

Public Policy for Grassroots Innovations Initiatives: Lessons Learned from Malaysia

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Abstract: Promoting and upscaling grassroots innovations require a specific public policy framework that appreciate the fundamental values of niche-specific innovations. These values are locally socio-cultural embedded and evolve over the different stages of innovation. In this respect, the nature of grassroots innovations is seemed evolves from organic- to mechanical-form; and from self-satisfaction to market oriented. This paper argues that level-specific policy instruments need to be carefully formulated to facilitate the smooth transition of the various stages of grassroots innovations without jeopardising its' real values. The uniqueness of grassroots innovations particularly at the early stage should be upheld as it is the essence of the spirit of *poor as providers* in grassroots innovations movement. The four case studies on Malaysian grassroots innovators who have experienced the various stages of innovation offer important lessons on how agents managing grassroots innovations should target in making the intervention successful.

Key Words: Social innovation, inclusive development, bottom of the pyramid, science and public policy

1 INTRODUCTION

Base the principal values in niche-specific innovations and the four case studies on Malaysian Grassroots Innovations (GRIs), this paper attempts to offer important lessons on how agents managing GRIs should be targeted in making the intervention successful. The main findings of this paper, especially in the context of policy implications, are both intellectual rich and practically important in complementing recent literatures which are mostly on theorising the nature of GRIs base on the concepts of non-linearity and strategic niche management [e.g. 1, 2, 3]. Indeed, studies in linking policy to the reality of GRIs is relatively limited excepts some quantitative account on intrinsic motivation to innovative behaviour [4]. By taking Malaysia as a case, this paper supports evidence-based policy formulation for developing countries. It addresses the call on "Innovation Policy 3.0", i.e. the need to rethinking innovation policies and particularly to consider creatively about the broader suite of innovation policies that could be put in place in addressing societal or grand challenges [5]. As for the case of GRIs, it is a great challenge for policy makers to reposition GRIs as *providers* to the national innovation wealth; and not as *dividers* of it [6].

2 LITERATURE REVIEW

2.1 Concepts, Natures and Processes of GRIs

The concept of GRIs refers to a symbiosis network of like-minded individuals, innovators, farmers, scholars, academicians, policymakers, entrepreneurs and non-governmental organisations (NGOs) that acknowledges the local traditional knowledge holders and grassroots innovators [see 7, 8]. The innovation agents, i.e. individual innovators often undertake innovative efforts to solve localised problems, and generally work outside the realm of formal organisations like business firms or research institutes [9]. Their innovations emerging from the knowledge, experience and skills embedded in communities and individuals outside the formal institutions of education, scientific research and industry and is equated to innovation in a rural environment for solving problems of and within a small community [6]. GRIs are generally based in the social economy (rather than the market economy) and they tend to focus on social and institutional innovation (rather than technological) [10, 11]. They are driven by social need and ideological commitment (rather than profit seeking). To some extent, GRIs similar to the concept of frugal innovation. It is a "good-enough", affordable products that meet the needs of resource-constrained consumers, and based on the ideological movement of Appropriate Technology – a set of small-scale, labour-intensive technologies that are easy to operate and maintain, and have minimal harmful impact on the environment. The technological choices are people- centred, small-scale,

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labour-intensive, energy-efficient, environmentally sound, and locally controlled [12-14].

GRIIs generally take place in two stages – Stage 1 that occurs in local context while Stage 2 in broader community (or trans-locality) sphere. In local stage, the existence of shared visions and expectations, informal networking and learning are the main motivation of innovations. [3]. In the trans-local stage, intermediaries (e.g. government departments and organisations, NGOs and private sector) play key roles in aggregating lessons from across multiple local projects, establishing an institutional infrastructure for the innovation niche as a whole, and framing and coordinating action on the ground in local projects. This eventually leads to the conceptualisation of social and cognitive activities that make knowledge flow possible in GRIIs – with interactions between local and global levels [2].

