Creating an Innovative Environment with FabLab – Case study: Bohol, the Philippines

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1. Introduction

A recent trend in ICT has been the creation of products by private citizens using digital fabrication equipment such as 3D printers and laser cutters based on data available on the Internet, and producing no more than the required quantity of products at a time. This new style of production has been called the "maker movement" and even the "third industrial revolution" in contrast to the conventional mass-production/mass-consumption model.

Governments around the world have started to adopt this new trend in their economic policy. In Russia, FabLab digital fabrication facilities (described below) were set up at a hundred locations in 2013. And in the US, the government has pledged that the 2015 national annual budget of $2.9 billion would be devoted to installing digital fabrication facilities in a thousand public schools. In France, the government announced that it would establish digital fabrication facilities in all regions under its digital district policy.

This movement is also prevalent in emerging/developing countries, which are keen to bolster economic growth by joining the "third industrial revolution" following the success of India and Korea, which achieved rapid growth during the IT revolution of the 1990s and early 2000s.

2. Making Products with the FabLab Network

The creation of new products in emerging/developing countries is supported by a set of laboratories and a worldwide network called FabLab (Fabrication Laboratory / Fabulous Laboratory). FabLab is a worldwide creative network aimed at supporting mutual cooperation to make better use of ICT. There are 581 FabLabs across 82 countries as of November 2015 (Fablabs.io 2015). Each FabLab offers a product development environment equipped with a set of digital fabrication hardware such as 3D printers and programmable micro-controllers, but is also open to citizens who want to fabricate personalized products utilizing ICT and open-source devices.

There have been quite a few cases of FabLab-enabled innovations, from the original 3D printers to smart houses at the grass-roots level all over the world (Tanaka 2012). Some innovations have occurred in developing countries like Ghana and Kenya, where unique processors for local food ingredients were developed. In Afghanistan, a young 'Fabber' produced wooden WiFi routers that make it possible to provide wireless Internet access even in remote hilly areas. Other interesting examples include a sensing device for the fat content of milk, and a hundred-dollar weather data logger for local agriculture, developed at the FabLab in Pabal, Pune, India (Gershenfeld 2007). These innovations were born in rural areas far from cities, clearly demonstrating the innovation potential of using FabLab in rural areas of developing countries.

The first FabLab in the Philippines was established in May 2014, since when the government has actively supported its expansion for economic growth and micro/small-sized economy build-up.

To examine the possibility of creating new products with ICT and FabLab in a developing country, this article describes a case study of how the first FabLab in the Philippines was established as part of a project to reduce poverty by building up an innovation environment using FabLab.

Photo 1: Delta type 3D printer produced at the FabLab Kannai in Japan

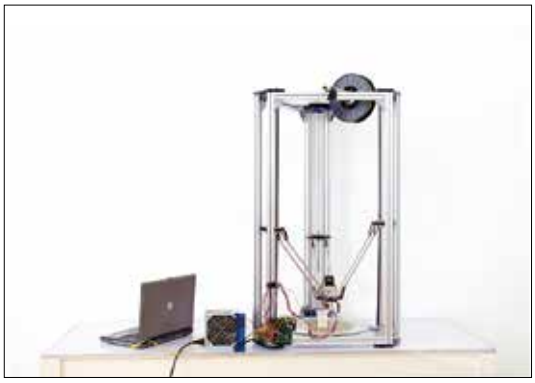


Photo 2: A "FabFi" wooden WiFi router produced at the FabLab in Afghanistan

Photo 3: Inside the Bohol FabLab

3. FabLab for Local Problem-Solving

The first FabLab in the Philippines was established in Bohol, which is two hours' flight from the capital Manila, and two hours by ship from the second largest city, Cebu. The total population of the province is 1,255,128. The provincial capital, Tagbilaran City, has a population of approximately 100,000 (Province of Bohol 2015). Bohol is now known as a safe island, but the local economy is still suffering from under-development due to the post-effects of anti-government activities in the past.

The project aimed at reducing poverty by using FabLab to build up the innovation environment was handled by the Provincial Office of the Department of Trade and Industry Bohol Office (DTI Bohol), which is a local government organization composed of 27 staff whose main mission is to promote economic growth in the locality.

