Making the FAB LAB Fabulous: A Project Scope Management Challenge

"There has to be a point of convergence, or if not a point of compromise."

Her tea was about to get cold. Dr. Jinky B. Bornales, ViceChancellor for Research and Extension, sat in the Chancellor's Boardroom, which was beginning to transition from a lively place of negotiation talks to a solemn and peaceful chamber where Dr. Bornales could reflect on what had just transpired 30 minutes ago. It was September 10, 2015, and her university, the Mindanao State University-Iligan Institute of Technology (MSU-IIT), had just sealed a deal of partnership with the Department of Trade and Industry (DTI) for the establishment of a FAB LAB inside the MSU-IIT.

As she sipped the lukewarm Belgian tea that she gotten from her previous research trip, Bornales reviewed the signed memorandum of agreement (MOA). She could not deny the uneasy feeling of discomfort that a new research unit – one which she would have to manage had -- just been added to her office.

Having earned a Doctor of Philosophy in Physics, for years past she had administered numerous internationally funded and coordinated researches focused on polymers, and she had even been nominated as an International Consultant for a research project in Polymer Science sponsored by the FCT, an agency of the Portuguese government. Although she was considered as one of the very few expert physicists in the Philippines to study on Brownian motion, her expertise in studying random phenomena had not prepared her to face this new professional challenge: to be not only a researcher but also an academic administrator.

Bornales had long dealt with fabrication in her previous research, which had dealt with developing prototypes for instrumentation. That experience was is why, when the DTI Provincial Director suggested

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the idea of creating a FAB LAB inside MSU IIT, she was very excited and eager to coordinate the FAB LAB with the Institute's researchers in engineering and sciences. Being the Institute's Vice Chancellor for research and extension, she saw that this opportunity could not have come at a more perfect time, because the Institute was all set for attaining research university status. Now, instead of fabricating devices outside the country, MSU-IIT would now have an in house unit to create innovative prototypes for the Institute's undergraduate, graduate and post graduate researches. That had been the plan. But then, two months before the MOA had been signed, her solid plan had been disrupted when the administrators of MSU-IIT, along with the regional officers of DTI, went to benchmark the FAB LAB Bohol, the country's first fabrication laboratory. During the morning tour in the Lab, the officers from FAB LAB Bohol emphasized the reason why FAB LAB Foundation initiated the FAB LAB Movement: FAB LABS were to democratize access to tools and machines for personal expression and invention, not just to students but also more broadly to local businesses.

Specifically, while having lunch during that visit to the FAB LAB Bohol, the DTI Provincial Director of Lanao del Norte expressed his excitement over the idea of having a FAB LAB in his territory, because the micro-, small- and medium-sized enterprises (MSME) of the province were in dire need of designs and prototypes for their innovations. Bornales was taken aback by the director's words. She had planned to integrate the lab with the research units of the Institute, not with local businesses. She pushed her concern away, but at the end of the day her concern arose with even more force because her fellow Institute administrators -- the Chancellor and the Vice Chancellor for academic affairs -- all expressed their plans to incorporate the FAB LAB not just in the research units but among the academic programs of the Institute.

Her state of unrest remained with her from FAB LAB Bohol right to the Chancellor's boardroom, where she is left all alone to go over the rights, duties and responsibilities of both parties. Although the MOA was just between MSU-IIT and DTI, the FAB LAB Foundation was the third party whose purpose for the FAB LAB also needed to be satisfied. In the coming days, Bornales would need to craft a project scope that would incorporate the intents of all three entities inside the Institute's FAB LAB.

"There has to be a point of convergence, or, if not, a point of compromise," she said to herself. So she got up from the chair in the boardroom where she had been sitting, left her already cold tea, and, with the MOA in hand, proceeded to her office where she hoped to tap the right individuals before they became busy for this year's Diyandi.[i]

Fabrication Unit of a Research University

The Mindanao State University-Iligan Institute of Technology was one of the nine campuses of the Mindanao State University System, a chain of government-owned higher education institutions spread across Mindanao.[ii] Founded in 1968, MSU-IIT had established its brand as the leading institution in Southern Philippines because of its excellence in science and technology and its passion for extensive research and community involvement. As shown in **Table 1**, in 2015 and 2016, the Philippine Commission of Higher Education (CHED) awarded MSU-IIT its highest academic awards with five CHED Centers of Excellence and twelve CHED Centers of Development.