2.2 Policy for Community-led Innovation and its Imperative Concerns

Public innovation policy comprises all state initiatives regarding science, education, research, technology policy and industrial modernisation, overlapping with industrial, environmental, labour and social policies [15]. Even though civil society is the fundamental component for community-based innovations, appropriate and niche specific public policy is important to act as a catalyst for this movement. This is evidenced in the *Honey Bee Network* in India, the community-based innovations have successfully persuaded policy makers to establish National Innovation Foundation (INF) to push the GRIIs innovations movement forward.

In order to solve social problem, public policy generally plays roles in, among others, providing standard level of acceptable quality of life for the target group and assisting interaction among actors involved [17]; and policymakers are required to outline policies that favour to knowledge policies to enhance innovation [18]. Indeed, a possible reason why developing countries are still lagging behind in innovation is due to the “one-size-fits-all” mentality among STI policymakers. This is because innovators in developing countries cannot simply replicates the same formula used in developed countries, as they have their own national histories and specificities; relevant factor, institutions and social actors; and information and context [19].

In specific to GRIIs initiatives, innovations are characterised as niche-based innovation and extensively driven by social-technical system. Hence, policy formulation for GRIIs should acknowledge the fact that technical knowledge developed in a niche context does not circulate to other location easily. It requires the process of aggregation (e.g. standardisation model building, writing of handbooks, formulation of best practices, etc.) armed with dedicated socio-cognitive work (e.g. social networks with sense of community) to make the local knowledge and practices sufficiently context-free, or de-contextualised [20]. In addition, the uniqueness of niche-based in advocating bottom-up enthusiasm of GRIIs movement should be addressed and analysis focuses upon the social networks, learning processes, expectations and enrolments of actors and resources of niches needs to be established [10].

Specific package of policy instruments and mechanisms to target intrinsic (i.e. pro-social acts such as the joy of creating and getting things done, seek out difficulties, and takes delight in ventures) and extrinsic (e.g. intellectual property protections, monetary support and rewards) motivations need to be made available in order to nurture and up-scale GRIIs initiatives [4].

3 METHODOLOGY

3.1. Research Framework

Fig 1 illustrates the research framework adopted in this study. In general, the framework is conceptualised on the multi-level perspective (i.e. local- and global-level) of community-led innovation as postulated in main literature in GRIIs study [i.e. 2, 20, 21, 22]. It is about the aggregation of value-laden local project to context-free generic knowledge that is transferable across location and communities in generating a greater impact to the society. The social elements such as shared rules and values are also part of the main focus of the study [see 20]. The framework exhibits that GRIIs generally take place in two stages – Stage 1 that occurs in local context while Stage 2 in broader community (or trans-locality) sphere, and targeted policy instruments are required in order to facilitate this aggregation and technology trajectory process.

We have identified four processes that required the attention of policy makers throughout the GRIIs cycle:

- (a) #P1: to provide valuable solution to the life challenges of an innovator. This includes the processes of ideation to actualisation of innovation. The end delivery from this process is mainly a practical and functional tool (or prototype).
- (b) #P2: to grant protection to the innovation and values generated from the innovators and facilitate better commercialisation of the innovation.
- (c) #P3: to disseminate the benefits of the innovation to both the local (i.e. #P3(a)) and trans-local communities (i.e. #P3(b)) in order to generate more socio-economic impacts.
- (d) #P4: to upscale the innovation as well the technological capabilities of the innovators from niche-specific solution provider to community development agent.

