How to Connect the Local Innovation Hub "FabLab" to Local Development in a Landlocked Developing Country?

Studying points

Students are expected to experience a journey of the economic development officers who are working for industrial promotion and economic development of their province. Through this case discussion, students are expected to learn about the emerging global network of FabLabs (digital fabrication laboratories) and discuss the potential of these facilities as local public goods for the development of local economy, especially in the context of landlocked developing countries (LLDCs), small island developing states (SIDS) and least developed countries (LDCs).

Basic information

- Region: South Asia
- Issue: Use of Local Innovation Hub for Industrial Promotion and Economic Development
- Key words: grassroots innovation, FabLab, 3-D printer, local development, CSI, industrial development
- Country: A (fictitious)
- Year: 2022

Characters

Characters	Description
Rajesh Rai (Main character)	Economic Development Officer, MTI Provincial Office, Chandrapur Province, Country A.
Taro Yamaguchi	JICA Volunteer (Product Design), MTI Provincial Office, Chandrapur Province, Country A.
Vikas Khatri	Lab Technician, FabLab Pavalpur, Department of Electronics and Communication Engineering, Pavalpur College of Engineering, Country A.

Abbreviations

CNC	Computer Numerical Control
CSI	Cottage and Small Industries
CSOs	Civil Society Organizations
DIY	Do It Yourself
ECE	Electronics and Communication Engineering
EDO	Economic Development Officer
IT	Information Technology
MTI	Ministry of Trade and Industry

MIT	Massachusetts Institute of Technology
PET	Polyethylene Terephthalate
QC	Quality Control
SOP	Standard Operating Procedure

Summary

Rajesh is the Economic Development Officer of the Chandrapur Province, primarily working for the industrial promotion and economic development of his constituency. He has his co-worker, Yamaguchi, recently assigned as JICA volunteer for product design. Rajesh saw Yamaguchi's struggles to train the local human resources to improve the quality of their local products and make those products look more attractive. Soon he saw Yamaguchi reaching a deadlock in just three months after his assignment. Yamaguchi was at a loss facing the reality of the local entrepreneurs, who were not able to meet the high quality standards as he had expected.

Rajesh and Yamaguchi had a series of discussions in search for the alternative approach for industrial promotion, besides the traditional targeted approach to select a few model local entrepreneurs and provide a lot of training opportunities for them. One day, they came to know about the FabLabs, digital fabrication laboratories, and heard that the new FabLab was established inside the engineering college located in a city in their province. FabLab is equipped with a variety of digital and analogue fabrication machines for the users to make (almost) everything. Even though it's located in the college campus, it's open to the community and the external users could take access to the facility and prototype their ideas as soon as they come up with the ideas. Rajesh and Yamaguchi thought that this kind of facility could fill the skill gap for the local entrepreneurs to make high value-added products.

Rajesh and Yamaguchi decided to visit the FabLab Pavalpur and met with Vikas, a lab technician stationed in the lab. After the observation of the facility and the following discussions with Vikas, they found that the FabLab Pavalpur had been inaugurated just recently and had not been so successful in receiving lots of users coming from outside the college campus. The majority of the users was college students, and that caused the facility underutilized until the students were released from lecture sessions in the afternoon every day. Rajesh and Yamaguchi also felt that the FabLab Pavalpur was still too far away from most of the local entrepreneurs making a living in remote places.

Even after their observation visit, they were not sure how they could connect the local entrepreneurs to the FabLab.

Key questions in reading this case

The students, who will assume the position to work for the promotion of local industries and the local economic development in their home country, need to be aware of the fact that the global network of FabLabs has been growing and expanding rapidly and there is at least one such lab, as a local hub for innovation, in most of their home countries. Based on this reality, policymakers may have to come up with measures to connect any kind of development projects and economic activities to these local innovation hubs.
The students are recommended to discuss the following:

1. What are the advantages of having a FabLab in the local community? Which existing FabLab is nearest to your constituency?

2. What do you want to make in the FabLab to address the issues you or your community has been facing? What local material do you think you could use to make it? And what material do you think you should purchase in the external markets?

3. In case you plan to install a FabLab in your constituency, where is the best location? What criteria should we set to shortlist the locations for the new FabLab? What is required to prepare for establishing a FabLab in your local community, in terms of equipment, human resources, user rules and regulations, etc.? What is the role of the public sector should play to install it in your constituency?