[i] Diyandi is the cultural and religious festival of Iligan City celebrated every September 29

[ii] Mindanao: Mindanao is the second largest and southernmost major island in the Philippines

Table 1
Institutional awards given to MSU-IIT by the Philippine Commission of Higher Education

Centers of Excellence (5)	Mechanical Engineering, Electronics Engineering, Physics, Biology, Chemistry, Mathematics, and Teacher Education
Centers of Development (12)	Civil Engineering, Chemical Engineering, Electrical Engineering, Metallurgical Engineering, Ceramics Engineering, Information Technology, Statistics, Marine Sciences, History, Sociology and Filipino

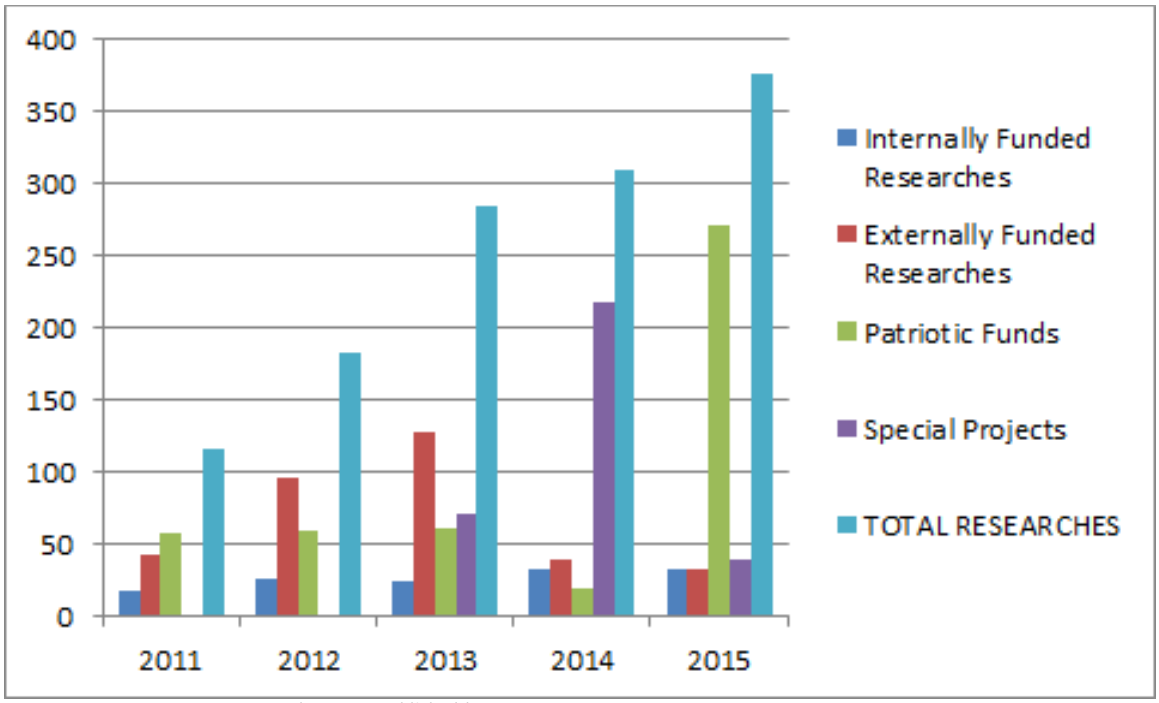
Source: MSU-IIT 2016 Annual Report published by MSU-IIT OVCPD, January 2016