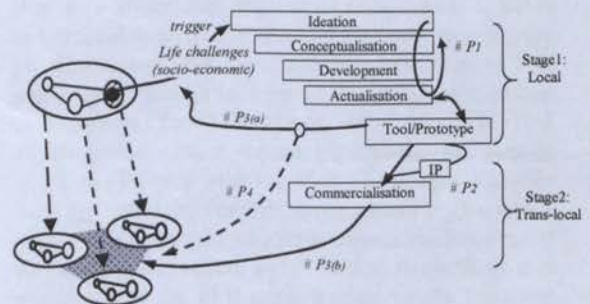


Fig 1. Research Framework
Source: Modification from [2, 20-22]

3.2. Case Study

An interview with the top management of Yayasan Inovasi Malaysia (YIM) was first conducted in July 2017 to obtain a brief overview of the GRIs and related programmes in supporting GRIs. A list of active grassroots innovators was secured from YIM's "Scouting for Grassroots Innovation" programme. The list has been carefully scrutinised in order to identify the best appropriate and "genuine" GRIs cases. In this regard, two types of predetermined criteria of selection were employed, i.e. the project must be (a) initiated by an individual innovator at the grassroots to solving his/her own socio-economic challenges; (b) experienced both the two stages innovation as indicated in Fig 1. Four cases have been shortlisted and on-site visits and interviews that have been performed in October 2017, namely:

- (a) Inno I: Grass-cutter machine for pineapple farming by a retired soldier.
- (b) Inno II: Multipurpose Truck operated on Vespa engine invented by a farmer to provide an efficient and energy-saving vehicle to transport the harvest.
- (c) Inno III: Mini Hydroelectric Dam constructed by a villager to provide cheaper electricity supply in his village.
- (d) Inno IV: Paddy Dispensing Machine invented by a farmer that significantly increase the productivity of the rice farmers.

Prior to the field visits, short phone conversations with each of the innovators were made in order to explain the background of the study. The scope of the interviews was also explained. As a whole, the case study was developed through secondary data, in-person semi-structured interviews and observations. The four interviews were conducted separately and in *Malay* (the official language of Malaysia). Each interview session was scheduled for 40 to 70 minutes and were tape-recorded prior to transcription. The case study protocol suggested by Yin [23] was followed closely. The exploratory questions used during the interview were listed in Table 1.

Table 1. Interview Guides and Questions

Primary Research Questions	Broad Exploratory Aspects
(a) What are the socio-technical elements that motivate GRIs?	<ul style="list-style-type: none"> • Sociocultural and economy background of innovator and the community • Historical origin and drivers of innovation
(b) What are the main characteristics of the innovations and sources of knowledge?	<ul style="list-style-type: none"> • Uniqueness of innovation (in related to concepts of appropriate technology; frugal innovation) • Stages and development of innovation and learning (ideation, prototyping, testing, marketing)
(c) What kinds the formal and informal institutional supports required?	<ul style="list-style-type: none"> • Formal institutional settings and networks • Informal supporting actors and social capital

(d) What are the policy concerns?	• Reflections, recommendations and moving forward
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4 FINDINGS AND DISCUSSION

4.1. Insights from the Case Studies

The following subsection provides an in-depth account on the four case studies in three perspectives – socio-cultural-economy; historical origin and uniqueness of innovation; and formal and informal institutional supports.

(a) Inno I (*Grass-cutter Machine for Pineapple Farming*)

– A retired soldier who is also a pineapple farmer from a small village has innovated a simple grass-cutter machine that has enabled faster cutting of grass weeds without damaging the fruits of pineapple farms. He improved the existing manual methods of cutting grass that are much slower, and the risk of damaging the fruits are much higher. The tool is low cost and only involved innovation at two small parts of a commercial grass cutter machine i.e. the blade and the metal plate. He had no formal technical training and his inventions were mainly based on interest and learning by doing. His invention started attracted public interest since 2009. After a local politician informed YIM about his invention, much publicity about his invention came his way, be it from government agencies, universities and even foreign buyers from overseas. Since then, he has been productive in inventing about nine others types of machine for pineapple farming, including machines for planting, fertilising and plowing. He started to receive tangible support from the government (specifically YIM) in 2011 in form of national recognition, award money, networking activities and advise on intellectual property (IP). The machines are now sold, by request – and can be customised according to the needs of the buyers. It is a one-man business, and he has no plans yet to expand the business further.

