

SWIM and Horizon 2020 Support Mechanism

Working for a Sustainable Mediterranean, Caring for our Future

Closing Workshop on water demand management, planning and infrastructure development.

Methods for planning and infrastructure development.

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Steigenberger Hotel, Cairo – Egypt

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Methods for planning and infrastructure development

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INTRODUCTION

Governments are challenged to balance multiple policy goals and make difficult choices when selecting infrastructure projects for public investment, particularly since available funds are often insufficient to implement the full suite of proposals. As such, government must make difficult decisions about which projects to select for implementation within a given investment period. This implies grappling with the relative efficiency and effectiveness of investments as well as project costs and benefits. The multiple considerations of project selection demand improved decision support frameworks that are sufficiently rigorous to accommodate multiple facets, yet practical to implement.

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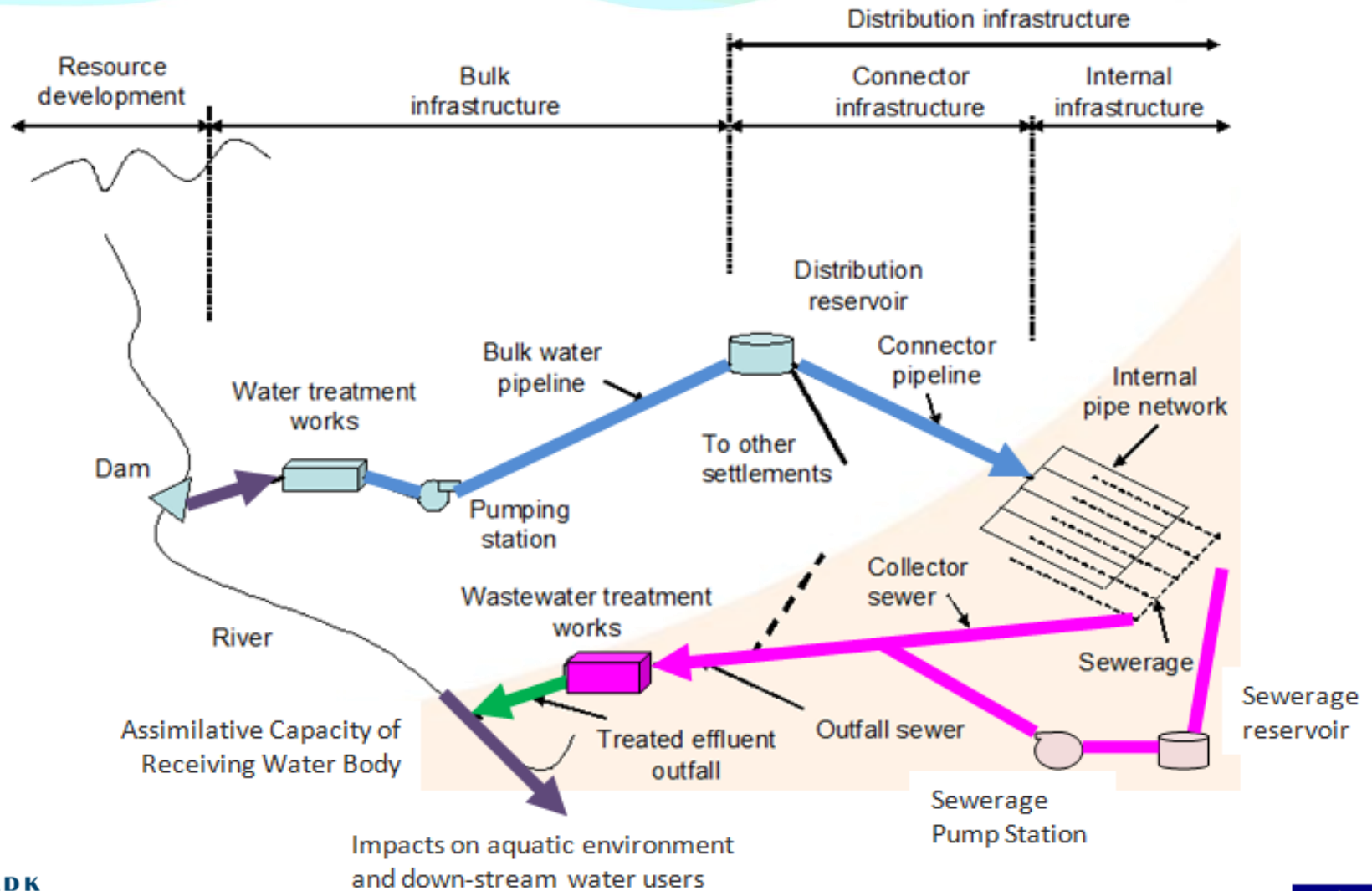


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ATKINS

The “Water Services Business”

1. Source-to-Tap-to-Source



Understanding the Water Services Business

- An essential service to ensure quality of life, health, social & economic development & environmental sustainability.
- It is the business of manufacturing and supplying a product: potable water and sanitation services.
- It is a non-stop never ending business (24/7/365).
- It is about infrastructure plus operations & maintenance.
- High risk area in terms of consumer frustration.
- Water comes at a cost: viability & affordability challenges.

Challenges to Water Services Delivery

- Poor water services **planning & prioritization**.
- **Aging water infrastructure**; increasing investment needs.
- Changing **workforce** with rising **lack of technical skills**.
- Poor **economic conditions**, with water services provision often a **“bankrupt business”**.
- Adequacy of **water resources**; **climate change** impact.
- Shifting patterns in **water demand**; **rising energy** costs
- Competing **political priorities** (LG elections).

Challenges to Water Services Delivery

Which actions do we prioritize ?



What direction do we guide / take?



Are we missing any “quick wins”?