With the opening of borders for the ASEAN integration in 2015 and the K+12 implementation of the Philippine Government that created the Senior High School level in 2016, Bornales envisioned MSU-IIT elevating to obtain research university status. Ever since her appointment as Vice Chancellor for Research and Extension (VCRE) in 2012, Bornales had been paving the way for the Institute to cater to research and development partnership opportunities with industries. She was able to pass along the "Research University" plan to the other Institute administrators, faculty and staff through series of international benchmarking, policies and orders granting the ease of doing research. Within her term as VCRE, an academic calendar shift was also implemented to synchronize with partner academic institutions, with collaborative research partnerships being one of the justifications of the calendar shift.

Bornales was one of the four (4) vice chancellors of MSU-IIT. She oversaw faculty and staff, who executed research and extension programs in their respective departments, namely the Department of Research and Department of Extension. Incentives and academic deloading had been implemented in the Institute and had successfully encouraged research presentations, publications, funding, and applications for patents, utility models, industrial designs and copyrights.

The establishment of a FAB LAB inside the Institute was expected to aid the research and development (R & D) projects managed by Bornales' office. As shown in **Figure 1**, over the past 5 years, the Institute's R&D projects had been increasing, along with the complexity of the research endeavors that researchers of the Institute were handling. Prototyping was identified to be very costly for R&D projects that involve physical designs. In some research conducted by the Electronics Engineering department, fabrication of the prototype -- which involved precision cutting -- was done in China. In other research that involved physical models of biomedical instrumentations, fabrication of the prototype was commissioned in a makerspace based in the US. Prototypes of some masters thesis and doctoral dissertations in engineering, biology and physics were even ordered in partner institutions in Europe and Australia. Bornales knew full well the very costly situation of prototyping. In her past research, she herself managed the very expensive logistics, time and financial cost of having to commission prototypes to makerspaces outside the Institute. The alternatives to the digital prototyping services that these makerspaces offered -- namely hiring of craftsmen and analog machines for cutting and fabrication -- were also identified to be costly in terms of time and price, and, most especially, in terms of quality compromise.

Figure 1
Distribution of R&D project managed by the MSU-ITI OVCRE from 2011-2015



Source: 2011-2015 MSU-IIT Annual Reports published by MSU-IIT OVCPD, January 2016

A number of academic programs of the Institute were also in need of digital fabrication equipment to augment the special projects and outputs of courses that involved three dimensional (3D) modeling and physical prototyping, such as "Engineering Science 52-Engineering Drawing with Computer-Aided Design and Drafting" managed by the Department of Mechanical Engineering and Engineering Sciences that had 320 students enrolled in the course. Other programs in the college of engineering -- such as bachelor's degrees in metallurgical engineering, ceramics engineering, civil engineering, electronics engineering, and electrical engineering -- had courses that dealt with physical prototypes, not to mention the capstone projects and theses requirements in the undergraduate, graduate and post-graduate levels.

As the excitement of the faculty members spread throughout the Institute because of the news of the establishment of an in-house fabrication laboratory, Bornales confirmed and validated the need and the purpose of the FAB LAB, which was to be used not just in research but also in the academic programs of the Institute.

Shared Service Facility for MSMEs

The Department of Trade and Industry (DTI) was the department under the executive branch of the Philippine Government that was tasked to expand trade, industry and investments in the country.[1] DTI functioned as the primary coordinative, promotive, facilitative, and regulatory arm of the Government to ensure sustainable business activities that would generate jobs and raise income among Filipinos.[2] The department was mandated with realizing the goal of a globally competitive Philippines with innovative industries and services sector that contribute to employment generation and inclusive growth.[3] Its mission of "Enabling Business, Empowering Consumers" was echoed throughout the entire department, from the

Secretary down to the Provincial Directors of its Regional Operations and Development Group. It was the Provincial Director of Lanao del Norte, Dr. Ruel B. Paclipan who had first approached Bornales in March 2016, just six months before the MOA signing. The project presentation was very simple and straight to the point. What was initially presented to Bornales was not the FAB LAB but the Shared Service Facility (SSF) Project for MSMEs.