(b) Inno II (*Multipurpose Truck for Palm Oil Plantation*)

– A small scale oil palm farmer has invented an efficient and energy-saving transporter using scrap metals to improve transportation of oil palm harvest. He has no formal education and previously worked as a truck driver before becoming a full time farmer. He realized that the conventional practice of using wheel burrows to transport fresh fruit bunches (FFB) from the oil palm plantation was very slow and labour intensive. This particular challenge led him to find possible solutions to transport the FFB more efficiently. He first experimented with a scooter transporter, but later in 1984, he tinkered with the idea of building a higher capacity vehicle by combining the scooter engine with a bigger vehicle frame using scrap metals and basic metal welding. He succeeded, and since then has built several prototypes of the FFB truck transporter. In the early days, he only received support from his family but later gained confidence from the rest of the villagers once the usefulness of the invention was visibly proven. Later, the National University of Malaysia's Centre for

Entrepreneurship and SME's Development (UKM-CESED) provided financial and infrastructural support for workshop renovation, provision of modern equipment and technical advice to upgrade his workshop into an enterprise. Subsequently, in 2011 he received government support through YIM in the form of infrastructural assistance for workshop renovation, national and international recognition, award money, networking activities and advice on the protection of intellectual property.

- (c) *Inno III (Mini Hydroelectric Dam for Rural Electrification)* – A villager invented a mini hydroelectric dam to provide cheaper electricity supply for his local village. He has no formal education and previously worked as a labourer for a logging company in town. The village had no rural electrification until recently and fully dependent on electric generators located at the school. The mini hydroelectric dam uses a simple turbine connected to a second hand engine, gearbox and dynamo to generate electricity from kinetic energy derived from the water current of a nearby river. It was produced with a minimal cost of RM10,000 and requires very minimal maintenance fee at RM15 per month per household. He started having idea about the project in the year 2000, but only began actual work in January 2003. The main driver behind this grassroots innovation is the inventor's natural interest in technical tinkering, and his deep concern on the long-term wellbeing of his large extended family and local community. He started to receive supports from the government, specifically YIM through national recognition, award money, networking activities and advice on intellectual property in 2011. YIM is currently assisting him with the patenting process, but he is not very aware of the development.
- (d) *Inno IV (Paddy Dispensing Machine for Paddy Plantation)* – A paddy farmer invented a paddy dispensing machine made from scrap metals and spare parts from unused vehicles. The machine has transformed the paddy dispensing activity from a labour intensive manual process to a mechanised one, and significantly increased the productivity of paddy farming in his village. In the past, the whole dispensing process took almost 2 weeks to complete. The innovation reduced the duration to two days. Before becoming a paddy farmer, he was technically trained and worked as a welder. In fact, he already owned a welding workshop. His transition to a career in paddy farming was motivated by the needs of his family to work on the rice fields that they owned. He first mooted the idea of building the dispensing machine in the year 2000, but the first prototype only came to fruition in the year 2002. Five more prototypes were produced in the subsequent years. Eventually, by 2011 he managed to commercialise the machines and to date, has sold over 100 units to nearby districts. He now receives support from YIM to upscale the commercial value and impact of his innovation through IP protection and upscaling strategy.

The summary of the key characteristics of the cases, based on the interview questions, is provided in Table 2.

4.2. Salient Common Themes

There are several salient points on the common themes and challenges synthesised via the cross-case evidences. Each of the salient points are supported by verbatim quotes:

- (a) *Community orientation and geo-cultural embeddedness* – Local community supports are the main drivers of GRIs and thus it is generally geo-cultural embedded. Hence, efforts to foster and strengthen GRIs should acknowledge the important of socio-cultural context of the grassroots communities especially the essence of collaborative and trust.