4. If you already have a FabLab in your constituency, who do you think are the potential users? Which stakeholders in your community, including the FabLab itself, should do what to strengthen the linkages between the community stakeholders and the local FabLab?

5. What do you think is required to ensure the sustainability of the FabLab business model in your constituency?

1. Introduction

My name is Rajesh Rai, and I am a mid-level staff member working at the Chandrapur Provincial Administration Office of the Ministry of Trade and Industry (MTI) of Country A, a small landlocked country in the Himalayan region of South Asia.

Chandrapur province is located in the southwestern part of the country, covering an area of 1,880 square kilometers. It is an underpopulated province with an approximate population of 69,000 and a population density of 36.7 persons per square kilometer. The southern part of the province borders Country B, our

largest neighbor in the South Asian region, and a primary national highway--the main artery of logistics for Country A--runs through the province from north to south, connecting it to the capital city in the north. Most districts in the province are in the mid hills, 2,000 to 3,000 meters above sea level, and the landscape of the province is neither favorable nor convenient for land transportation, except along the North-South Primary National Highway.

Pavalpur, the second largest city in Country A, is located in the southern part of the province, bordering Country B and serving as a major hub for logistics. However, all the plains fewer than 100 meters above sea level belong to Country B, and the residential areas on the Country A side face steep ridges and valleys. Despite some restrictions on the land development for residential purpose, 19,000 citizens live in the town area.

My office is in the provincial office in the town of Chandrapur, which is also the name of the province. It is a two-hour drive to the capital city and a one-hour drive to the city of Pavalpur in the south. My job at the MTI Provincial Office is: (1) To promote industrial development, job creation, and further investment in the province; (2) To protect consumers by monitoring the fairness of transactions; and through these efforts, (3) To uplift the local economy and improve the quality of life of residents.

We report to the Governor of the Province directly, and I work under him to promote the competitiveness of the cottage and small industry sector where total asset of the business is $10,000 or less. We are responsible for tourism promotion, food industry development, and manufacturing development, as well as export and investment promotion. Specifically, we can provide loan guarantees for bank loans for capital investments and business financing to cottage and small entrepreneurs; initiate new product design and development in our locality; coordinate training workshops to familiarize local people with business skills, product development skills, and other knowledge; host job fairs for early-career job seekers; and make arrangements for local entrepreneurs to participate in trade fairs both within and outside the province.

I studied marketing at a national university in the capital city and joined the ministry ten years ago. The Chandrapur Provincial Administration Office is my second duty station. In my office, there is another staff assigned primarily to industrial promotion. His name is Taro Yamaguchi. He is a Japanese volunteer recently dispatched by JICA via the central office of MTI as a product designer. Yamaguchi is also in his early 30s, and I heard that he had studied product design at a university of arts and design. I was not aware of such a major within higher education. There is no design college in Country A. After graduating from the university, Yamaguchi worked in production design at a hardware company for a few years and then became a freelance web designer and system engineer for several clients. He had nearly 10 years of work experience before he applied for the JICA volunteer program.

2. Geographical Disadvantage of Chandrapur Province

As a small landlocked country, logistics in Country A depend totally on land transportation or air freight. All the imported goods are brought into the country via neighboring countries such as B and T. For all goods imported via land from Country B, Chandrapur is a gateway province. Before the pandemic, once the import crossed the border, they were unloaded from the large-scale cargo trucks in the go-downs in Pavalpur, reloaded to small trucks and distributed to various parts of our country. However, due to the pandemic, the government of Country A designated the border area as red zone with a high-risk of transmission. Following this determination, all goods imported from Country B were transported all the way to the capital to be unloaded and reloaded for delivery to different destinations.

This caused a serious disadvantage for local manufacturers in the Chandrapur province who rely on imported materials. In addition to the limited availability of these materials, transportation costs per unit doubled. This drives up the wholesale price of almost all products from Chandrapur province, putting them at a price disadvantage compared to similar products produced in the capital.

A further difficulty is that Pavalpur shares the national border with Country B. It's only a four-hour drive from the country border to the capital city. Therefore, foreign travelers entering the country in Pavalpur can travel through Chandrapur province all the way to the capital without stopping. Given local products are neither price-competitive with those sold in other provinces or uniquely available only within the province, there is no reason for travelers to stop in Chandrapur to purchase its products from the local markets. This problem has been bothering us for many years.

To address this issue, we have selected 10 local entrepreneurs throughout the province and provided technical guidance to improve the quality of their products. We have also provided financial and technical support for these priority businesses. We expect to see a trickle-down impact from these proprietors that will eventually uplift the local economy of the province.