Planning (a difficult task)



Governments face challenges for infrastructure planning:

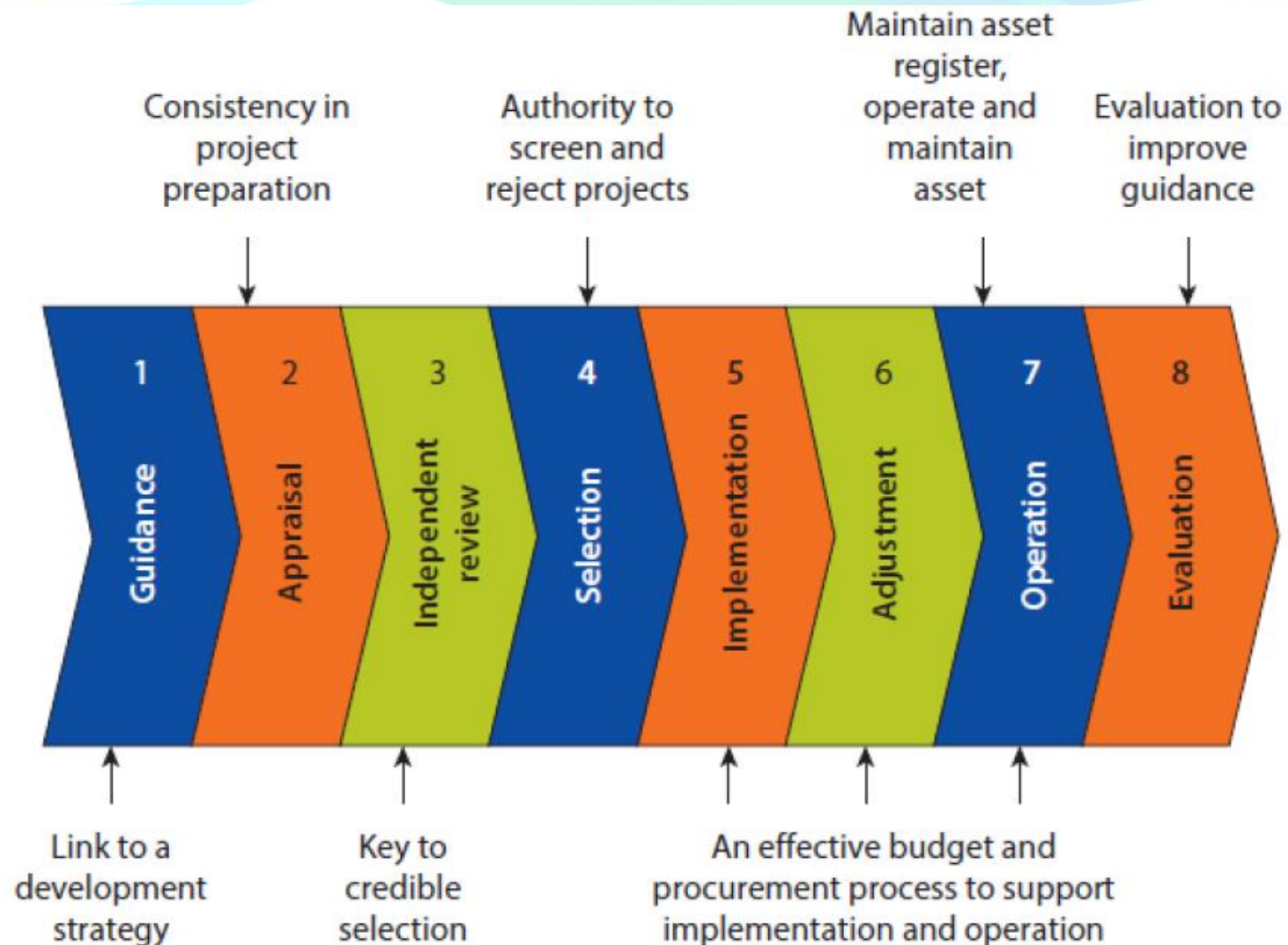
- Investment needs in all sectors.
- Limited public resources and fiscal restrictions.
- How to optimize the use of public resources?
- How to compare different investment options?

Need for an objective system to prioritize infrastructure investments.