"Why do I do this? Because all the farmers in this village are in difficulty. All done manually – how can that be? All want to depend on foreign workers – how can that be? We cannot afford to employ foreign labour. We should innovate like other countries. Not that we are not clever. We are clever!" (Inno I)

"In the beginning, nobody helped me to develop the truck. Some people even said that I was crazy for looking for scrap metals... the neighbours paid me build the truck for them. When the community appreciate what I do, give praises, I feel very proud." (Inno II)

"Family is the main driver for my success. The neighbours too. 80% of my strength are derived from them." (Inno III)

"Now I've already commercialised the machine. The way I do business is through word of mouth. It is not difficult to sell the machine as there are many farmers in this area. I tried the machine at my paddy field first" (Inno IV)

- (b) *Broader perspective of upscaling* – the upscaling of local GRIs is not always about monetary return and business purposes. Indeed, it is about creating bigger social impact to wider and neighbouring community. It is about public goods and societal well-being development.

"The motivation to create new machines are always, I will continue as long as I can. Inventing is good in itself." (Inno I)

"If there are youngsters who are interested in this field, please come. I will teach. If they can do it, I am happy. If young people are successful, it will reduce the burden of their parents." (Inno II)

"My hope is for the truck to be diffused to the whole country. Not so much for cities, but more for the rural areas and inlands. The truck is actually suitable for muddy and forested areas." (Inno II)

"Now, my innovation has been publicised to the whole country... there are so many villages without proper electrification – especially those areas that can only be accessed by foot." (Inno III)

"My future plan is to design the machine that are also suitable for other paddy varieties. The spirit should be there!" (Inno IV)

- (c) *Is patenting really necessary?* – Although there is a strong effort from the public agency to provide IP protection to the GRIs. Nevertheless, it seems that the grassroots innovators are not expressing a high desire on IP. Somehow, IP matters are not their main concern.

"They did ask to apply for patent. However, the machine drawing that they have made cannot be used. It doesn't reflect the machine that I gave. This is because the person involved in the drawing has never done farming before. [...] The design that the company made was very beautiful, but the machine

did not work. So the patenting project just ended there." (Inno I)

"They are helping with patenting the truck with eight functional engines. Not sure what the status is now" (Inno II)

"They have asked for the invention to be patented, but I'm not sure. I have not received any patent certificate" (Inno III)

"Patenting is currently in the process. They are helping with documentation. I am not overtly concerned about the patents as I already know how to develop the machine. Design of the machine can be easily copied, but copying the 'development process' is much harder." (Inno IV)

Table2. Summary of the Cases

Key characteristics	Inno I	Inno II	Inno III	Inno IV
Sociocultural and economic background of the innovator	A pineapple farmer from a village and his members of the family are generally farmers. Family has lived in the village for generations. He is a retired soldier.	A small scale oil palm plantation farmer. No formal education, but has experience working as a lorry driver.	A villager in a rural village. No formal education, but has experience working with a logging company in town.	A welder who later became a paddy farmer. Technically trained as a welder and owns a welding workshop.
Unique of the innovation	A simple grass-cutter machine, with the blade and metal plate of a normal grass-cutter has been modified to cut grass without damaging pineapple fruits in the plantation.	An agricultural harvest transporter made from scrap metals and spare parts from unused vehicles. It has eased transportation of agricultural harvest by smallholders.	A mini hydro dam for rural electrification by using scrap metals and spare parts of unused vehicles. It is based on a simple turbine connected to an engine, gear box and dynamo.	A paddy dispensing machine that transformed the paddy dispensing activities in a village from a labour intensive manual process to a mechanised one.
Impacts of innovation	Increased efficiency of grass cutting at pineapple plantations i.e. faster and less laborious compared the conventional practice of using sickle knife. To date, the inventor has produced nine other machines for improving the productivity of pineapple plantations.	Higher quantity and weight of harvests can be transported at one time. The inventor has produced more than 100 units of the truck, and some of them has been sold to local farmers and commercial buyers.	Enabled 24 hours electrification for several households and providing cheaper way of generating electricity compared to electric generators. There have been requests to replicate the innovation in other localities.	Increased the productivity of paddy farming activities in a village i.e. by reducing the duration of the paddy dispensing process from 2 weeks to 2 days. The inventor sold over 100 units of the machine to nearby districts.
Formal institutional supports	No formal institutional support in the first 16 years. Since 2011, YIM gave support in terms of recognition, award money, networking and advise on IP protection.	No formal institutional support in the early stage. A local university provided support in financial and infrastructural support, followed by YIM in terms of recognition, award money, networking and advise on IP protection.	No formal institutional support in the early stage. Since 2011, YIM gave support in terms of recognition, award money, networking and advise on IP protection.	No formal institutional support in the first 11 years. YIM gave support since 2011, in terms of IP protection and upscaling strategy.
Informal supporting actors	Strong support and motivation from family members and community after after value of innovation was proven to be useful.	Strong support and motivation from family members. Support from village community was lacking in the beginning, but increased after value of innovation was proven.	Strong support and idea sharing from family members and the village community. Also mentioned the skills gain from former employment in a logging factory.	General support and idea sharing from family members and the village community.