3. Struggles of JICA Volunteers for Industrial Promotion

When Yamaguchi joined my office, he asked me why the above-mentioned approach had been adopted. I explained that we had once provided guidance to various proprietors, but soon we learned that only a few were highly motivated and able to follow our guidance. I emphasized that the 10 entrepreneurs were those who were passionate enough and highly motivated.

Before Yamaguchi, we had received two JICA volunteer product designers in our province. At that time, we had targeted 10 entrepreneurs for technical guidance. We expected his predecessors to come up with a design for the new local

products, and then give technical instructions to local producers to make them based on that design. This seemed like a usual practice for us. However, after he went through all the activity reports of his predecessors, Yamaguchi told us that those volunteers seemed to be skeptical about the effectiveness of this approach. “If I read between the lines, they had been feeling a strong riptide,” he muttered to himself.

About a month after his arrival, Yamaguchi asked me if he could go out for observation visit to the workplaces of the 10 local entrepreneurs. He insisted that he wanted to know who our clients were and how they had been doing business. “Maybe I had better know the state of the CSI sector in our province,” he said. Therefore, we decided to visit 10 places, taking almost two full weeks together.

He was stunned at the work environment of their workplaces. Besides a few business houses located along the North-South National Highway, many of them were located in the hilly area, a one- to two-hour drive from the highway on a farm road. Some of them were located on the ridge of steep mountains or in the bottom of the valleys and were inaccessible even by car. To visit these workplaces we had to walk from the nearest access point.

One workshop was located in the deep forest area, and we saw a simple CGI roof placed over four log pillars. It was a handmade facility with a circular saw to make wood accessories.

In another workshop, we saw villagers gather and work in a poor dark hut made of bamboo and palm trees. The floor area was about three square meters. There was no electric motor-powered equipment, and everything was done manually.

There is a stitching house along the National Highway, where some of the small local tailors attended training and learned sewing machine operations. We had expected the participants to replicate the operations in their own villages with a sewing machine we had distributed. However, no pattern paper was used to draw outlines on the fabric to cut out the cloths, and they were cutting the cloths almost randomly with the scissors. As the result, the cut-outs were not uniform in shape, and even if they were sewn together, they would not be able to make the large quantities of uniform handicrafts.

Yamaguchi pointed out that none of their workshops had posted operational guidelines nor standard operating procedures (SOP). He found that there was only one workshop that posted instructions on the wall detailing quality control standards for their products. It was handwritten in the local language, with ambiguous phrases such as "Stitch neatly. If it’s not, start over.”

“Their products are far from marketable. We cannot sell them," Yamaguchi said. He emphasized that for the mass production of traditional handicrafts in Japan, very precise and detailed operational procedures have to be defined and taught to each and every one in the workshop.

Yamaguchi also had difficulty communicating with the workers who came in and out at each of the workshops we visited. Wherever he went, he tried to speak directly to the people working there. But every time he asked his first question, "What are you doing with this?" he faced difficulty in asking more in-depth questions. He couldn't get the answers as he had hoped. The workers also looked like they were at a loss on how to respond to him. He thought that it was partly because he did not understand the local language, and he eventually began communicating in writing over memo pad. Then we realized that many of the workers did not know the units of length or how to take the measurements with a ruler.

A month after our observation trip, Yamaguchi decided to visit one of the workshops and host a training workshop on bag making.

He had already researched the products the target workshop could make, by visiting the souvenir corner of a small roadside restaurant where their products were sold. He prepared four different samples of bags and accessories with very simple designs. For each design, he prepared 2-D sketches, instructions, pattern papers, and a paper mock-up to understand the 3-D form image. Since I could not accompany him due to my earlier commitment, I had my office assistant, Purna, accompany him as a teaching assistant-cum-interpreter.

Purna later reported to me that Yamaguchi gently and carefully explained to the six or seven participants how to make the mock-up. "When you are cutting the cloth with the scissors, you have to leave the scissors half open in the middle of the cutting process." Purna described that Yamaguchi apparently tried to explain the basics very carefully. His advice included:

"If you close the scissors, you won't be able to control them well, ending up with rough cut-outs."

"With pattern papers, you could make a uniform product every time."

"You must avoid damaging the pattern papers. And please save them in a good condition. You have to use them over and over again."

