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A FabLab for development in rural Philippines: Reflecting on the recipe for success for a community technology center.

Tomoaki Watanabe¹ and Yutaka Tokushima²

ABSTRACT

This paper reports a participatory case study of a locally based digital technology center, a FabLab in Bohol, Philippines. A FabLab offers a range of digital fabrication technologies to the local public, which potentially can be used for creating tools for work, prototyping and manufacturing products for sale, and a wide range of other purposes. The technologies typically include 3D printer, laser cutter, CNC milling machine, and others. A FabLab abide by its Charter, including the principle of openness to the public at least some of its operating hours.

One of the authors were involved in the launch of the place, and the process of help locals to take advantage of the technological capacities for improving their living conditions. The paper argues that keys to the success are not simply technological capabilities. The facility needs active users who are willing to connect technological capabilities, locally available skills and resources, and market opportunities or local problems causing less-than desirable living conditions. The chance of such matching to occur is not necessarily high for localities in general. In Bohol, it was not a process that happens easily. There were a group of people interested in improving quality of local life and local economy who actively explored matching possibilities to arrive at some working combinations. In addition, it is pointed out that the existence of inter-local connections, specifically the organizational proximity with another FabLab located in Indonesia served as a crucial catalyst for bringing about the development of local craft product.

In a more abstract terms, the case in authors' view points to the possibility that successful ICT-enabled development occur not just because of technological capabilities, but because of active body taking charge of matching process and inter-local network serving to complement otherwise scarce human resources and skills and ideas embedded in them.

In order to connect this case more with existing body of scholarship on ICTs for development, this paper compares the nature of FabLab with telecenters, more

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prevalent form of locally based community technology centers. Limitations of telecenters in terms of contributing to development seem to exist with two types of passivity. First, the users may remain passive users of information services provided online. Second, the facility may be a passive provider of capabilities waiting for users. This is close to a local library open to the general public, although telecenters are not bound to be a passive institution. FabLab Bohol seems to be active in the sense that users are not just consumers of service, but creators of things that they use or sell. It is also active in that the core members running the Lab are active match-makers.

Introduction: FabLab as a local technology center

This paper reports a participatory case study of a locally based digital technology center, a FabLab in Bohol, Philippines. The term FabLab means both a space, an organization, and a network. As a space, it hosts a range of digital fabrication technologies. The technologies typically include 3D printer, laser cutter, CNC milling machine, laser cutter, and others. Fab Foundation (undated a) keeps an inventory of recommended machines and tools. While 3D printer is nowadays the best-known digital fabrication technology, it has not always been with a FabLab. The space is at least partly open to the local public, allowing hobbyist as well as business use of the facilities (Fab Foundation, undated b). What is important from this paper's perspective is that commercial use of the lab facilities by a visitor is explicitly allowed. A visitor may create tools for his work, prototyping and manufacturing products for sale, and engage in other commercial use of the lab.

As an organization, FabLab is an entity that adopts The Fab Charter (Fab Foundation, undated c), a set of principles the entity and users of the lab should follow. The principle of openness to the public is stipulated here.

Public attention to FabLab has significantly increased as the 3D printer gains attention, along with the broader “maker” movement, the activities of those who are interested in producing things by themselves. The earliest FabLabs include those in South Boston area, Vigyan Ashram in India, and Costa Rica. From its earliest stage, FabLabs have been close to the developmental concerns.

In a more abstract sense, FabLab is one form of locally-based technology center, and many of telecom policy researchers are familiar with another form of such facilities: telecenter. Common to both, and many other forms of local technology centers is the idea of empowering locals by providing access to important technologies that may not be affordable for them as individuals. Typical goals of such facilities are to generate economic benefits, either for poverty reduction or local economic development, empower disadvantaged individuals and communities, and provide learning opportunities of various kinds. While there are some such facilities used to support telework (Falch and Anyimadu, 2003), this paper focuses on the context of developing countries and otherwise disadvantageous settings.

Gollakota et al. (2012) lists three types of beneficial information for farmers such as production quality, market related information, and others, that telecenters could provide. Use of these pieces of information, one can see, would help farmers to become more productive. Ngowi et al. (2015) reports similar findings for agro-pastoral population in Tanzania.