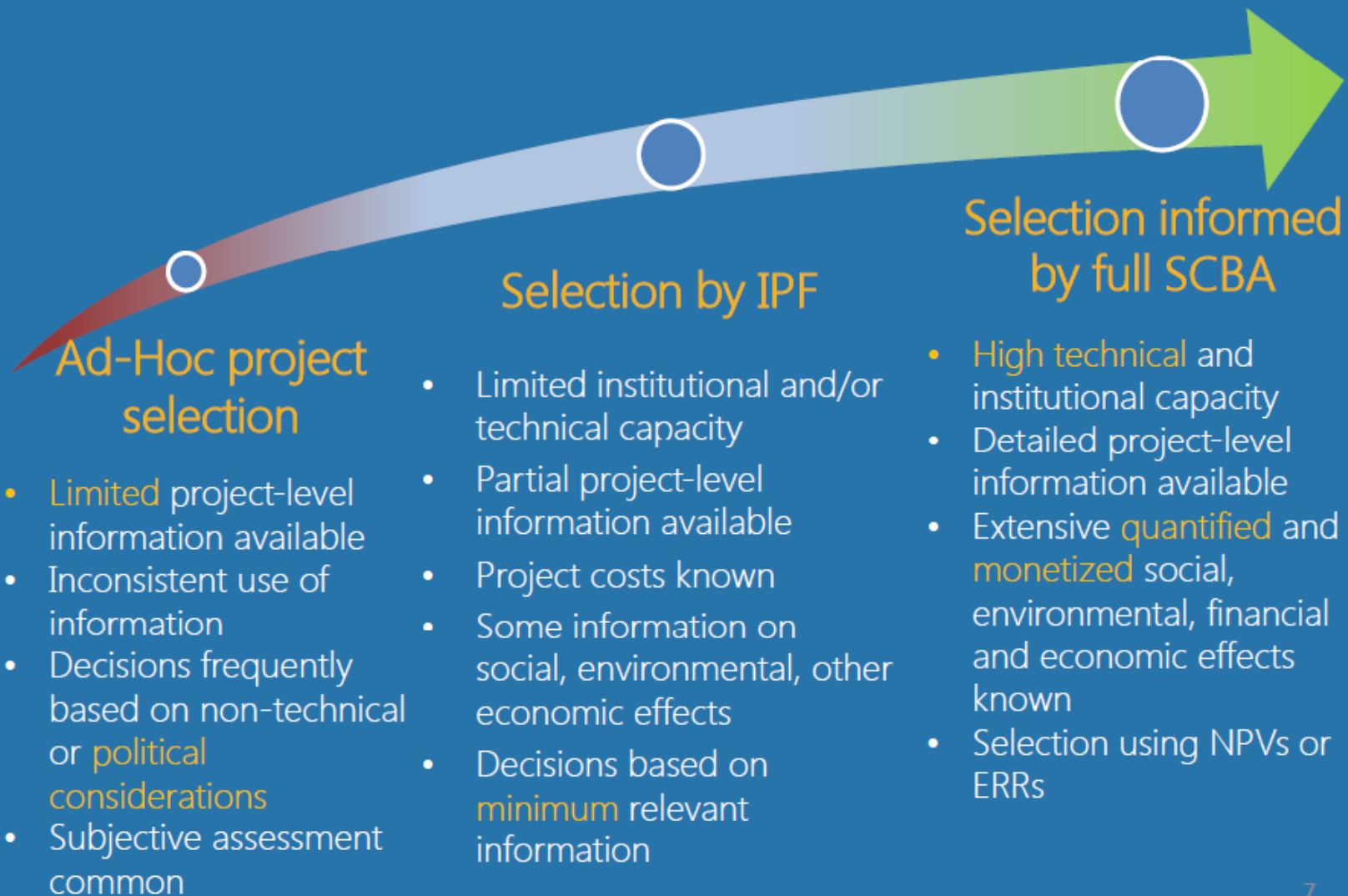
Common challenges at the project level

- Limited / inconsistent project data availability & quality.
 - Limited technical and institutional capacity.
 - High costs and extensive time required to do SCBA.
- appraisal across large sets of projects.
- Problems in data comparability.
 - Reversion to political selection.

Key features of a Public Investment Management System



Infrastructure Prioritization Framework (IPF) & Social Cost-Benefit Analysis (SCBA) by the World Bank



Advantages of the IPF

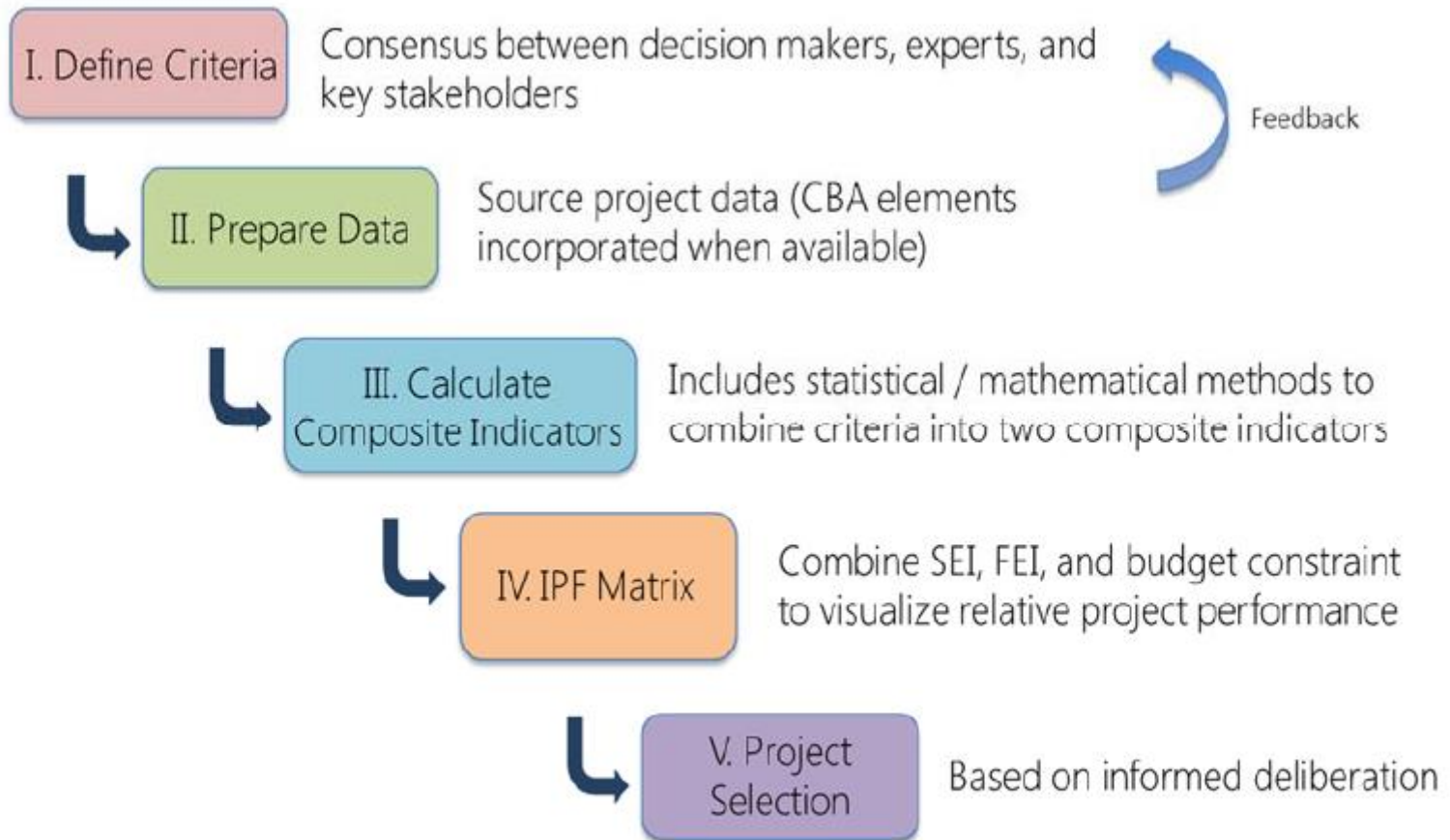
The IPF is a quantitative multi-criteria approach to compare proposed infrastructure investments within a sector according to government-selected social, environmental, financial, and economic criteria. Statistical methods are used to combine this information into a **Social-Environmental index (SEI)** and a **Financial-Economic index (FEI)**. These two composite indicators are then displayed alongside the sector budget constraint, allowing a classification of projects for further selection and implementation.