I also asked Yamaguchi, "How was it?" He complained, "I got interrupted by incessant calls to their mobile phones during the workshop. The participants didn't seem to stay focused on the training itself. Every time they received a call, they excused themselves and left the training site. On top of that, they always tried to check their text messages every time they received them."

Somehow, he managed to proceed to the hands-on session on sewing machine operations by the early afternoon. But he said that he couldn't complete the session as he had wanted. He had to close the one-day training workshop in the evening. For the uncompleted modules, he left verbal instructions by saying to the participants, "Do not stitch off the reference line you draw with the pattern

paper."

"Hopefully my last message was taken well. As long as they keep stitching along the reference line, they could make the similar products as shown by the paper mock-ups."

He looked quite shocked and exhausted to see that even the entrepreneurs we identified as model did not know how to use scissors correctly or understand the benefits of using pattern papers.

Two weeks later, Purna revisited the workshop alone and collected the bags that the training participants made as homework assignment. As soon as he came back, we asked him to show us the bags. Purna hesitantly took them out of the carton box. At one glance, Yamaguchi had his eyes wide open and then covered his eyes and looked up to heaven. When he closed the training, he had left written instructions with sketch drawings and the paper mock-ups as a sample. He had expected to see them make the same bags by following the instructions.

Seeing his disappointment, I felt sorry for him. Honestly speaking, I was also disappointed. We had never expected that the entrepreneurs we used to describe as "highly motivated and able to follow our instructions" could not prove that they would effectively improve the quality of their products.

4. Ineffectiveness of the Skill Development Programs

Since the Economic Development Officers in the provincial offices of the MTI act as coordinators and do not have the skills or know-how to design and make new products by themselves, we have relied on external resources in providing trainings for local entrepreneurs in the province. Civil society organizations (CSOs) and consulting firms used to dispatch their staff as resource persons. The central government also believes that the development of CSI sector is crucial for the development of the local economy, and with the financial and expatriate support of donor agencies, different ministries planned different training programs and requested the EDOs to coordinate hosting the trainings. We have collaborated with the central government offices by calling for applicants and sometimes designating specific entrepreneurs as participants, based on the criteria set by the organizers. Thus we have provided a number of capacity building opportunities for local businesses in a wide variety of topics including quality control (QC), natural dyeing, and the production of specific products. Each time, the organizers awarded the participants with a completion certificate, and the organizer and each participant had their two-shot photo taken with a big smile on their face, not to mention the group photos of all the participants. Those snapshots were posted on the official sites on social media as a proof of their mastery of the skills they have acquired in the training.

I don't think the content of each training was that bad. But we might have provided

too many trainings without coordination. The participants did not have time to review what they learned and practice the new skills over and over again. In most cases, after one instructor left, the lessons learned were forgotten, and the participants went right back to the state they were in before the training. This happened again and again over the years.

I felt like I was hit by the reality I had never wanted to face for many years.

Since then, Yamaguchi repeatedly said to me, "I think it is too inefficient to give technical guidance directly to the target audience." There are many people who are out of work in the province. There are many people who really need empowerment. Among the workers who run small businesses in their villages, there are many who have experienced school dropout before they reach Class 10. They may not be able to get a job because they don't have enough basic education. He said, "If they have mastered basic education, if they can read, write, and do math, they have already found some kind of job opportunities here or have left their villages to get a job in the cities, haven't they?"

Around this time, Yamaguchi and I began to have discussions on how we could promote regional development in the province. In Chandrapur, the average education level of workers in the CSI sector is low, making it extremely difficult to improve their skills by providing too many capacity building programs. In addition, the logistical disadvantages of a landlocked country make it extremely difficult to add value to the products created in the province. How can these two obstacles be overcome? The targeted approach for skill development that relies on step-by-step capacity building programs may be the conventional approach for development projects. But we now knew it would take too much time before we would see a tangible impact from this approach.

We wondered if there was an alternative. Yamaguchi said, "How about providing innovator education to a small group of highly educated people and promoting industrial development by creating innovation?" Until that point, we had invested in 10 or more human resources. Sometimes we had to cover much wider audience in our targeted training programs. "If we concentrate our investment resources in the education of local innovators, and jointly explore new approaches to apply skills and know-how to all aspects of production from management to product development and then to all the production processes, could it be a better investment and more efficient development project that would benefit a wide range of the CSI sector in the whole province?"

"But how could we educate innovators? Is such an enabling environment available in Chandrapur?" I asked Yamaguchi suspiciously. I was not fully sure yet. He didn't seem to be confident enough, either.