Dorwick (2007) reports learning activities for local children in an “at-risk communities” provided in part through community technology centers. Kreps (2007) reports effectiveness of cancer education to low literacy people, and community technology centers were found to be an effective channel for their specific program. (See also, Salovey, et al., 2009, for providing cancer and computer literacy education for children of racial minority groups; Engel-Cox, 2008 and Baur, 2008, for recognition of role of community technology centers). Aitkin (2002) reports empowerment of women in remote mountain areas via the Internet and other ICTs. Servon and Nelson (2001) identified access, literacy, and content (including content creation and publication) to be the major functions community technology centers serve. Telecenters are probably the best-known term for now, but there is a wide variety of terms and financial and organizational arrangements. Some of these differences may affect effectiveness (see Windsor and Royal, 2014; Medina et al., 2006; Falch and Anyimadu, 2003; Gomez et

al., 2009; Islam and Hasan, 2009).

Although some of the above-cited literature report specific benefits among the users of telecenters or participants of programs at telecenters, overall economic benefits seem to be rather limited. Mercer (2006) points out that the expectation for economic benefits from the Internet use, seen in the dominant discourse surrounding the Internet in international aid communities and other related sectors do not match with the actual use (leisure and recreational), and the implicit assumption that poverty could be solved by technology is misguided. Molony (2006) provides a critical view on such discourse. Telecenters are not necessarily frequently used, or effective in alleviating poverty (D. N., 2001; Gollakota et al., 2012). Targeted users may not have preexisting inclination to make use of technologies or necessary skills to make the use effective and comfortable (Medina et al., 2006; Nora et al., 2011). This state of affairs alone is not to be equated with the failure of the idea of telecenters for development. It may be that the models for success are not sufficiently articulated or shared, leaving only a small portion of the facilities to meet expectations. It may also be due to the difficulty of measurement and attribution as suggested by Sey and Fellows (2009). However, the fact remains that telecenters, after all, are not that easy to be effective, and the effects are not clearly large. This is disappointing enough for some considering that telecenter was “hailed as one of

the most promising solutions to development problems around the world.” (Breitenbach, 2013) It is in this context that this paper brings FabLab into the picture.

FabLab offers a somewhat different design and set-up for local technology centers as explained below. After seeing more than two decades of telecenter projects and research, it is too naïve to expect that large economic benefits come easily from many FabLabs. However, there are some reasons to think that technology centers with focuses like FabLab’s could be more effective in generating economic benefits. This may lead to reexamination of implicit assumptions underlying the traditional model of such centers such as telecenters. In the following, this paper shows a relatively successful case of FabLab in rural Philippines (section 2), and points to key ingredients for its performance (section3). It moves on to highlight some contrasts between FabLab and more conventional telecenters to reconsider the design and set-up of local technology centers (section 4). The paper closes by recapping main findings and stating major agendas for further research.

2. A participatory case of FabLab in Bohol

One of the authors were involved in the launch of FabLab, very first one in the Philippines, and the process of helping locals to take advantage of the technological

capacities for improving their living conditions. It is by any means too early to declare a success, but it made a good start with promising indications. The process provides some lessons in authors' view. We first report the local context, FabLab's significance in the context as perceived by one of the authors, acceptance of the idea by locals, and the project's outcome so far (see also, Tokushima, 2015, for a much detailed auto-ethnographic account on the same set of matters). Lessons are drawn in the next section.

2.1. Local Contexts

The FabLab is created in Bohol. The island of Bohol is not geographically advantaged for manufacturing and other associated industries. Philippines' major population centers such as Manila and Cebu are on different islands. Indeed, many of the materials (and possibly products) have to go through Cebu, located west of the island, before reaching to Bohol. That alone would make it difficult to be price competitive against Cebu, the second largest city in the Philippines and well-known tourist site. It takes 2 hours by high-speed boat to go over the strait. The State of Bohol bears a small capital city, with population of about .1 million, and total state population is about 30% larger, living surrounding areas, including dozens of surrounding islands.

In relation to Japan, Bohol was one of the fiercest battle fields in the World War II, which was among the reasons for the author to go volunteer there.