One of the main reasons why DTI Bohol decided to adopt the FabLab concept without any prior experience is because the region faces serious logistical problems due to its geographical situation. The Province of Bohol consists of a main island and more than 70 other small remote islands, which means that product distribution has to rely on sea transport. However, it has no ports that are able to carry large-scale vessels, and therefore all product distribution is centered around the Port of Cebu on the other side of Bohol, which takes two hours to reach by high-speed boat (or 4–5 hours by freighter).

Almost all freight destined for Bohol is shipped in large containers that are first carried to the Port of Cebu for temporary storage in warehouses. It is then divided and repacked into smaller containers so that small carriers can come to pick them up for transport to the smaller Port of Bohol.

Manufacturing industries require that various materials and consumables are available in stock almost all the time. But in Bohol, this is too expensive due to the high cost of shipment and storage. Thus high procurement costs push up production costs, making products from Bohol less competitive than products made in Cebu that can be marketed in the same town. It is therefore very difficult for Bohol to create products whose market value can cover the production cost.

In an extreme instance, there are only two ways in which manufacturing-based local businesses can be promoted under these circumstances:

- Producing high-quality products that can compete with their counterparts from outside the province
- Creating innovative products that are not sold outside the Province

The DTI appears to have been unsuccessful so far in finding solutions and measures to overcome this logistics problem in Bohol, which has been one of the major problems preventing growth of its manufacturing industry.

While visiting the area with the Japan Overseas Cooperation Volunteers (JOCV) of the Japan International Cooperation Agency (JICA), I proposed that this problem could be solved by implementing the above-mentioned project to reduce poverty by introducing an innovation environment with FabLab. This project was aimed at generating innovation that could benefit the local economy by using digital fabrication, while drawing on FabLab's worldwide product making network. The first step was to establish a FabLab as a production environment and as a base for further work.

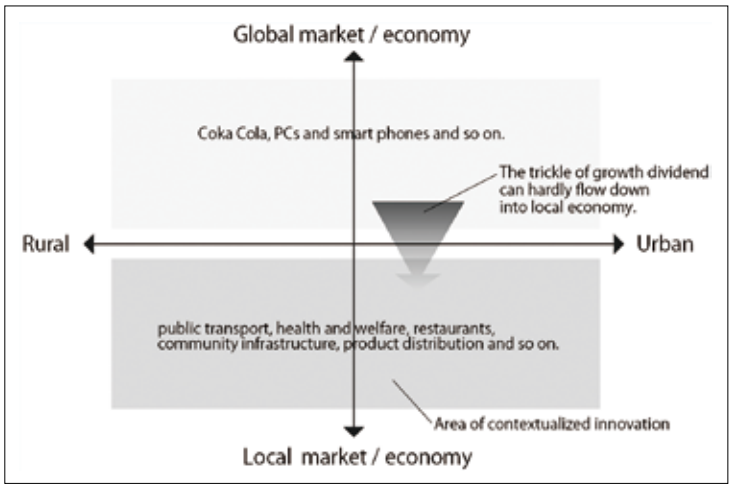
This project was conducted jointly by DTI Bohol, JICA, the Department of Science and Technology (DOST) Bohol Office, and the Bohol Island State University (BISU). These organizations shared the initial cost of about $122,000 (Php 6,300,000), including the cost of equipment and consumable goods, and the renovation of building facilities.

Although this project was proposed and started by one JOCV volunteer, it was allocated a fairly large budget because the local government supported its core idea of "contextualized innovation" in the form of local projects.

I should point out that "contextualized innovation" is not limited to innovations that are adequately competitive in the global economy, but also to innovations that can improve the well-being of a small local area, including the effectiveness and efficiency of local institutions or individuals. Specifically, contextualized innovation is context-based innovation that brings breakthroughs or improvements to the *status quo* of local individuals and organizations engaged in businesses such as transport, health and welfare, restaurants, community infrastructure and product distribution, and local groups that mostly consist of such people. The overall goal was to revitalize the local economy by contextualized innovation. To explain contextualized innovation more concretely, micro recycling facilities would be a good example.

In Bohol, a lot of plastic waste is discarded everywhere by the roadside. The situation gets worse further away from the provincial capital. On the other

Figure: Conceptual diagram of contextualized innovation



hand, there is no steel waste, because steel is easy to process and recycle at the local steel mills, so scavengers collect and bring the steel waste to local mills for cash. If there are many local facilities that process plastic waste as a new production material, plastic waste will disappear from the streets. Community projects such as micro recycling facilities can therefore improve the *status quo*.