Comprising 97% of the businesses in the Philippines as of 2015, MSMEs play a major role in the Philippines' economic development through their contribution to rural development, decentralization of industries, creation of employment opportunities and more equitable income distribution.[4] As shown in **Table 2**, Republic Act No. 9178 known as the Barangay Micro Business Enterprise Act of 2002 has defined MSMEs to be businesses with asset size worth between PhP 3 million (USD 60,292[iii] and PhP 100 million (USD 2,007,267).[5]

Table 2
Classification of businesses based on asset size according to Sect. 3 of R.A. 9501

BUSINESS	*ASSET SIZE*
Micro Enterprise	*Below PhP 3, 000, 000*
Small Enterprise	*PhP 3, 000, 001- PhP 15, 000, 000*
Medium Enterprise	*PhP 15, 000, 001- PhP 100, 000, 000*
Large Enterprise	*Above PhP 100, 000, 000*

Source: DTI, "Guide to the Magna Carta for Micro, Small and Medium Enterprises (RA 6977, as amended by RA 8289 and further amended by RA 9501)," May 23, 2008

In 2004, DTI published the SME Development Plan, which presented periodic integrated efforts to strengthen and stimulate the MSME sector so that it could contribute significantly to the country's development.[6] These development plans served as guiding principles of DTI in enhancing the operations of individual MSMEs, improving the MSME operational environment, and in assisting priority industries. One result of this assistance to priority industries was the conception of SSF Projects.

The SSF Project was first implemented in 2013 by DTI, with the aim of upgrading the products, services and processes of MSMEs by providing processing or manufacturing machinery, equipment, tools and related accessories for the common use of a priority industry cluster.[7] As of October 2014, a total of 862 SSF projects were identified, ranging from varied targeted industry clusters from coconut product processing to coffee processing, from ice cream making facilities to fabrication equipment like that of the FAB LAB project. The FAB LAB establishment had undergone two of the four phases that every SSF project should undergo: identification of its eligibility as well as project evaluation. In these phases, MSU-IIT was identified as the SSF project's Cooperator, which should provide counterpart support through space to house the equipment, support tools, support personnel and working capital. After the MOA signing between MSU-IIT and DTI, Bornales would be coordinating with the Provincial Director on the remaining two phases, namely procurement and then monitoring of the SSF project. An excerpt from the MOA detailing the rights and responsibilities of both parties is shown in **Appendix A**.

The FAB LAB SSF project's beneficiary industry clusters as identified by DTI were food processors, GDH (gifts, decors and handicrafts) makers, metal fabricators, and designers. As stipulated in the MOA, Bornales noted that the Provincial director wanted the facilities of the FAB LAB to assist MSMEs in the GDH, ceramics, metal and furniture sector in developing prototype products such as souvenir items and the like through short run production which could then be used for market testing before full-blown commercial production.

[iii] The Forex rate of 1 USD =49.7464PHP as of February 2, 2017 has been used in this USD/PHP conversion http://www.xe.com/currencyconverter/convert/?From=USD&To=PHP

DTI also envisioned that the FAB LAB could be used by the local designers to develop packaging and labeling designs tailored fit to the specific requirements of the MSMEs in the processed food sector. As expressed in the MOA, DTI expected that the FAB LAB SSF project would improve the quality of the region's existing products, encourage the creativity of entrepreneurs in developing new products from existing raw materials and ensure their long-term viability by providing the necessary tools and equipment to make their products competitive in the global market. The project's total cost was identified to be PhP 7,845,250 (USD 157,788)[iv] with details in **Appendix B**. DTI hoped that the six pieced of equipment it provided to MSU-IIT would used to improve the capability of MSMEs in the region.

