Methodology for Developing a Plan to Enhance the Sustainability of Energy Service Delivery in NTT in 21 Steps based on the I3A Framework

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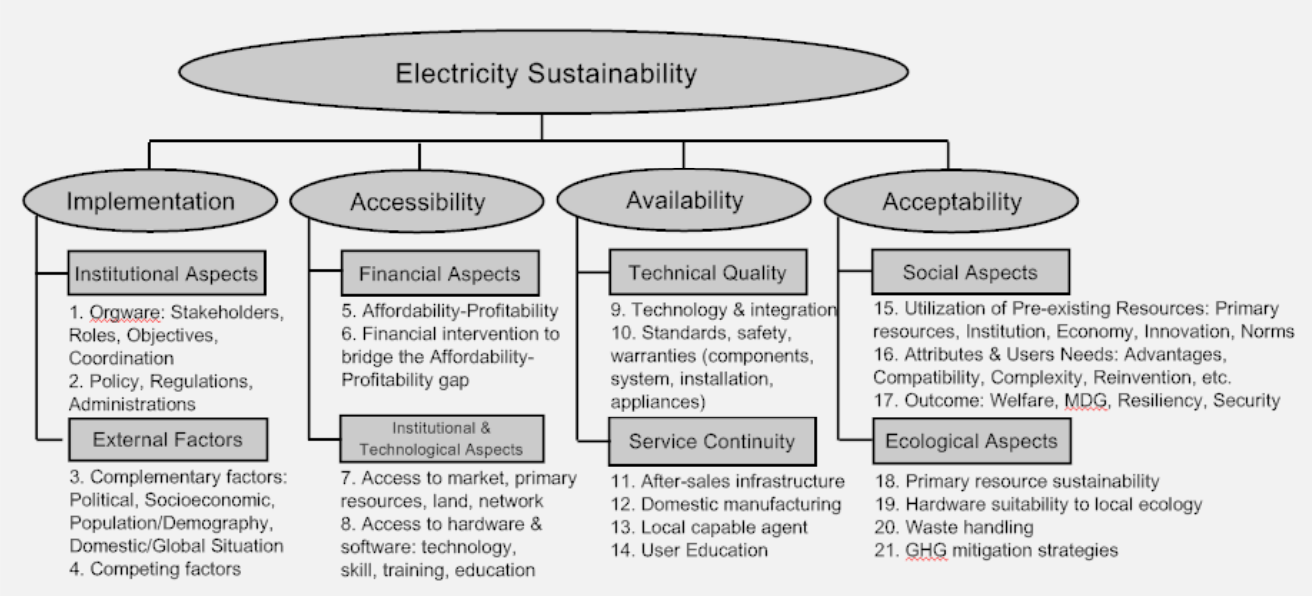
I. IMPLEMENTATION *(Institutional aspects & external factors that facilitate/constraint project schemes)*	
1. Stakeholders, roles, objectives, interrelationships	
2. Policy, regulations, administrations	
3. Complementary factors (political, socioeconomic, population, domestic/global situation)	
4. Competing factors	
II. ACCESSIBILITY *(Financial, Institutional & Technological aspects)*	
5. Affordability & Profitability	
6. Financial intervention required to bridge the A-P gap	
7. Access to market, primary resources, land, network	
8. Access to technology, skill, training, education	
III. AVAILABILITY *(Technical quality & energy service continuity)*	
9. Technology & integration	
10. Standards, safety, warranties (components, system, installation, appliances)	
11. After-sales service infrastructure	
12. Domestic manufacturing	
13. Local capable agent	
14. User education	
IV. ACCEPTABILITY*(Social & Ecological aspects)*	
15. Utilization of pre-existing resources (primary resources, institution, economy, norms)	
16. RE attributes vs Users requirements (advantages, compatibility, complexity, reinvention, etc.)	
17. Outcomes: Welfare, Sustainable Development, MDG, Community resiliency, Energy security	
18. Primary resource sustainability	
19. Hardware suitability suitability to local physical environment	
20. Waste handling	
21. GHG mitigation strategies	