He founded FabLab Bohol during its stay as a Japan Overseas Cooperation Volunteer (JOCV) between Aug., 2012 and Dec., 2014. He had experience in design of physical products and digital/ electronic hardware. His host was State Office of Department of Trade and Industry, a department in charge of a range of economic development and competition issues. Within the Department, he belonged to the team responsible for business development, and one of the major targets were Middle-, Small- and Micro-Sized Enterprises (MSMEs). His primary responsibility as the volunteer was to provide designs to MSMEs the local DTI office supports.

DTI's support for local MSMEs in Bohol was not particularly successful. One reason seemed the inherent cost structure issue mentioned above. Another had to do with the shortage of passionate, growth-oriented businesses. In order to overcome the cost disadvantage, quality is an obvious key. However, the author observed that even the recipients of the DTI support, which are relatively eager to learn and grow, remained rather under-disciplined in their quality control exercises. In fact, among the 10 such businesses, only one had any protocol, and the one was paper on the wall with hand writing saying something to the effect of knit properly, and if you fail, reject it, with

about 10 bullet points. The quality of labor was not outstanding, either. Through the visits to these businesses and interactions with workers, the author found out that some are not familiar with measurement unit of lengths, or how to properly use basic tools such as rulers or scissors. The end products apparently had varying qualities and inconsistent sizes. The author eventually sensed that well-educated people often went out of the Bohol island to Cebu or elsewhere for better employment opportunities, and those locals who could take work demanding patience people were often involved in farming. It is perhaps not surprising given these that souvenir shops for divers in Bohol carried predominantly Cebu-produced crafts, only leaving 10-20% for Bohol-produced ones. The author also found out that years of support and technical trainings provided for how to produce better products were not followed by the recipients. It seemed that simply fulfilling his mission would end up in oblivion after a few years.

2.2. FabLab's significance

In place of conventional technical assistance and training, the author came up with the idea of setting up a FabLab. To be clear, FabLab not something the author was closely involved prior to this point, though its basic equipments were familiar due to past work experiences.

The locality was facing two challenges as the author understood – cost-disadvantage and lack of talent. The former could be tackled two ways by the introduction of FabLab, he thought. The latter would be also addressed at least in part. First, the issue of cost disadvantage would be tackled by making use of locally available materials, such as buri (somewhat sturdy plant pulp) and by recycling discarded plastic wastes. With some knowledge of material processing techniques, it would be possible to conceive ways to create things from those materials that do not cost as much as imported materials. Second, using somewhat better design elements would be possible first by introducing the division of labor. The workers at the local businesses had not been eager to learn, retain, or improve upon the techniques that gave their products consistencies and better quality. For example, they had not been interested in using pattern (template) for cutting out the materials for sewing. Using laser cutter at FabLab, this kind of task could be performed by machine and an operator. The design choices would become wider as a result. Design, often taking the form of digital data, could even be obtained elsewhere over the Internet, because there were web sites providing just such data and instructions. Establishing a FabLab, as opposed to some other similar spaces such as TechShop or HackerSpace meant that the Lab operators would enter into a circle of global community interested in “*Make. Learn. Share.*” – the lab operators

would be able to learn from others in the global FabLab network who would be willing to share. Third, the shortage of talent could be addressed through the same division of labor – now the craft workers would not necessarily be pushed to learn and follow “better” ways presented from outsiders requiring changes in their attitudes and practices. Rather, materials would be pre-processed at the FabLab so that the workers could easily handle and create better quality products.

2.3. Process of Acceptance

Above reasoning for introducing FabLab to Bohol was not immediately or easily accepted. The DTI local office staffs were occupied with existing projects, often ones with much higher profile. The author was a new volunteer. However, the author sensed the buy-in from the closest staffs when presenting one idea: melting the plastic wastes littered throughout the island to create strings, and use them for some craft products. The plastic wastes were not collected in Bohol due to the lack of recycling facilities. Business possibility using plastic wastes as material meant such collection could happen, like it had been with steel, which would contribute to the landscape. The support from the staff members might be related to DTI’s earlier support for local weavers investing in better machinery. Competition with neighboring Cebu had still

been a concern afterwards, it seemed. In any case, these DTI staff members became important proponents of FabLabs in multiple occasions, from securing funding to set up the FabLab, to helping local entrepreneurs to get government grant for expanding his business.