Open Fabrication Laboratory for Public Access

The Fab Foundation was organized in February 2009 with the purpose of providing access to the tools, knowledge and financial means to educate, innovate and invent using technologies in digital fabrication.[8] This purpose is achieved by creating a network of FAB LABs comprised of off-the-shelf, industrial-grade fabrication and electronics tools, configured by open source software packages. As of November 2016, the Fab Foundation had organized 1,005 FAB LABs spread across 98 countries.[9] Fab Labs were organized through partnerships with different individuals and organizations who met technical requirements and shared the ideals of the FAB LAB Charter.[10]

The foundation not only assisted partners in establishing new FAB LABs, but it also tracked and evaluated the impact of these FAB LABS in business, educational and social contexts. Fab Foundation encouraged sharing of ideas through organizing a community of open-source thinkers. The foundation organized international and regional conferences and created online and offline platforms where partners could upload documentation of their ideas and designs. One requirement for being able to establish a Fab Lab was that partners conduct of an "Open Day" when anyone could visit the laboratory and use the equipment for free. From a simple vision of Dr. Neil Gershenfeld to democratize access to digital fabrication equipment, FabLab had grown to be a global network of local labs, enabling invention by providing access for individuals to tools for digital fabrication.

Managing the Scope

As Bornales walked the hallway from the Chancellor's Boardroom to her office, she remembered a project scope management framework that could aid her in the analysis of identifying the scope and limitations of the Institute's FAB LAB. She just needed to identify the five phases that could guide her in making the FAB LAB Fabulous though convergence or compromise.

[iv] Converted per 1 USD =49.7200PHP as of 27 Dec 2016
http://www.xe.com/currencyconverter/convert/?From=USD&To=PHP

Appendices

Appendix A
MOA for the SSF on the Establishment of a Fabrication Laboratory

MEMORANDUM OF AGREEMENT

SHARED SERVICE FACILITIES (SSF) PROJECT

KNOW ALL BY MEN BY THESE PRESENT:

This MEMORANDUM OF AGREEMENT ENTERED INTO ON SEPTEMBER 9, 2015 by and between:

The **DEPARTMENT OF TRADE AND INDUSTRY – REGION X**, a government agency duly organized and existing under the laws of the Republic of the Philippines, with principal office at **Corrales Avenue cor., A. Luna Street Cagayan de Oro City**, represented herein by its **Regional Director, LINDA O. BONIAO**, and hereinafter referred to as **"DTI-*RO*"**;

-and-

MINDANAO STATE UNIVERSITY-ILIGAN INSTITUTE OF TECHNOLOGY, a state university and existing under the laws of the Republic of the Philippines with principal office at **Bonifacio Ave., Tibanga, Iligan City**, represented herein by its **Chancellor, DR. SUKARNO D. TANGGOL**, and hereinafter referred to as the **"COOPERATOR"**;

...

ARTICLE II - RIGHTS, DUTIES AND RESPONSIBILITES OF "DTI-*RO*".

1. Initiate procurement of machinery, equipment and tools necessary for the setting up of the SSF. The procurement shall be done in accordance with the provisions of R.A. 9184, otherwise known as the *"Government Procurement Reform Act",* and its Implementing Rules and Regulations.

2. Shall: (a) with an authorized representative of the "**COOPERATOR**", inspect and receive the machinery/equipment/tools that were procured upon delivery by the supplier thereof to ensure that they meet all specifications as defined in the DTI Purchase Request form; and (b) turnover the machinery/equipment/tools, once delivered to designated project site in accordance with prescribed procedure, to the cooperator.

3. The DTI shall provide insurance to cover loss or damage to the machinery, equipment and tools due to but not limited to fire, theft, earthquake, lightning, floods and other acts of God for a period of one (1) year commencing on the date of delivery of the machinery, equipment and tools to the **"COOPERATOR"**.

4. Grant the **"COOPERATOR"** use of the machinery, equipment and tools subject of this MOA free of charge during the effectivity of this MOA. It is hereby understood that the ownership of the machinery, equipment and tools subject of this MOA remains with **"DTI-*RO*"**. This shall be stipulated in a Deed of Assignment executed by DTI in favor of the **"COOPERATOR"**.