5 CONCLUSION AND POLICY IMPLICATIONS

5.1. Targeted Policies for Two Stages of Development

The key insights from the case studies provide empirical supports to the two stages of GRIs as illustrated in Fig1 that are important in informing the policy-making processes:

- (a) In *Stage 1*, life challenges and difficulties (usually in related to social and economic) trigger the desire to innovate among the innovators. The ultimate objective is to provide solutions to the local people – the value created for the good of the villagers. Most driven by individual efforts and passionate, this value creation process is time consuming and involves the interactive processes of ideation, conceptualisation, development and actualisation. It requires long-term self-commitments, “peace of mind”, and supports from family members. Sources of knowledge are mainly from innovator’s tacit knowledge (or hand-on experiences) with a little help from other forms of informal networks (e.g. villagers, ex-employers, etc.). The product development will be mainly base on trial-and-errors and learning by doing. The main delivery from this niche process is a tool or prototype that operates directly on the ground. The aspects of functionality, practicality and simplicity are the features of innovations, without much concern over the appearance and stylist of the tools. Most of the tools are assembled and constructed from the used parts and components in order to reduce the price. The value dissemination in terms of problems solutions are in the forms of informal – commonly via word-of-mouth. The grassroots innovators are seen as problem solution providers to the niche pressures.
- (b) *Stage 2* is the level where the formalisation and upscaling of local niche innovations (or village level) into trans-location settings that attempt to benefit a broader community at the regional (or district level). It normally begins with efforts to provide protection on the prototype and follows by commercialisation. However, some prototype is directly commercialising without first getting its IP protection. In this context, public agencies and research institutions provide assistances in the process of IP documentation as well refining the prototype that suit the IP. Exhibition, road show and other forms of promotion and awareness programmes are organised by the agencies in highlighting the successful stories and products of the innovators. Some entrepreneurial funds and training programmes are provided to the innovators. This attracts a vast interest from communities at the regional level (especially school and university students). In this stage, the grassroots innovators are seen as community’s capacity development agent beyond their own niche.

5.2 Targeted Policies for Two Stages of Development

The main findings support that grassroots innovators are largely motivated either by intrinsic motivations or by a combination of intrinsic and extrinsic motivations. The

importance of intrinsic motivation is comparatively greater during the early stage, when uncertainty about innovation is high. The importance of extrinsic motivation, on the other hand, increases when innovation is complete, awaiting application [4].

Amalgamating the findings of the four case studies and the three functions of public intervention instruments (i.e. regulative, financial and administrative), there are three policy concerns in fostering and supporting GRIs without undermining and jeopardising the typical spirit and main interest of the innovators:

- (a) Avoid oversimplified approaches or even over-generalisation or one fir policy;
- (b) Recognise geographical specific, culturally embedded of local communities and wide spread of heterogeneity; and
- (c) Develop unique policy instrument (regulative, financial and administrative) based on cases and circumstances.

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