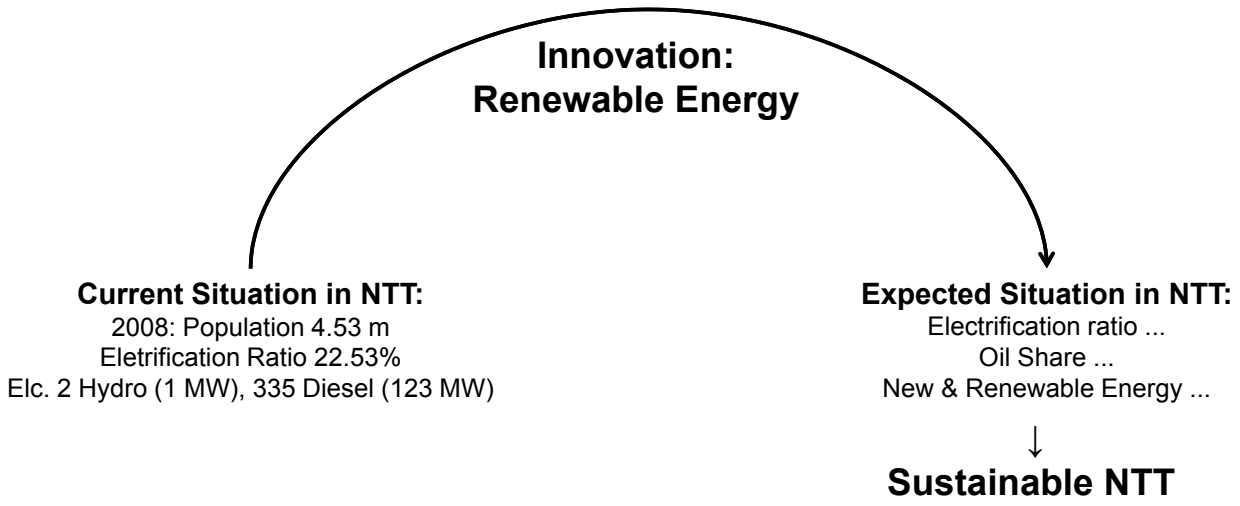
I3A Framework: Electricity Services Sustainability



I3A Framework: An **implementation** that maintains energy service **accessibility** (financial, institutional, technological), **availability** (technological, institutional) and **acceptability** (social, ecological), considering the hardware, software and orgware aspects of energy service delivery during & beyond initial project life *(Retnanestri 2007)*

Retnanestri, 2007, The I3A Framework – Enhancing the Sustainability of Off-grid Photovoltaic Energy Service Delivery in Indonesia, PhD Thesis, http://unsworks.unsw.edu.au/vital/access/manager/Repository/unsworks:1598

Change, Innovation & Diffusion of Innovation

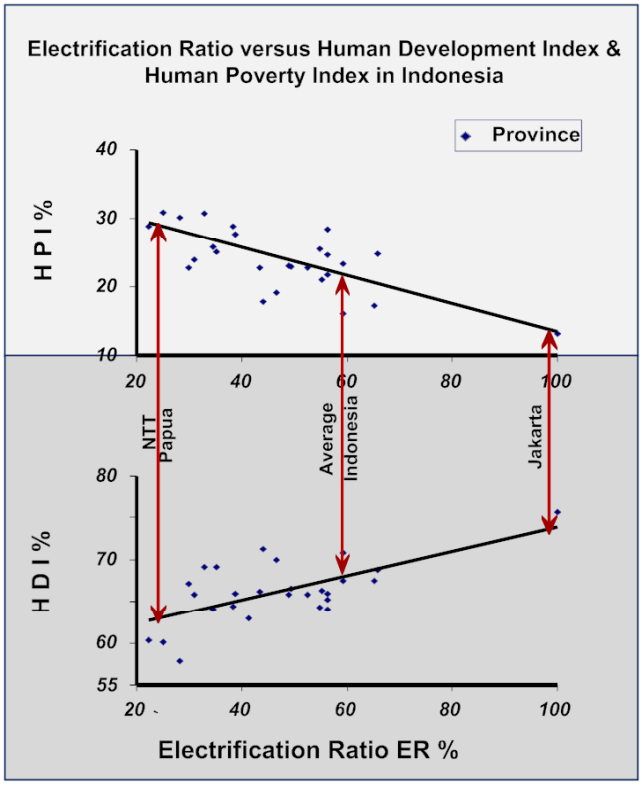


Diffusion of Innovation: "The process in which an innovation is communicated through certain channels over time among the members of a social system" *(Rogers, 2003, p5).*

Innovation: "An idea, practice or object that is perceived as new" by its adopters (*Rogers 2003*)

Rogers, EM., (2003), The Diffusion of Innovations, Fifth Edition (1962, 1971, 1983, 1995, 2003), Free Press, New York, ISBN 0-7432-2209-1.