FabLab's acceptance faced another major challenge when securing the manager, a professor at Bohol Island State University. He had expertise in industrial design, but not experienced with computer-controlled fabrication machines. What took him to turn his mind was not the author's explanation that familiarity with computer-assisted design tools is critical, but operating the machines are relatively easy. Such attempt failed more than once, but when he, and two other people visited FabLab Japan to get hands-on training, he thought the lab manager post would be something he could handle.

It is noteworthy that thanks to these and other people believing in the potential of FabLab, the lab is funded mainly by local money, and run by locals, with the sense of ownership.

2.4. Achievements

The official launch of FabLab Bohol was May 2015, which is less than two years ago from the point of writing this paper. As such, it is still not easy to tell if the

project is a clear success. The authors are about to engage in an assessment of the current state of affairs of FabLab Bohol soon. However, what we know so far indicates that it has a good start with achievements at various stages of its maturity.

Many ideas and prototypes were conceived and developed. This was partly thanks to the FabLab Asia Network's first international conference, *FAN1*, held at Bohol, coinciding with FabLab Bohol's inauguration. The event received wide range of participants, including members of FabLab community in Asia, such as Taiwan, Japan, Korea, and beyond, such as Israel, some people from related industries, and local stakeholders. Part of FAN1 was a competition, which received 16 entries. Outside of the competition, some locals interacted with foreign participants with more experience with digital fabrication technologies, and discussed prototypes. Hands-on workshops on various technologies were held as well.

Some of the ideas became implemented. One was a low-cost public building using traditional Japanese technique of fixing wood materials to each other. The building later received attention of the State government, and was eventually built with the government's cooperation. Another was chairs using fibers from typhoon-hit, fallen banana trees. Mayor of Tagbilaran City, the capital of State of Bohol, and some of the city government officials present in the FAN1 conference liked it so much that they

supported the creation of business out of that idea. This idea was combined with the recycling of plastic-waste, and it is an ongoing project with the city planning a small-scale recycling facilities at 15 different sites where plastic and banana fiber would be produced as materials useful for production.

Other ideas leading to implementation came from designers DTI local office hired to exploit FabLab's potential. They included craft works, package design for food products, and mold for soap manufacturers. Designers were both locals, hired out of local schools.

Yet another example was from a participant of FAN1, a local student at BISU. He created coin cases using a laser cutter at FabLab. The material was coconut skin, which would otherwise be discarded. One of the local DTI staff members, who was the earliest supporters of the introduction of FabLab, took notice of the product. The staff member introduced it to the local city government, which in turn decided to support the production with a budget to help reduce the poverty. The way the student conducted business was to give her design to help disaster victims' economic recovery. Upon the city's support, other workers were also involved into the production. The product is in the market, making revenue, which goes to the workers.

Still another was a local business owner who attended a workshop on Arduino,

a small multipurpose electronic device controllable with a computer program. He developed a prototype using Arduino for controlling lights in houses. The prototyping was successful enough so that it is now in the process of mass production. The business owner was also interested in reselling Raspberry Pi. Raspberry Pi was a small (credit card-sized) computer composed of CPU, RAM, GPU, and others, all on one board, for the price of 20 – 40 US dollars.

These examples do not guarantee that these ideas will keep being generated, implemented, and resulting products improve the lives of locals either as consumers/users or businesses involved in the production side. The initial enthusiasm will inevitably wane, and an event like FAN1 does not happen so frequently. However, the involvement of multiple stakeholders, including public officials, students, the university, and others makes this project somewhat hopeful.

After all, keys to the success are not simply technological capabilities. The facility needs active users who are willing to connect technological capabilities, locally available skills and resources, and market opportunities or local problems causing less-than desirable living conditions. The chance of such matching to occur is not necessarily high for localities in general. In Bohol, it was not a process that happens easily. There were a group of people, it seemed, interested in making use of the potential

by connecting with business opportunities or other local needs. It is also apparent that without people with passion and sense of ownership, it is very easy that many pre-conceived scenarios and plans will stall. Challenges are not simply with the matching of technological potentials and business opportunities or local needs, but include others along the way, such as family emergency happening to a close ally, shortage of proper materials, lack of initial funding, etc. At least at this point, it seems that no simple recipe exist to expect and address all of these potential problems than having some quality people tackling the issue.