5. Digital Fabrication Laboratory (FabLab)

It was a few weeks later that I heard about FabLab for the first time. In the tea break in the provincial administration office, our Planning Officer suddenly spoke about the one in Pavalpur. He told me that he had heard a new FabLab had recently opened in the town.

“What is FabLab?” I asked him. But Yamaguchi seemed to know it. He said he had heard about it when he was in Japan. “If there is a FabLab in our neighborhood, it would be a great opportunity for us,” he said.

FabLab is an abbreviation for digital fabrication laboratory. Since the first two FabLabs were opened in rural India and in Boston, the United States in 2003, the number of FabLabs in the world has doubled every 1.5 years. There are already more than 3,000 FabLabs worldwide, located in both developed and developing countries. The FabLab is a place where people can work on their individual projects. Whenever people come up with a new idea for something to make, they could quickly develop a prototype with the machines available there and see if it works. It is equipped with digital fabrication machines, such as a laser-cutter, 3-D printers, and CNC milling machines.

FabLab is not only about each individual facility, but also about a global network of people and labs involved in personal and social fabrication. Through mutual cooperation, peers within FabLabs teach and learn from each other, share open-source data, and create an environment for decentralized production and innovation eco-systems among citizens at the grassroots level in many parts of the world.

For example, in the FabLabs in Ghana and Kenya, the users invented food processors for processing local foods. In South Asia, a wooden long-distance WiFi router was prototyped to help bringing wireless Internet networks to remote areas. In rural India, a milk fat measuring device and a $100 weather data logger for agriculture were prototyped. This has proved that we could create innovation even in rural areas very remote from cities.

As we continued our research, Yamaguchi became more and more excited.

"For example, when we are making bags, if we can use a laser-cutter, we can cut out local fabrics based on the digital data. We can cut the cloths precisely and repeatedly replicate the cut-outs. With a laser-cutter, we could create holes for the needle in advance and hand-stitch even the hardest natural fibers exactly the way we want, without using a sewing machine,” he told me.

“But isn’t it difficult to prepare the design data for laser-cutting?”

“In most cases, the design data for beautiful, well-designed bags is already available on the Internet. All we have to do is find it. There is no need for workers

to learn how to use pattern papers and draw reference lines on the cloths for cutting out with the scissors. If someone can operate the digital fabrication equipment, they can mass-produce beautiful bags with a uniform shape. We could even develop special designs specific to our province and no other region could copy them."

"Does the FabLab in Pavalpur has enough knowledge to respond to all our inquiries? Do their staff have experience in making bags, for example?" I asked.

"If they don't understand how to make bags or how to customize them to be made from local materials, they can ask for help or advice from other FabLabs inside or outside our country," he said.

We further came to know that we could use a small CNC milling machine to cut local wood to make wooden accessories. We have abundant forest resources in our province and with the machines available in the FabLab Pavalpur, we could develop unique wooden accessories locally.

Apparently, it is not necessary to make the entire design from scratch, as the base design data could be obtained in the open-source data platform on the Internet or from 3-D data already shared in the FabLab network. If we could add Chandrapur's unique cultural flavor to the downloaded data as decoration, it is possible to create new locally-made accessories of the same quality as major accessories sold worldwide, produced only in Chandrapur.

I have found another potential of the FabLab for our province as I further proceeded in my own research. One of the major challenges for our small mountainous landlocked country is waste management. In the past, food waste used to make up the major volume of the total waste. It was bio-degradable and was not so much of a problem. But nowadays, plastic wastes, vinyl packages, plastic bags, and PET bottles comprise the bulk of the waste, especially in the town areas where we frequently see them thrown away on the roadside.

The central government frequently initiates nation-wide clean-up campaigns, and many citizens volunteer to participate in the clean-up activities only then, temporarily regaining the beautiful landscape of the towns. But soon the citizens again start throwing away their trash. The landfill site developed on the suburbs of Pavalpur is already full, and the municipal government office has reportedly been criticized by the town-dwellers for temporarily suspending the operations of waste collection trucks.

"If we could convert the plastic waste to a more processable state, and if we could be equipped with the machines in Chandrapur that could easily upcycle plastic waste into products, that could lead us to create new job opportunities," I shared with Yamaguchi.