At the planning stage, this facility was quite simple, consisting of a customized glue gun with an attached device that uses heat to reprocess waste plastic (polyethylene/plastic) from shopping bags into long strings. The actual presentation regarding the micro recycling facilities went like this:

> "When plastic is heated, it becomes soft and can be reprocessed into a recyclable material. It's not difficult to build a facility by ourselves. But if we want to improve the quality and make this string salable at the market, we need to cut aluminum parts more precisely. This can be done using the digital fabrication facility installed in the FabLab."
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> "The existing local MSMEs could then weave a new fabric of Bohol origin using the reprocessed strings, and local bag producers could make a new eco-friendly bag from the new fabric. The resulting project could simultaneously achieve a more beautiful Bohol and a new local industry while creating a strong brand of *Made in Bohol*."

Despite its simplicity, this idea can create highly intense and durable local fabrics by keeping traditional and natural textures made from plastic strings as the warp, and local natural raffia fibers as the woof. If the production of a "micro recycling facility" is realized, then

- Scavengers collect plastic waste, and local recycling processors make plastic string out of the wastes as a new industry
- Existing local MSMEs can use the reprocessed strings weave a new fabric of Bohol origin
- Local bag producers can make new eco-friendly bags from this fabric

At the beginning of the project, a series of preliminary meetings were held with each organization. We stressed the ease with which simple facilities can promote local production using digital fabrication tools at FabLab. As a result, these organizations recognized FabLab's importance, and were persuaded to go ahead with the project.

The development of this micro recycling facility has continued in collaboration with FabLab Kannai through the FabLab network. This facility makes it easier to recycle plastic and create products using new recycling materials based on the concept of local production for local consumption. The Tagbilaran city government is currently planning to build up these facilities at all 15 barangays.

At the time of writing (November 2015), a year and a half has passed since FabLab Bohol was established, and other contextualized innovations have been made besides the micro recycling facility. For example, people have created crafts and food packaging for local firms, and used a 3D printer to produce molds for the mass-production of local foods and soaps. Coconut shells have been adapted to make coin cases based on an original design, and production was started by local people who lost their jobs due to the aftermath of

Photo 4: Material from reprocessing plastic bags to form long strings (upper), fabric hand-woven with the plastic strings as warp and wool as woof (lower left), and fabric hand-woven with the plastic strings as warp, and local natural fibers called raffia as woof. The raffia is made from buri palm trees (lower right)

Photo 5: Low-cost construction of public office buildings built with digital fabrication facilities designed by Keio University

Photo 6: The product of an entrepreneur who aims to launch a lighting system that can be controlled by a smartphone app

the earthquake disaster. Public buildings are also being constructed inexpensively by combining traditional Asian joint structures with digital fabrication technology. Several other innovations have been achieved in a similar manner.

Moreover, a young entrepreneur created a controllable lighting system based on a smart phone and a micro controller. His interest in starting a business came about as a result of an encounter with FabLab, so we are achieving overall goals of stimulating projects that have a positive economic impact.

The impact of the Bohol FabLab has been highly praised at the national government level by President Aquino, and this endorsement has led to a range of government activities promoting FabLab, such as a multi-sector FabLab study meeting held by the DTI Secretary (Manila, Dec. 2014) and a large-scale awareness-raising event for citizens (Feb. and Oct. 2015, Manila).

Thanks to these promotional activities, the number of FabLabs in the Philippines increased from one in 2014 to three at the time of writing (Nov. 2015). At least eight more labs are in the pipeline, and I am certain that the number of FabLabs will reach 11 by early 2016.

4. Concluding Remarks

At Fab9 (the 9th Global Conference of FabLabs), the Japan International Cooperation Agency announced that it would seek to exploit the potential of FabLabs for socio-economic development and project formulation in development cooperation programs. The World Bank also reported on the scenes of the 10th conference (FAB10) and FabLab's impact on development. With this level of exposure, I expect that new forms of manufacturing, FabLabs, and development cooperation using innovation will gain momentum.

However, there are still questions remaining, such as how exactly can a development cooperation program including FabLab be implemented, and what conditions do we need for Fablab to generate further contextualized innovations? Scholarship in this area has just begun, and various challenges will emerge in due course. Yet I commit myself to move ahead my research program, which might contribute to innovative joint development projects in developing countries.

Note: This article is based on the personal views of the author, and is not an official view of any specific organization such as Keio University and JICA.

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Photo 7: President Benigno Aquino III evaluated this activity highly and announced the expansion of the FabLab network all over the country