3. Success factors: Readiness, people, and proximity.

This paper is not to suggest that FabLabs are easy to be successful. The case of Bohol suggests that it is not easy to gather support and start one. To the authors' knowledge, recipe for success is still being explored. There have been about a decade of history of the movement, and no simple formula emerged. Financial stability or sustainability of a lab is a concern held by many lab operators in many parts of the world. On these aspects, telecenters and FabLabs are different only in degree, with FabLabs having shorter history and only several hundred cases worldwide. In light of this, this paper offers three explanations to account for what makes successful: one has

to do with readiness, another with *active body*, who takes charge of matters, and proximity.

3.1. Readiness

In general, it is not a surprise that social change with technology adaption frequently faces the problem of properly identifying conditions for success, either for developmental goals (as in the case of FabLab Bohol), or of other kinds. There may be people who are in the situation that the only obstacle for betterment of their lives or businesses is access to certain technologies. They may possibly see the benefit of technologies very quickly, and their adaption is more likely to lead to some success. Not every context is as ready as this, of course, for any potentially beneficial set of ICTs. In order to realize technological potential, there may be other conditions to be met. Not just technology alone, but skills, localization, change in business practices, public attention and involvement, financial support beyond initial launch, regulatory reform, or some other things. Many would agree that not everyone is ready to take advantage of potential offered by a given set of technologies.

Given this differing degree of readiness, some technology adaption cases are likely to fail. Yet knowing that some contexts are readier than others, it is still very

difficult to know which of the cases needs just some small interventions to a successful adaption. The difficulty is attributable for at least two factors. First is a cognitive factor of sort. There is inherent difficulty in discerning if particular adaption is likely to succeed. Contexts in which adaption happens are diverse and complex. One cannot readily identify all the relevant factors affecting likely outcome of the adaption. Over time, we can perhaps hope to have some heuristics or cognitive short-cuts which identify a limited set of factors to be particularly noteworthy. Second, there is social factor. Not everyone is interested in the rigorous assessment of the likely outcome of an adaption. There may be a hype surrounding technologies, leading to premature adaption, for example. Some people and organizations are interested in promoting such hype and adaption. Complicating the matter is the interaction between the cognitive and social factors. “Hype” in some cases works as self-fulfilling prophecy. That is, amount of people’s expectation may positively shape the outcome, by leading stakeholders to invest more into the opportunity and solving associated problem more eagerly. When there are successful cases, there may be positive network effects, such as formation of support and expert communities, supply of associated services, and so on. In Bohol’s case, the initial condition was not ripe. People’s understanding of relevant technologies were missing, acceptance took time and effort, as described in the previous section.

3.2. Active Body

Facing the inherent difficulty of knowing how easy a success for FabLab is in a given locality, and inherent complexity of the matter, it is reasonable that people become the key success factor. There may be so many unexpected problems in the course of adaption. The same can be said of unexpected opportunities. At least for the time being, it is therefore reasonable that we expect people's capability to solve the problems and seize the opportunities, rather than relying on prescribed strategies or plans. These people usually need to be passionate, or strongly interested in the success. Experience, skill, recourses are all important, but may not be sufficient for difficult and complex cases. Following Sasano (2014), we call this group of people an *active body*. He argues, from a perspective of industry cluster researcher, that localities successful at creating innovative environment sees local group of individuals and organizations voluntarily acting on behalf of the area, constantly exploring the next moves, trying to involve other individuals and organizations across different sectors. Their activities lead to local cooperation, which in turn results in innovation and business creation. There has been the idea of *champion* being crucial for the success (e.g. Colle, 2005). The major difference with that and active body is that the former tends to highlight one individual,

while the latter assumes a group. In case of FabLab Bohol, it was DTI's local officials, along with some other local stakeholders who took the ownership of the project. It is probably fair to say that one of the authors is among them. They often go above and beyond what is required of them, investing their own money and time to make FabLab project successful.