Watching on YouTube, we could find that there were already a variety of ways to

reuse PET bottles, such as making filaments for 3-D printing, or converting bottle caps into plastic boards with an open-source heat pressing machine. We learned about a global network similar to that of FabLabs, called *Precious Plastics* and comprised of like-minded makers promoting plastic upcycling. They were selling not only the machines for plastic reprocessing, but also selling the design data of the machines to promote their decentralized production.

The more we researched, the more we were fascinated by the FabLab as an attractive option for industrial promotion. It was a matter of time that Yamaguchi and I decided to go to Pavalpur to visit the FabLab Pavalpur, which had opened just two months ago.

6. The Road to FabLab Pavalpur

The road to Pavalpur from the Chandrapur Provincial Administration Office was the North-South Primary National Highway. On the way, we had to pass dangerous areas where landslides frequently occur in the monsoon season and where air currents from the Great Plains of Country B collide with the cliff-like mountains, frequently causing heavy fog that would lead vehicles to go off the road and fall down in the cliffs. After passing the high-risk section, we started descending from an elevation of 2,300 meters above sea level. The climate was completely different in Pavalpur even though it belonged to the same province as Chandrapur. Even in the middle of winter, it was as sunny as spring down there.

The FabLab Pavalpur was located on the campus of the engineering college, just outside the main town area of Pavalpur. We arrived in the morning during classroom sessions at the college. We made an appointment in advance, but the manager of the FabLab, a teaching faculty of the Department of Electronics and Communication Engineering, was not available as she had been on duty in the classroom sessions in the morning.

Instead, we were received by Mr. Vikas Khatri, the Lab Technician of the Department of ECE. Mr. Vikas is in charge of advising FabLab users on a full-time basis. He was the only staff assigned primarily to the FabLab Pavalpur.

We learned from Vikas that this was the sixth FabLab in the country, inaugurated just recently with financial and technical support from JICA. Besides the standard set of digital fabrication machines such as 3-D printers, a laser-cutter and CNC milling machines, it’s equipped with conventional fabrication machines like a sewing machine, an inter-locking sewing machine, and a digital embroidery machine, as well as several woodworking machines and a stock of programmable microcontrollers. The total cost of the equipment was approximately $170,000, and JICA supported the initial investment, including equipment procurement and technical guidance, and human resources development of fab instructors.

“I was able to take the Fab Academy and successfully graduate from it, thanks to JICA's support," Vikas said.

Here Vikas was referring to the FabLab global network's own human resource development framework called "Fab Academy," a six-month intensive course of personal fabrication with modules based on one of the most popular programs of the Massachusetts Institute of Technology (MIT) in the United States, "How to Make (Almost) Anything." From January to July each year, participants from around the world participate in the online lecture sessions, work on weekly assignments, and receive evaluations from their peers. The Fab Academy takes a distributed approach, which means that the participants could work on their assignments and their individual projects at a FabLab nearby, which is appointed as a local country hub. It's a very intensive program and the participating students must spend 35 hours a week on average on their assignments. In this way, students gain hands-on experience in every aspect of making before their final projects are accepted and they become eligible to graduate. Fab Academy graduates are expected to serve as instructors in the FabLabs around the world, providing a variety of advice to the users there. When they are unable to give advice on their own, they can get advice from alumni they know through this global network of students.

"But the tuition fee is still too expensive. It's $5,000 per applicant and I couldn't afford it personally. Without the financial support from JICA, I couldn't have applied for it," Vikas added.

"When you took the Fab Academy program in our country, who provided the venue for your fabrication exercises?" we asked.

"The first FabLab in our country was launched five years ago in the capital. Due to the tuition fee and the difficulty of the curriculum, many decided not enroll while other dropped out even though they received scholarships. Until recently, we didn't have even a single Fab Academy graduate from our country. But the facility was already there."

Vikas told us that the first FabLab in the capitol provided its facility and extended logistics support to the Fab Academy, including the invitation of fab instructors from neighboring countries and procuring necessities for students to work on their assignments. He added that the cost of the logistics supports by the country node were financed by grants from the Fab Foundation. "The half of the tuition fee of $5,000 was channeled to the country node. But I suppose that $2,500 per student was not enough for the country node to cover the total expenses incurred to their logistics. We owe a lot to the FabLab in the capital."

"I'm getting a bit confused. Do we all have to take the Fab Academy course as pre-requisite to be a user?" Yamaguchi asked.

"No. Unless you want to be the instructor of the FabLab, you don't have to have comprehensive knowledge and hands-on skills," Vikas answered. Yamaguchi looked relieved.