5. Conduct periodic inspection of the shared service facility to monitor its condition in order to promptly identify any problem that may arise so that appropriate remedial measures may be undertaken. In addition to DTI, the Commission on Audit (COA) officials and personnel have visitorial rights. The periodic inspection / evaluation, reporting, monitoring requirements, date of commencement and date of completion of the shared service facility shall be included and specified in the Manual of Operations to be prepared by the **"COOPERATOR"**and the "**DTI-RO**."

6. Jointly with the **"COOPERATOR"**, prepare and approve a Manual of Operations which shall include, among others, the organizational/functional/ structure of the shared service facility, procedure for accessing the services of the facility, business plan, schedule of fees to be collected from the users of the facility, communications plan to promote the use of the facility, and reportorial procedures.

7. The schedule of fees to be collected from the users of the facility shall take into account the sustainability of the operation of the facility in terms of cost recovery, as well as the building up of funds to be devoted solely for the repair and maintenance of the SSF including the renewal of an all-risk insurance policy for the facilities..

8. Monitor and evaluate the operations of the facility, particularly in terms of its production and financial condition. The DTI-Regional Offices shall consolidate and evaluate accomplishment reports submitted by the DTI-Provincial Offices.

9. Provide, when necessary, additional technical support for capacitating the **"COOPERATOR"**, including prospective cooperators, to sustainably manage and operate the facility in accordance with the objectives of the **"SSF"**.

10. Institute appropriate actions against the concerned cooperator which may include, among others, suspension or termination of the project, in case of violation of the provision of this MOA and/or legal action for misuse of approved and released funds, the legal cost of which shall be shouldered by the accredited conduit.

ARTICLE III – RIGHTS, DUTIES AND RESPONSIBLITIES OF THE "COOPERATOR".

1. Provide facilities to house the machinery, equipment and tools subject of this MOA, and counterpart support facilities such as power and other ancillary facilities, as well as working capital and personnel needed to manage and operate the shared service facility.

2. Shall (a) together with an authorized representative of **"DTI-*RO*"**, inspect and receive the machinery, equipment and tools that were procured upon delivery by the supplier thereof to ensure that they meet all specifications as defined in the DTI Purchase Request form; and (b) receive the machinery/equipment/tools, once delivered to designated project site in accordance with prescribed procedure, and acknowledged in writing receipt thereof.

3. May also take out insurance to cover its loss or damage to the machinery/equipment/tools.

4. Jointly with the **"DTI-*RO*"**, prepare and approve a Manual of Operations which shall include, among others, the organizational/functional structure of the shared service facility, procedure for accessing the services of the facility, business plan, schedule of fees to be collected from the users of the facility, communications plan to promote the use of the facility, and reportorial procedures.

5. The schedule of fees to be collected from the users of the facility shall take into account the sustainability of the operation of the facility in terms of cost recovery, as well as the building up of funds to be devoted solely for the repair and maintenance of the facility including the renewal of an all-risk insurance policy for the facilities.

6. Manage and operate the shared service facility in accordance with the Manual of Operations mentioned in Article II, No. 4 above, as well as provide working capital for operating expenses. It is hereby understood that ownership of the machinery, equipment and tools subject of this MOA remains with **"DTI-*RO*"**.

7. Conduct periodic preventive maintenance work to keep the machinery, equipment and tools subject of this MOA in good working condition.

8. Return the machinery, equipment and tools subject of this MOA to **"DTI-*RO*"** upon the termination of this MOA, in good working condition save for the wear and tear arising from its normal usage. Where the deterioration of the machinery, equipment and tools subject of this MOA arose from the fraud or negligence on the part of the **"COOPERATOR"**, the latter shall indemnify **"DTI-*RO*"** for all expenses that may be incurred to restore the machinery, equipment and tools subject of this MOA to a working condition.

9. To take care of the machinery, equipment and tools subject of this MOA as a good father of a family and to ensure it from loss or damage due to theft, fire, flood or other acts of God.