The approach recognizes that objective evaluation and selection of investments cannot be dissociated entirely from policy discourse, professional experience, or the politics of project selection. In addition to economic benefits, projects may be chiefly valued by governments and other stakeholders due to key policy goals which are non-economic in nature, or due to considerations that objective indicators cannot measure, such as protecting priority habitats, promoting social inclusion and cohesion, or honoring culture.

Advantages of the IPF

1. Can be adapted to account for policy goals.
2. Combines social-environmental and financial-economic variables.
3. Accommodate data and resource limitations.
4. Includes the sector budget constraint.
5. Displays information in a simple visual interface.
6. Informs discussion of rebalancing sector allocations.
7. Improves data collection processes.

IPF Procedure



Source: Marcelo et al, 2015

Social and Environmental Index (SEI)
Financial and Economic Index (FEI)

Two Dimensional Structure: (a) Socio-Environmental, (b) Financial-Economic

Social-Environmental Indicators (SEI) (example)

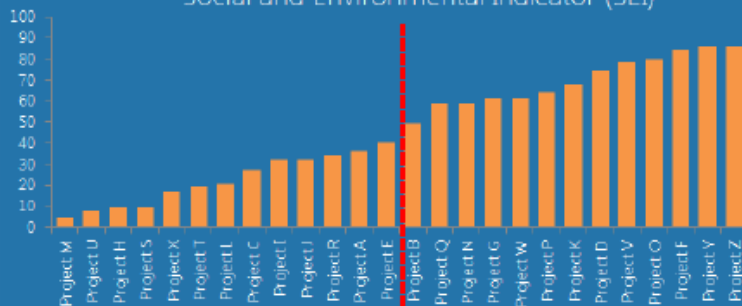
- Beneficiaries*
- Affected population*
- Environmental effects*
- Poverty levels*

vs.

Financial-Economic Indicators (FEI) (example)

- Benefit-cost ratio*
- Multiplier effects*
- Externalities*
- Implementation risks*

Social and Environmental Indicator (SEI)



Fundable projects given
the budget constraint

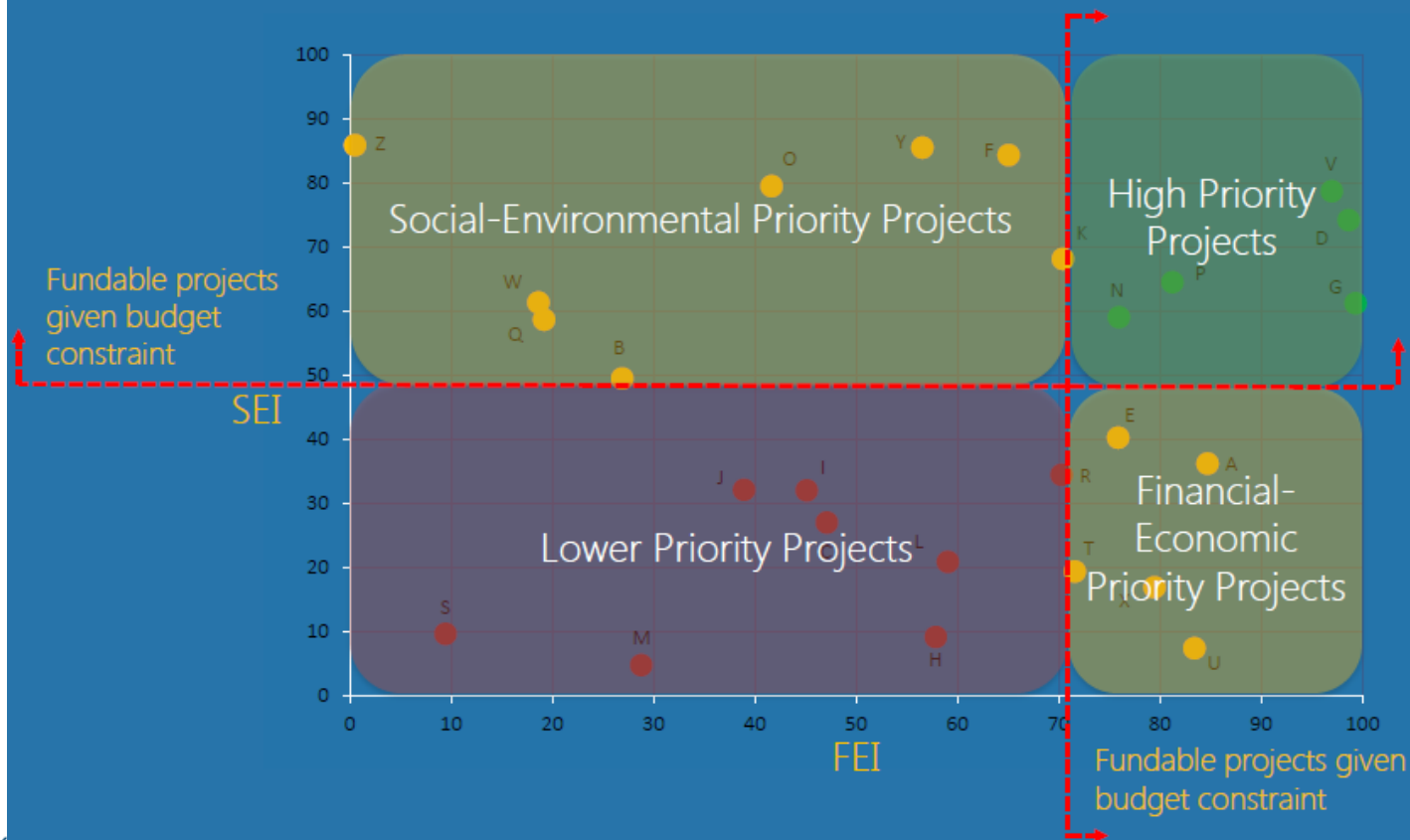
Financial and Economic Indicator (FEI)



Fundable projects given
the budget constraint

Infrastructure Prioritization Framework (IPF) Matrix

- (x, y) coordinates are defined by the (FEI, SEI) score pair



IPF Application for water projects selection in Sri Lanka

- STEP 1 - 2

An initial list of 27 projects corresponding to project proposals that NPD received from the National Water Supply and Drainage Board (NWSDB) and several from the Megapolis Master Plan was considered.