This is not to say that motivated quality people solve everything. Our argument rather is that faced with uncertainty, while general conditions seem sufficiently good to provide reasonable possibility for success, active body are most versatile resource and force to generate the desired effects and outcomes.

3.3. Proximity

Proximity is a very important factor in relation to the role people play in shaping the success/ failure of a local technology center. People are more flexible than pre-designed scenarios or plans, but they also have limitations, biases, and constraints. It is helpful that members of active body, as well as others involved, can learn from outside of their localities in order to explore options to solve the challenges they face locally. FabLab being a network-oriented entity, indeed helped resource constrained people at Bohol in multiple ways. To cite another example, other than those explained

already, Hon FabLab in Indonesia helped accelerate the preparation stage of the FabLab Bohol, by hosting some visitors from Bohol, suggesting to form brotherhood relationship between the two labs, promising help, and giving confidence to key people in Bohol that they can turn for help for things like operating machines or short supply of some materials.

Proximity in this sense is not to be equated with being located in urban centers. It should be understood, as Torre and Gilly (2000) suggests, that organizational proximity also works to foster learning and innovation. Torre (2008) also points out that proximity could be temporary, which seems to resonate well with the fact that FAN1 conference established interactions among otherwise distant people, leading to new ideas, improvements, and seeds of future collaborations.

4. Implications to telecenters and other local technology centers

What authors argued in the previous section are intended to be generic, as opposed to specific to FabLabs. It is so that other cases of local technology centers or even other technology adaptations for social change may be understood in the same framework of readiness, people making up an active body, and proximity for learning. There is probably some other shared challenges, too. It is recognized in the digital

divide literature that providing access to technologies does not necessarily close the social gaps because of the perceptual, attitudinal, behavioral, and/ or cultural differences in technology use and its benefits. (Warschauer et al., 2010 on educational achievement gaps, for example.) This probably applies well to the FabLab's attempt to empower disadvantaged communities.

Other than these commonalities, it seems possible to draw some more implications, from a somewhat fresh perspective FabLab offers to local technology centers. When compared to FabLabs, limitations of telecenters in terms of contributing to development seem to exist with two types of passivity. First, the users may remain passive users of information services provided online. One may point out that using the Internet is much more active experience than watching TV or consuming other mass media. It is also true that passive receipt of information matters in achieving some of the developmental goals, as shown in telecenter literature on the provision of health and agricultural information. However, FabLab is much more conscious of its character as a place people can use to generate businesses. While focused with small firms Japan has many local technology centers providing access to facilities (e.g. Fukugawa, 2009). Telecenters could be designed for business users as well, such as those who would like to engage in online transactions.

Second, the facility may be a passive provider of capabilities waiting for users. This is close to a local library open to the general public. It is important for such institutions to exist to ensure access to a wide range of information, without intervening their learning activities. Yet more active operation is possible, too. FabLab Bohol is active in this sense – the core members running the Lab are active match-makers trying to involve local businesses to make use of their facilities. The distinction between providers and users is less clear. This idea of activeness is not completely foreign to telecenter literature. Badsar et al. (2011) suggests that the availability of locally relevant content is the most influential factor on various outcomes of telecenters, such as economic gains (Similar arguments could be found in many qualitative studies, such as Medina et al., 2006). Content and program development is more active part of telecenters than providing access. FabLab operators go one step further at times, by organizing stakeholders to help start a business, for example. Even that idea is not totally foreign to telecenter, either.

5. Conclusion

This paper reported a case of FabLab, a place providing public access to digital fabrication technologies, established in Bohol, Philippines. Like other local technology

centers such as telecenters, contributing to development through FabLab is not guaranteed to be easy. The author argued that case of FabLab Bohol suggests active body (Sasano, 2014) of people working to realize the technological potential to contribute to the goals is important. This is because launching and operating of a FabLab is complex that passionate quality people, who can go beyond prescribed scenarios or plans, play a great role in seizing unexpected opportunities and solving unexpected problems. Empowering them by connecting with other FabLab operators, users, and stakeholders was found to be effective, resonating with notions of organizational and temporal proximity (Torre and Gilly, 2000; Torre 2008).

FabLab Bohol, and other FabLabs in general suggests that local technology centers can be more proactive in generating local business and economic benefits or addressing social needs.

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