10. Submit to **"DTI-*RO*"**, in accordance with the schedule set forth in the Manual of Operations, periodic reports pertaining to the shared service facility's production and financial condition.

11. Beneficiaries of the SSF as defined in Section 4.1 of Memorandum Order No. 15-58, Series of 2015 shall be encouraged to use the shared service facilities based on rules specified in the Manual of Operations.

12. The Cooperator is prohibited to sell, dispose, transfer or mortgage the machinery/equipment/tools and shall solely use said machinery/equipment/tools as a shared service facility of the SSF beneficiaries as defined in Section 4.1 of Memorandum Order No. 15-58, Series of 2015.

ARTICLE IV – DURATION OF THE MEMORANDUM OF AGREEMENT.

1. This Memorandum of Agreement shall be effective upon signing by the authorized representatives of both parties and shall be in force for a period of two (2) years.

2. The Usufruct Agreement shall be for a period of two (2) years.

Appendix B
Total Project Cost of the FAB LAB SSF Project

Particulars	DTI-SSF	MSU-IIT	Total Project Cost
Fixed Assets			
I. Existing (list of Cooperator's existing equipment)			
Laboratory area		200,000.00	
II. Proposed SSF Equipment			
Laser Cutter	942,250.00		
Small Milling Machine	787,000.00		
Big Milling Machine ShopBot CSC Router/Milling Machine	1,684,000.00		
Print and Cut	1,360,000.00		
3D Printer – Maker Bot Replicator 2	543,000.00		
Sewing Embroidery Machine	635,000.00		
III Support Equipment		584,000.00	
Total Fixed Asset	5,951,250.00	784,000.00	
Pre-Operating Costs		1,110,000.00	
Total Project Cost	**5,951,250.00**	**1,894,000.00**	**7,845,250.00**

Source: Archive of DTI-Lanao del Norte, September 2015

Endnotes

1 DTI, "About," Accessed 27 December 2016 http://www.dti.gov.ph/about
2 DTI, "About," Accessed 27 December 2016 http://www.dti.gov.ph/about
3 DTI, "About," Accessed 27 December 2016 http://www.dti.gov.ph/about
4 DTI, "Micro, small, and medium enterprise (MSMEs)" Accessed 27 December 2016
http://server2.dti.gov.ph/dti/index.php?p=532
and
Prinz Magtulis, "BIR, DTI link up systems to was tax registration," Oct. 11, 2016 Accessed 27 December 2016
http://www.philstar.com/business/2016/10/11/1632242/bir-dti-link-systems-ease-tax-registration
5 DTI, "Guide to R. A. 9178: Barangay Micro Business Enterprises (BMBEs) Act of 2002," August 2009 Accessed 27 Dec 2016 http://www.businessesfightingcorruption.org/laws/RA_9178.pdf
6 DTI, "Micro, small, and medium enterprise (MSMEs)" Accessed 27 December 2016
http://server2.dti.gov.ph/dti/index.php?p=51
and
DTI, "SME Development Plan 2004-2010 Accessed 27 December 2016
http://server2.dti.gov.ph/uploads/file/SMED%20plan%202004-2010.pdf
7 Erlinda M. Medalla, Fatima del Prado, Melalyn C. Mantaring, and Angelica B. Maddawin, "Preliminary Assessment of the Shared Service Facilities," Discussion Paper Series Philippine Institute for Development Studies, Accessed 27 December 2016 http://dirp3.pids.gov.ph/websitecms/CDN/PUBLICATIONS/pidsdps1618.pdf
8 The Fab Foundation, "Financial Statements, December 31, 2013," Accessed 27 December 2016
http://www.fabfoundation.org/wp-content/uploads/2012/07/FabFoundationSignedFinancials2013.pdf
9 The Fab Foundation," Show Me Fab Labs" Accessed 27 December 2016 fablabs.io
10 "The Fab Charter," October 20, 2012 http://fab.cba.mit.edu/about/charter/ Accessed 27 December 2016