SEI	FEI
<ul style="list-style-type: none">– Beneficiaries/Users per \$ invested– Jobs created (direct and indirect)– Poverty level (in area of intervention)– Quality of existing water– Water-borne diseases– Alternative water resources	<ul style="list-style-type: none">– Benefit-cost ratio– Existing water resource yield

IPF Application for water projects selection in Sri Lanka

- STEP 3

The approach to calculate the composite SEI and FEI is two-fold and includes (a) identifying the criteria to be included in each composite indicator, along with their units of measurement, and (b) specifying a method to estimate or assign weights to the criteria involved in calculation of the SEI and FEI. In this section, the criteria selected as inputs to the SEI and FEI are described, along with the selected weighting methods.

SEI (8)	FEI (2)
<ul style="list-style-type: none">– New beneficiaries/users per \$ invested– Jobs created (direct) per \$ invested– Poverty level (in area of intervention)– Bacterial quality of existing water– Water-borne diseases– Continuity of supply– Existing safe water coverage	<ul style="list-style-type: none">– Benefit-cost ratio– Existing water resource yield– Non-revenue water (%)

IPF Application for water projects selection in Sri Lanka

- STEP 3

SEI 1. Beneficiaries: For each project, the criterion 'beneficiaries' measures the number of new direct project beneficiaries per million dollars invested.

SEI 2. Jobs Created: This criterion accounts for the number of direct jobs created by the project during the construction and operational phases. The number of jobs created during the operational phase was available in the pre-feasibility studies of the projects. The number of jobs created during the construction phase was calculated based on the cost estimate for pipe laying works and civil/structural work and the unit cost of labor.

SEI 3. Poverty Level: This criterion refers to the poverty level in the area where the project is to be located.

SEI 4. Bacterial Quality of Water: Because almost all projects in the analysis include water treatment, these projects aim to improve the quality levels of supplied water. Bacterial quality is measured by the number of failed water quality tests during the last 36 months in the areas where the projects will be implemented.

IPF Application for water projects selection in Sri Lanka

- STEP 3

SEI 5. Prevalence of Water Borne Diseases: This criterion measures the average annual number of diarrhea/ dysentery, hepatitis, and typhoid cases in the last five years per 100,000 of the population to be served by the projects.

SEI 6. Continuity of Supply: This criterion is based on the hours of water supply per day in the areas where the project will be located. The lower the hours of supply, the higher the priority for implementing projects serving those areas.

SEI 7. Existing Safe Water Coverage: This criterion measures the percentage of population with access to safe water sources. Projects are given higher priority if they are located in areas where fewer consumers (as a percentage of the population) have access to safe water.

IPF Application for water projects selection in Sri Lanka

- STEP 3

FEI 1. Benefit-Cost Ratio: For each water project, the benefit-cost ratio (BCR) corresponds to the net present value of all financial and economic benefits divided by the net present value of all costs (annualized operating expenses and capital expenditures).

FEI 2. Existing Water Resource Yield: This criterion is used to check the level of implementation hazards for the projects by verifying the extent to which the new projects will be able to extract water from existing water resources. This is done by considering whether the project has Approved Water Rights, MOUs with other users, and water availability throughout the year. The higher the existing water resource yield, the higher is the contribution of this input criterion to the final composite FEI score.

FEI 3. Non-Revenue Water: This criterion measures the percentage of non-revenue water (NRW) that exists in the existing water supply schemes serving the areas or DSDs where the new projects will be located. NRW is a good measure of the economic efficiency of the current water supply systems. The higher the existing NRW, the greater the need for projects that improve infrastructure and management practices.

IPF Application for water projects selection in Sri Lanka

- STEP 3

**SEI=0.09*Beneficiaries+0.19*Jobs+0.10*Poverty+0.24*Continuity
WS+0.09*Bacterial Quality+0.19 Safe Water Coverage +0.09 Diseases**

INDICATORS	Contribution (as a %) of each indicator to the composite SEI score under different weighting schemes				
	Standard PCA*	PCA with weights>0	PCA with weights>min requirement	PCA weights using NPD rule	Simple Average
	(1)	(2)	(3)	(4)	(5)
1. Beneficiaries/US m\$	0.055	0%	9%	15%	14.3%
2. Jobs created/US m\$	0.574	27%	19%	9%	14.3%
3. Poverty level	0.082	12%	10%	15%	14.3%
4. Continuity of water supply	0.333	28%	24%	15%	14.3%
5. Bacterial quality of water	-0.479	0%	9%	9%	14.3%
6. Existing safe water coverage	0.564	30%	19%	24%	14.3%
7. Prevalence of water-borne diseases	-0.040	2%	9%	15%	14.3%
Total		100%	100%	100%	100%
% of data variance explained	33%	29%	22%	17%	16%

Notes: *The figures presented in this column are the originally calculated weights using the unrestricted PCA methodology

IPF Application for water projects selection in Sri Lanka

- STEP 3

$$FEI = 0.16 * NRW + 0.68 * BCR + 0.16 * WRYield$$

INDICATORS	Contribution (as a %) of each indicator to the composite FEI score			
	Weights from PCA*	Weights > 0	Weights > min requirement	Simple Average
Non-revenue water	0.507	50%	16%	33.3%
Benefit Cost Ratio	0.508	50%	68%	33.3%
Water Resources Yield	-0.696	0%	16%	33.3%
Total		100%	100%	100%
% of data variance explained	49%	34%	28%	19%

Notes: *The figures presented in this column are the originally calculated weights using the unrestricted PCA methodology