In addition, since the FabLab is a network, we learned that the FabLab Pavalpur sometimes collaborates with other FabLabs to make prototypes for items that cannot be made with the equipment available at FabLab Pavalpur alone. For example, it does not have metalworking facilities or high-precision 3-D printers, but the "Super Fab Lab" in the capital city has these high-end precision machines. Therefore, Vikas refers his users to the Super Fab Lab if necessary.

“On the other hand, we are affiliated with an engineering college, so we are strong in electronic circuit work. And since we also have a civil engineering department and an IT department, we will have a capacity to research and develop customized drones for specific purposes, such as infrastructure monitoring and crop disease and pest monitoring, in the future.”

Though an hour had passed since we arrived at the FabLab Pavalpur and started discussions with Vikas, I hadn’t seen a single person come to the Lab as of 11 a.m.

Just for curiosity, I asked about the profile of the users coming to the Lab. Vikas smiled wryly.

“Our students and teaching faculty rarely come because they have classes and practical sessions until 4 p.m. If you want to see how the FabLab Pavalpur is being used, I suggest you come again after 4 p.m. It is used for course assignments from each department, and for prototyping works to be exhibited at various makers competitions held on campus. Some students come to make personal gifts for friends and family.”

“So, if it’s before 4 p.m., the facility can be used by the community users coming from outside the College?”

“We emphasize interactions among users with different backgrounds. So, it is fine if you come after 4 p.m. I think it will be a great opportunity for our students to interact with people from the outside community. You can also get advice from the students.”

According to Vikas, after the launch of the FabLab Pavalpur, the FabLab management team initially tried to promote the use of the Lab by hosting orientations and machine familiarization workshops mainly targeting students and faculty members. But they soon found out that their initial efforts resulted in users coming after 4 p.m. “So, we are now working to make our Lab better-known in our community, by approaching neighboring primary and secondary schools, nursing schools, and business communities in Pavalpur.” They are also thinking of involving more lab technicians, who are not teaching class sessions in the morning, creating more synergies inside the college campus between different labs and FabLab Pavalpur.

“So, that means local businesses within the province can come and use the

facility for their own purposes?" Yamaguchi and I looked at each other and were excited.

"Of course. They are welcomed," said Vikas. "However, material usage fees should be borne by the users. For the materials that need to be imported from abroad, such as 3-D printer filaments, users could use our materials in stock. But they are not for free. It is advisable that users should choose and bring the materials they want."

7. How to Overcome the Physical Proximity Issue

I understood that the basic principle among the FabLab users is "Do It Yourself (DIY)". But it would be difficult for local businesses in remote areas to come all the way to Pavalpur. Therefore, I asked another question, "Is it possible for your Lab to undertake the production here based on orders from local businesses?"

Vikas kept silent for a while, and then answered cautiously.

"Our principle is DIY. The original idea of the FabLab is to facilitate the process of users bringing their ideas to take shape immediately after they come up with their ideas. However, if local businesses are willing to pay reasonable fees for designing and consultation, occupying the machines and the staff labor costs for our staff, there is no reason why we can't undertake contract production."

We were relieved. But Vikas quickly added, "But contract production sounds like it's departing from innovator education and an innovation environment you two have initially explained to me? Besides, we can't take the risk that our clients will say at a later stage, 'This is not what I had in my mind,' and unilaterally cancel their order. The client and our designers must go through the co-design process here in the lab. If that is the case, wouldn't it be better for the client to experience the entire process, from design to prototyping, on their own?"

Indeed, he was right. Many local business proprietors in the province do not have personal computers at home. At best, they use their mobile phones to connect to the Internet and search for existing design data. If they were to download the data and remix the design, they would need to try it themselves, while learning how to operate the program from someone who knows how to operate it.

"Once you create the design data, we will save it so you can duplicate it anytime as many times as you want, and if you don't like it, you can have it re-designed here," Vikas added.

On that day, I drove my private car out to Pavalpur. If we had taken a taxi, it would have cost us $16 for a one-way trip. The national income per capita of this country is $3,000, or $250 per month. The per capita income in Chandrapur is lower than this, about $180 per month. In this context, a round-trip of $32 is still a large financial burden for most of the local businesses.

The FabLab is about three kilometers from downtown Pavalpur, and a taxi ride costs $2.50 each way. Even this fare is still too expensive for some citizens. Vikas admitted that even local primary and secondary school students were not able to come to the FabLab Pavalpur on their own.