Electrification Ratio & Socioeconomic Development in Indonesia
ER, HDI & HPI Correlation



Population 238m **Electrification Ratio:** 60%, **Average kWh/capita:** 564 (NTT- 74; Jak- 2077).

Current Situation: Demand growth 9%/year; Supply growth: 3-4%/year leading to electricity crisis; Oil share for electricity generation 63%

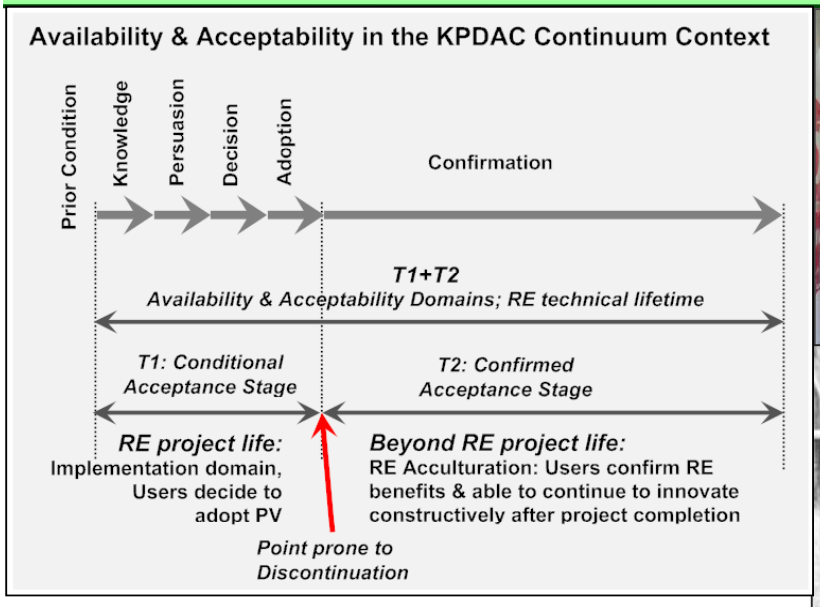
Future Target: 80% Electrification ratio (2014); no more black out (2010); decreased oil usage

HDI: Life expectancy, educational attainment, living standard
HPI: Poor health, illiteracy, poor access to clean water and earning below a dollar a day

(PLN 2008, UNDP 2008, CIA 2008, BP PEN 2006, Sulistomo 2010)

PLN 2008, Indonesian Electricity Statistics 2007 ; UNDP 2008 Human Development Reports, http://hdr.undp.org ; CIA, 2008, The World Fact Book, Indonesia, www.cia.gov

Availability & Acceptability: During & Beyond RE Initial Project Life
Example Off-grid PV & Micro Hydro



T1 & T2 Availability: Confidence in technical quality & continuity of energy service delivery (technical standards, after sales service infrastructure)

T1 & T2 Accessibility: Conditional & Confirmed Acceptance → Acculturation of energy service technology into local community's life

Exp: The KPDAC Continuum & Acculturation Process of RET

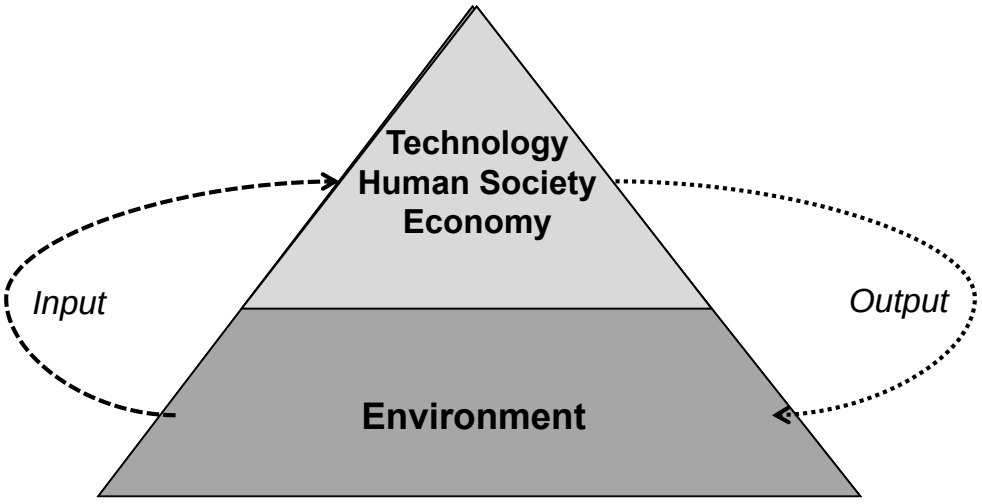
Prior Condition	1 Knowledge	2 Persuasion	3 Decision	4 Adoption	5 Confirmation
Previous practices	Aware of RET existence	Form un/favourable attitudes to RET	Decision to adopt or reject RET	Adopt RET; Re-invention may occur	Confirmation of RET adoption
Q0. Is it the best option?	*Q1. What is RET? How does it work? Why does it work?*	*Q2. What are the dis/advantages in my situation?*	*Q3. What are the consequences of my decision?*	*Q4. Where can I obtain RET? How can RET best fit my situation?*	*Q5. Dis/Continue RET adoption.*
Diagnose problems, shed light on alternative ways to address problems	*Establish information-exchange relationship; Knowledge awareness; Promotion; Education: Provide sufficient and accessible information*			*Adoption, Implementation, Financial &Technical assistance, User education*	*Stabilize adoption, prevent discontinuation.*
					RET is acculturated if Users can continue to confirm its benefits