IPF Application for water projects selection in Sri Lanka

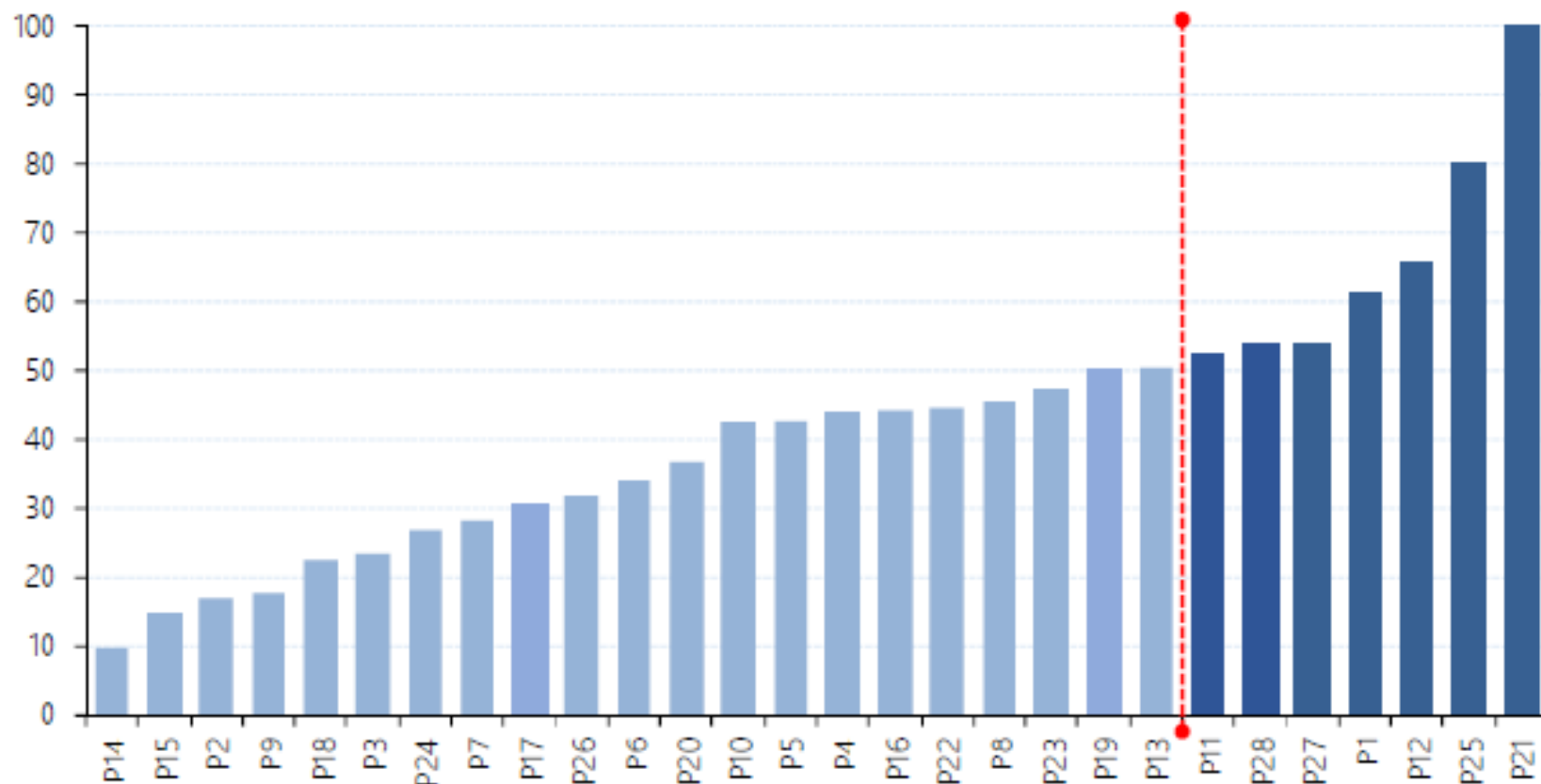
- STEP 4

ID ²¹	PROJECT	SEI Ranking	FEI Ranking	Investment (US \$m)
P1	Kirama-Katuwana WSP ^a	4	21	9
P2	Kandy North (Pathadumbara) Water Supply ^b	26	10	112
P3	Katana Water Supply (Phase I & II) ^a	23	16	45
P4	Hemmathagama Water Supply Scheme ^b	14	8	60
P5	Thambuththegama Water Supply ^a	15	6	91
P6	Anuradhapura South Water Supply ^b	18	7	102
P7	Towns East Polonnaruwa Water Supply ^b	21	13	359
P8	Matara Stage IV Water Supply ^b	11	20	134
P9	Expansion: Water Pipeline Orugodawatta-Ambatale Road ^c	25		64
P10	Eheliyagoda Water Supply ^b	16	14	34
P11	Eppawala Water Supply ^b	7	4	40
P12	Palugaswewa Water Supply ^a	3	3	20
P13	Valachchenai Water Supply ^b	8	25	75
P14	Dankotuwa Water Supply ^a	28	23	92
P15	Greater Galle Stage III ^d	27	17	67
P16	Bandarawela, Diyathalawa, Haputhale Integrated Water Supply ^b	13	15	111
P17	Divulapitiya Water Supply ^a	20	27	57
P18	Mirigama, Kandalama, Kaleliya and Ganegoda Group Towns Water Supply ^b	24	26	95
P19	Hatharaliyadda Water Supply Scheme ^a	9	24	13
P20	Eppawala, Rajangana, Nochchiyagama & Giribawa WSP ^b	17	18	357
P21	Yan Oya Water Supply ^b	1	2	102
P22	Towns South of Puttlam WSP ^b	12	12	98
P23	Greater Mannar WSP ^b	10	11	109
P24	Greater Vavuniya WSP ^b	22	9	159
P25	Construction of Treatment Plant at Kethhena ^a	2	1	3
P26	Ingirya, Handapangoda Water Supply ^d	19	22	81
P27	Makandura, Pannala, Kuliyapitiya Water Supply ^b	5	5	14
P28	Kalpitiya WSP ^b	7	20	94