This challenge aside, after the short introduction to the equipment installed in the FabLab facility, we learned that some of the equipment could immediately contribute to improving the quality of the products handled by major businesses in the province.

One such machine was a laser-cutter that could be used to create a luxurious look on the plywood containers in which the local mushroom producers could place a bottle of mushrooms for sale. Although the design of the walls of the container would need to be thought out, I was told that there is a web-based program that can easily create the size of the box and outlines for cutting out the wall assembly components.

The second machine is a digital embroidery machine. There are about 20 local tailors in the province, but many of them work only with a sewing machine. If embroidery could be done based on texts or illustrations, it might be possible to add value not only to the sewing of clothing but also to the handicrafts being sold here. When we talked to a young female entrepreneur who runs a stitching house in the town of Chandrapur about FabLab Pavalpur, she showed a keen interest in the digital embroidery machine. She said, "I would like to go and see what kind of machine it is."

Yamaguchi said he had seen some of the machines before in the FabLabs in Japan. “If we had something like this nearby, the level of product development would definitely be improved considerably," he said happily. He said he had done his own research on the internet, including watching YouTube videos, and had thought that this could have potential. But after seeing the machines in action, I wanted to somehow connect this enabling environment for local innovation in our neighborhood to the economic development of the province.

But the digital fabrication equipment in the FabLab is computer-controlled, so it requires previous computer knowledge and operating skills. In addition to the accessibility issue, there is also a concern that there are very few local business houses that might be able to utilize the FabLab locally.

Vikas said, "The latest digital fabrication equipment is very easy to operate, so it is not that difficult to learn.” He also emphasized that the FabLab network is full of friendly and cooperative members from whom he is always ready to take advice. “Besides the northern part of Chandrapur is rather close to the metropolitan area, so you can even use the FabLabs in the capital.”

But I am still worried. How can we provide the environment for local innovation in the province? How can we overcome transportation barriers and determine how

and through whom to provide innovation education? There are still many unknowns.

[END]

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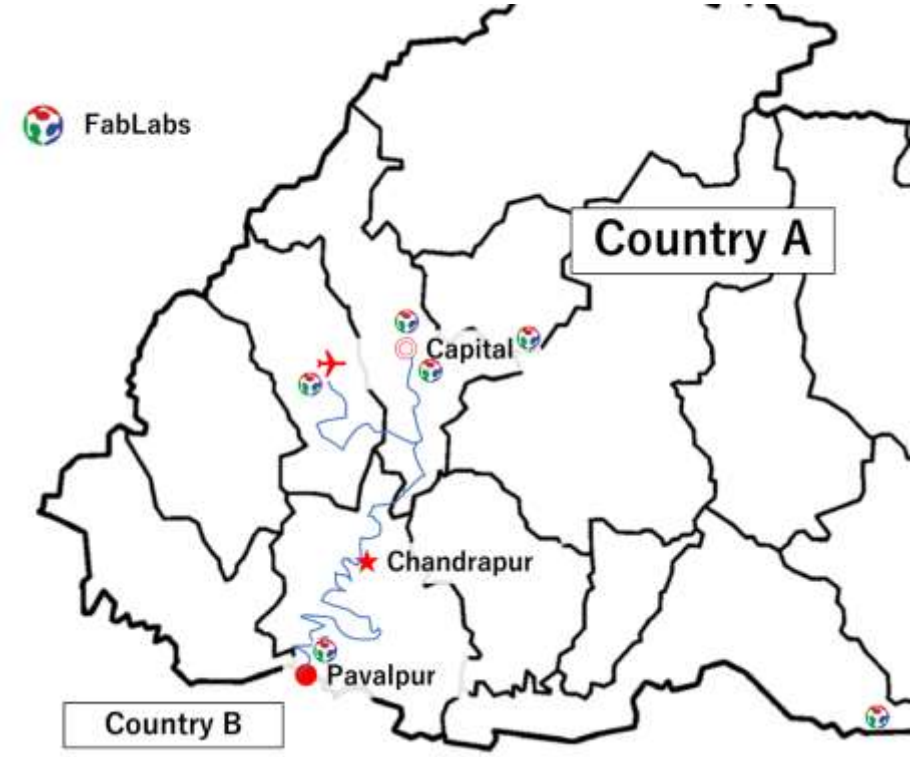
Attachments

1. Map of the Country A
2. Photo Image of the FabLab

1. Map of the Country A



2. Photo Image of the FabLab

[Source] FabLab Asia Network http://fablabasia.net/what-is-fablab/

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