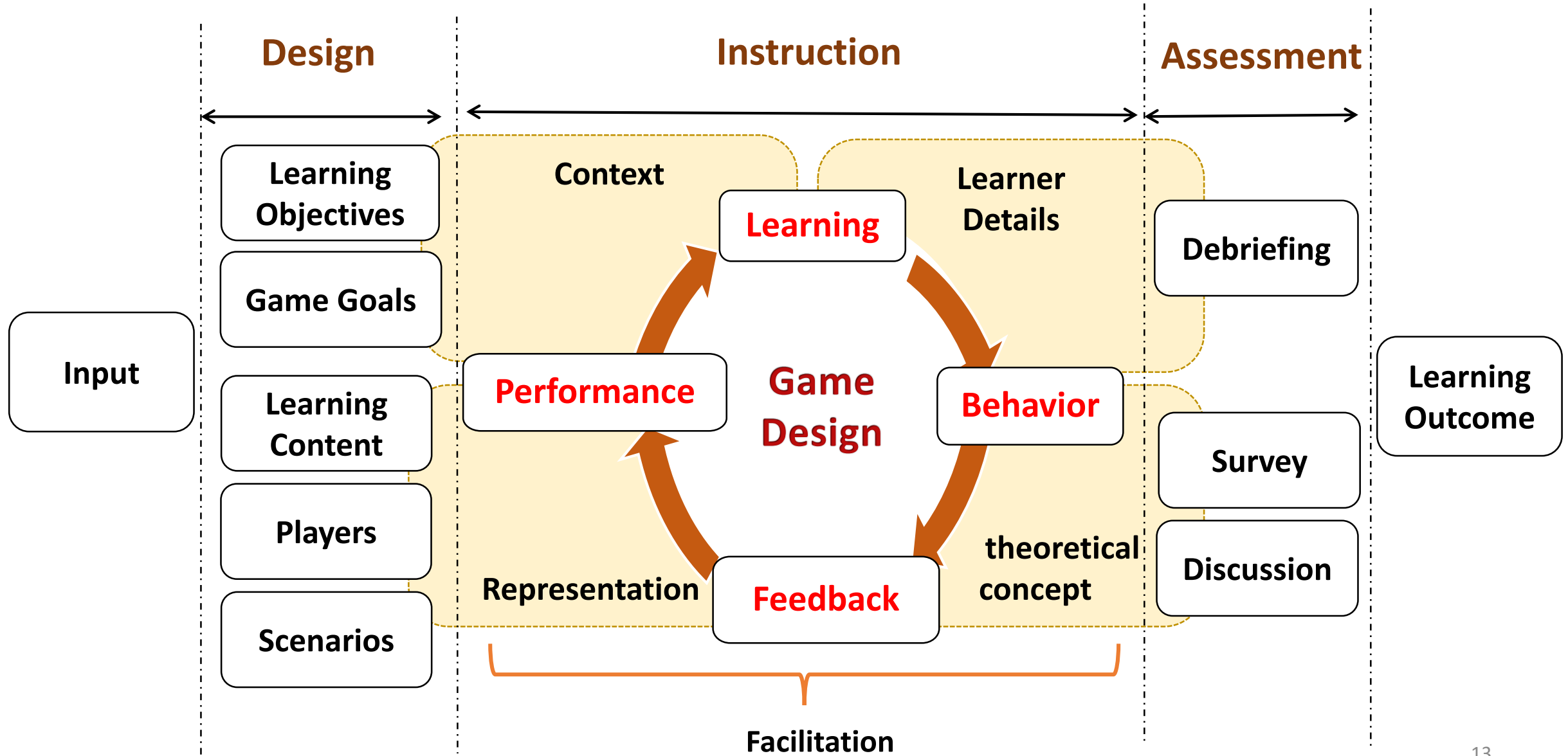
There are various types of role plays:

- Multiple Role Play
- Single Role Play
- Role Rotation
- Spontaneous Role Play



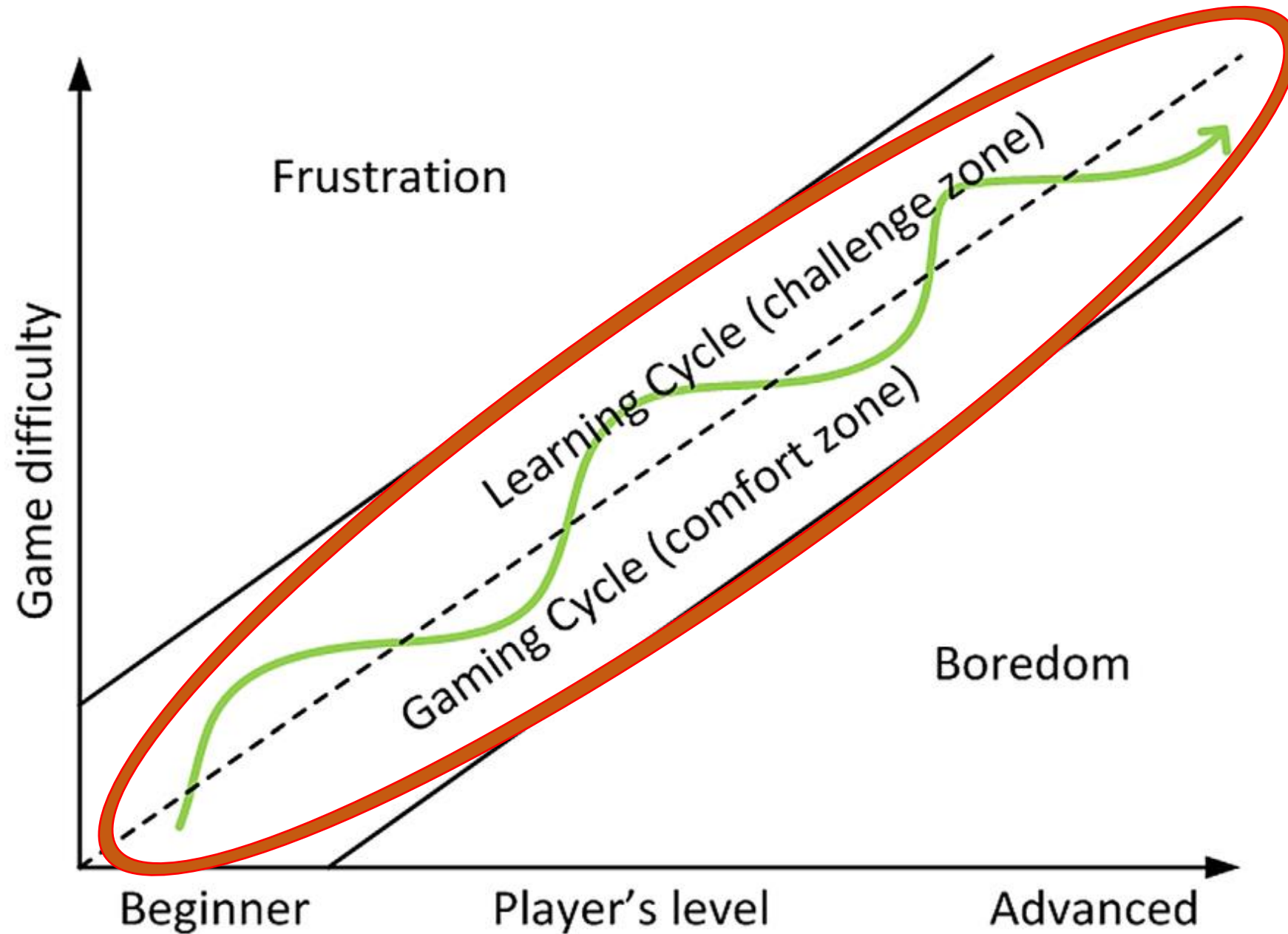


GAME DEVELOPMENT FRAMEWORK



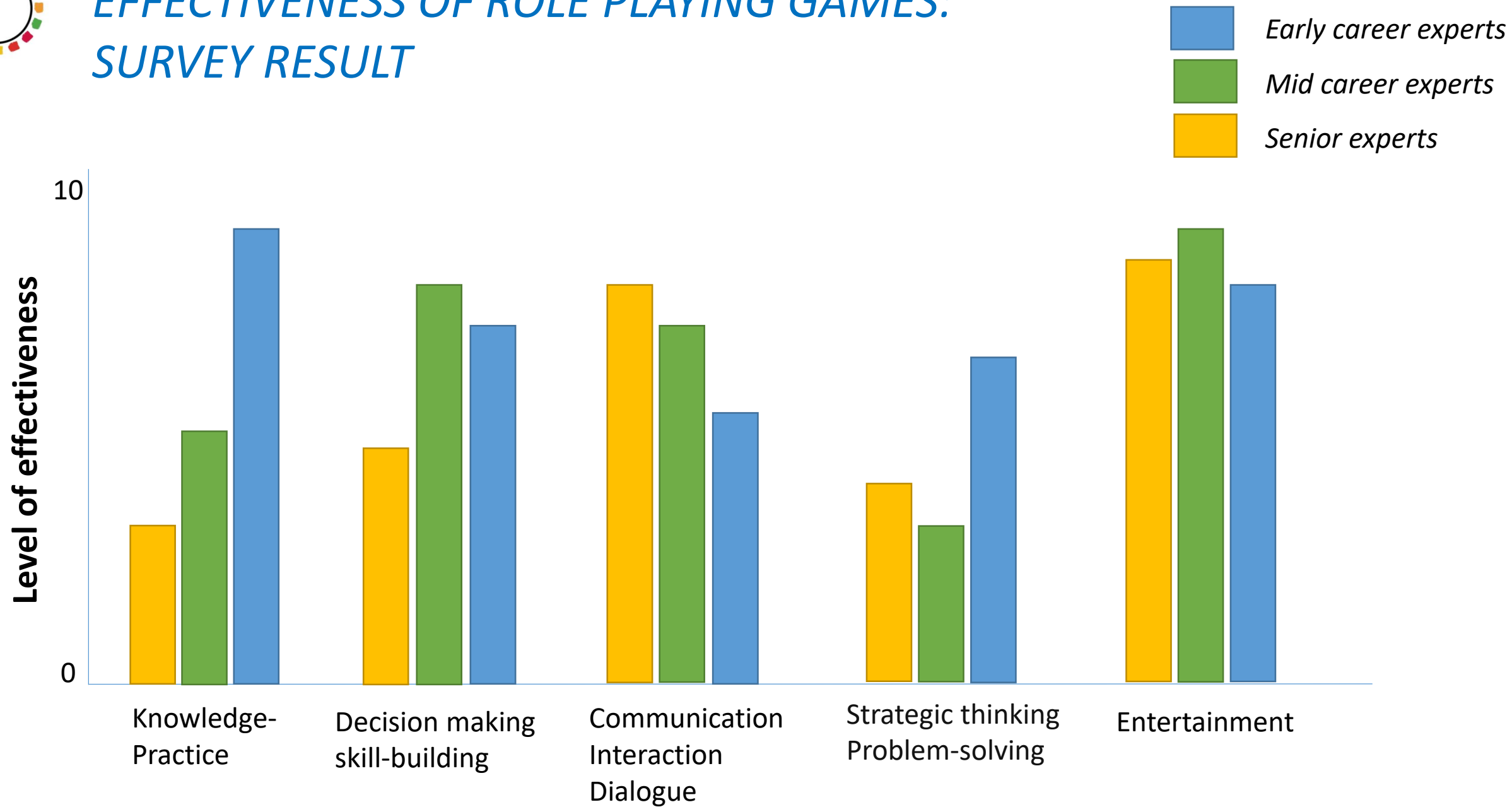


SERIOUS GAMES DESIGN METHOD





EFFECTIVENESS OF ROLE PLAYING GAMES: SURVEY RESULT





Nexus of 'Digitalization – Sustainable Water Management – Education'



Thank You



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www.bonnalliance-icb.de/en/icb/projects/digitainable/



#digitainable #icb
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