IPF Application for water projects selection in Sri Lanka

- STEP 4

Social and Environmental Indicator (SEI)



--- Budget constraint of US\$ 0.35b

IPF Application for water projects selection in Sri Lanka - STEP 4

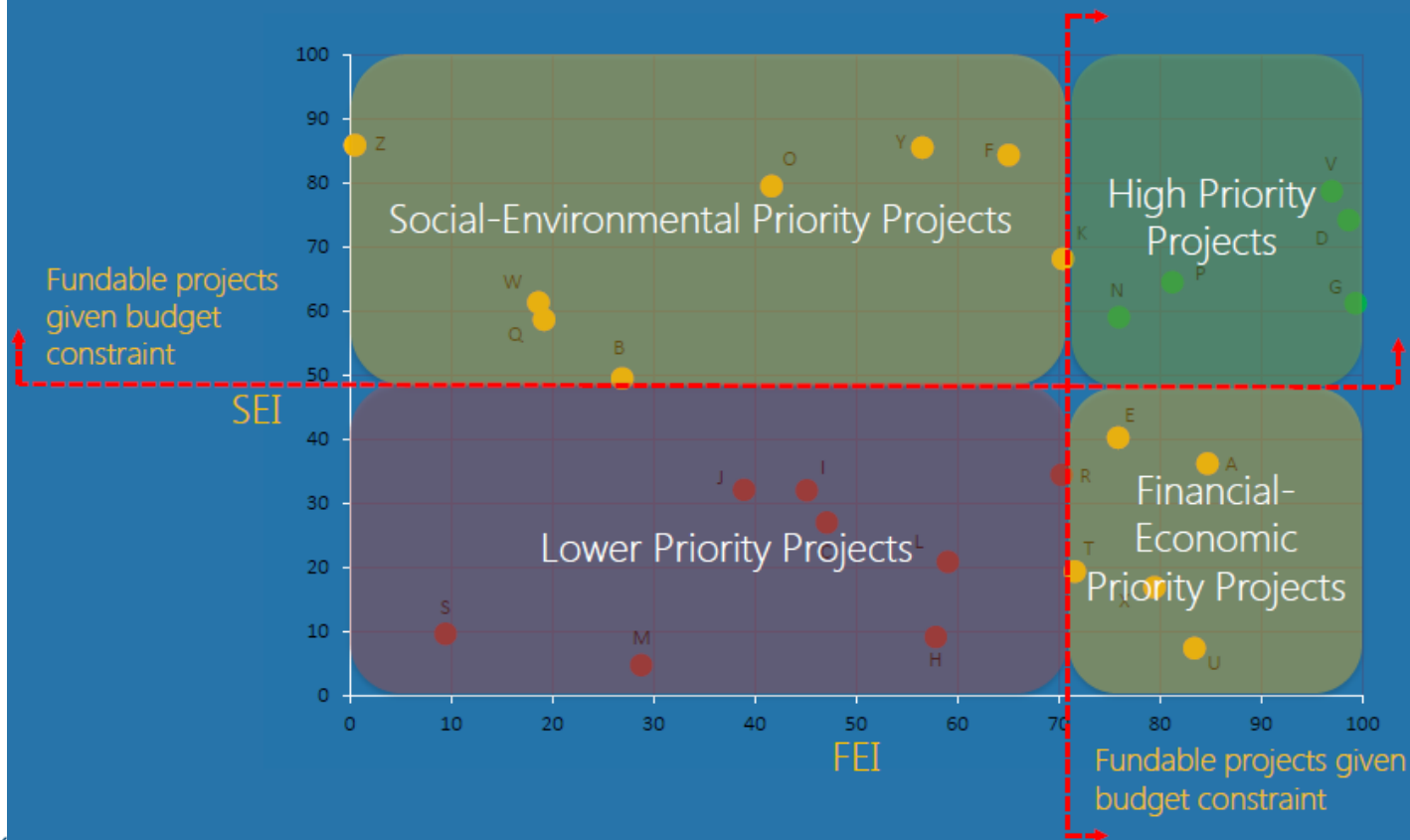
Financial and Economic Indicator (FEI)