Acculturation Process

The KPDAC continuum:

- Interweaving of hardware-software-orgware that explains the what, why, who, how involved in the RET acculturation process, as well as its success or failure
- Hardware: Equipment, Software: Skill, information, Orgware: Institutional context

Technology, Society, Economy & Environment

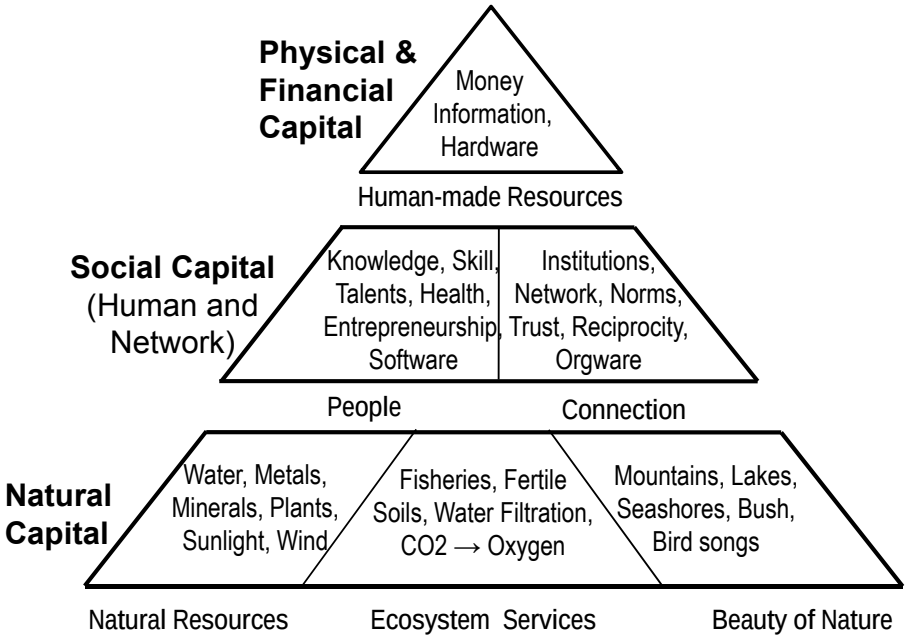


TSE Pyramid: Our existence is dependent upon the services provided by nature

Sustainability is about maintaining long-term and continued healthy balance between technology, human society, economy & the environment

Enlarging the scope of human activity (technology, society, economy) may compromise the environment's ability to support human activity

Community Resources: Physical, Social & Natural Capitals



Reproduced from Hart 1998, with some modifications.

Dr. Maria Retnanestri

Dr. Maria Retnanestri completed her undergraduate degree in Electrical Engineering at STTNAS Jogjakarta, Indonesia in 1991. Maria was awarded her Master of Engineering Science (MEngSc) and PhD degrees at the School of Electrical Engineering & Telecommunications, the University of New South Wales (UNSW), Sydney, Australia, in October 1999 and November 2007 respectively.

In her PhD research, Maria Retnanestri developed the I3A (Implementation, Accessibility, Availability and Acceptability) Framework to investigate overall sustainability of renewable energy projects, considering their institutional, financial, technological, social and ecological sustainability dimensions.

Currently she is on leave from STTNAS Jogjakarta College as a Postdoctoral Research Associate at UNSW funded by an Australian Development Research Award (ADRA) 2007 to identify ways to overcome barriers to renewable energy for sustainable development in developing countries.

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Research Project: http://www.ceem.unsw.edu.au/content/RenewableEnergyinIndonesia.cfm?ss=1