--- Budget constraint of US\$ 0.35b

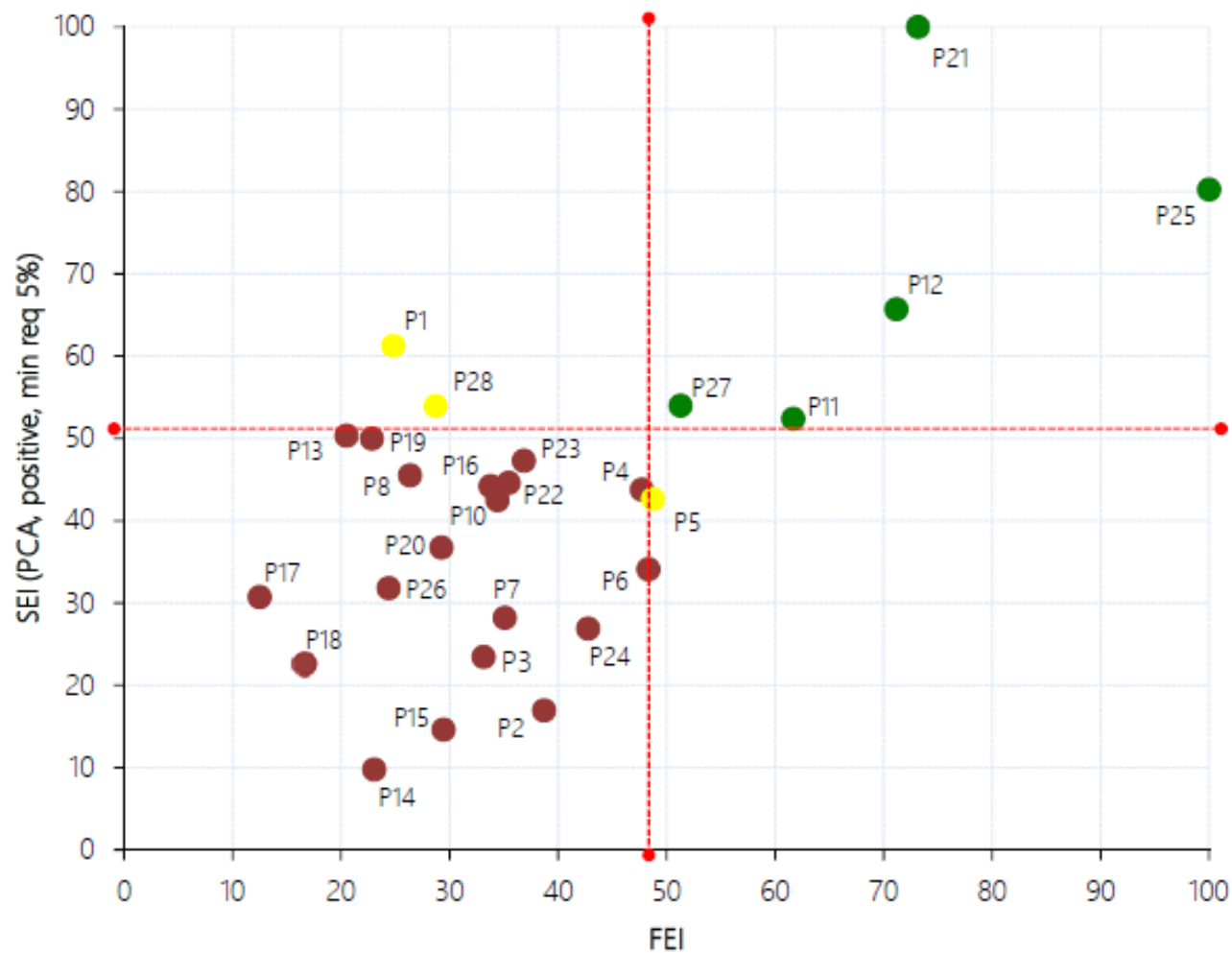
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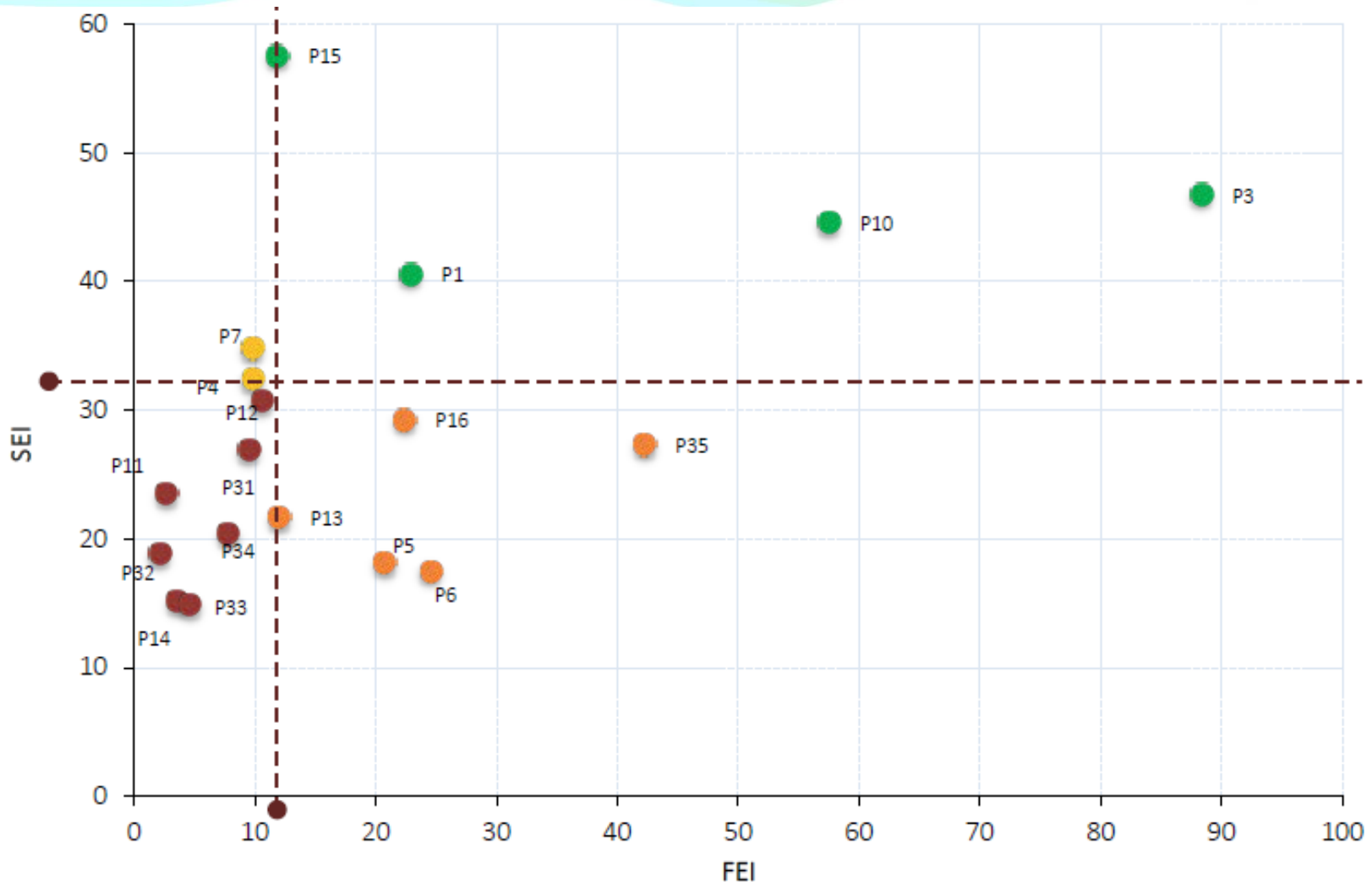
IPF Application for water projects selection in Sri Lanka

- STEP 4 - IPF Matrix: Mapping of projects by SEI and FEI



IPF Application for water projects in Panama - STEP 4 -

IPF Matrix: Mapping of projects by SEI and FEI



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Thank you for your attention.

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