

MAYA PEDAL AS A CASE STUDY OF PEDAL-POWERED MACHINES IN SUSTAINABLE RURAL DEVELOPMENT

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ABSTRACT

Bicycles are widely recognized as an indispensable part of intermediate technology for the transportation of people, cargo and sometimes life saving services, but what about for grinding corn, pumping water and creating durable, insulating roofing tiles? Asociacion Maya Pedal (Maya Pedal), a non profit based in San Andres Itzapa, Guatemala is using *bicitecnologia* (bicycle technology) to increase production and efficiency in these processes and other agricultural and small business activities in rural Latin America.

Maya Pedal's "*Bicimaquinas*" (bicycle machines), or pedal-powered machines, increase economic well-being by improving production without creating social dislocation or pollution. Each *bicimaquina* is produced with old bikes, concrete, wood and metal. All of the machines are designed to be affordable and easily repaired by communities that lack access to a mechanic or specialized parts. Maya Pedal produces a corn de-graining and milling machine, a blender, a water pump, a micro concrete vibrator, a coffee de-pulper, a metal sharpener, a nut de-husker and bicycle soil plow/tiller/hoe. There are also prototypes for a washing machine, electricity generator and sewing machine. All of these machines use the bicycle's highly efficient transfer of energy and rely completely on human power.

Velo Mondial's market place is the ideal forum to share Maya Pedal's designs and the track record of these machines as part of local enterprises. Also, it provides an opportunity to discuss Maya Pedal's success and failures over the past eight years as it has struggled to be a compelling advocate for *bicitecnologia* and to sustain itself as an organization.

1.0 INTRODUCTION

Asociación Maya Pedal (Maya Pedal) is a non-governmental organization in the Chimaltenango region of Guatemala. Using old bicycles Maya Pedal creates pedal-powered machines that support rural enterprise and domestic activity in the highlands of Guatemala. Since its beginnings in 1997, Maya Pedal “has quietly created the most diverse collection of bicycle-machine designs anywhere” (Fox 2005, 2). For two and a half months during the fall of 2005 I had the opportunity to live and work in San Andrés Itzapa as a volunteer for Maya Pedal. During that time I worked extensively with the staff and board of directors of Maya Pedal, an intern from the Sierra Club in British Columbia and several international volunteers, including three members of the Maya Pedal Actives group (a group of engineers based out of the Massachusetts Institute of Technology (MIT)). Much of the information presented here is based on my communications over the last six months with the above-mentioned persons, as well as email and phone conversations with representatives from PEDAL (Pedal Energy Development Alternatives) Power (a Canadian non-profit that advocates for the use of pedal-powered technologies, henceforth referred to as Pedal), Bikes Not Bombs and Working Bikes (American bicycle advocacy organizations based in Boston and Chicago respectively); any and all mistakes are solely my own. My involvement at Maya Pedal was as an activist, not an anthropologist. My observations occurred during my participation in the activities of Maya Pedal. I have not made an effort to gather financial or demographic data separate from that produced by Maya Pedal and other organizations in collaboration with Maya Pedal. Also, please note: this paper is in no way meant to be an exhaustive inventory of the designs or projects on which Maya Pedal is currently working, or has worked on in the past. I have chosen the machines and projects that I have worked with directly and that are particularly illustrative of the possibilities and difficulties in implementing and improving pedal-powered technology.

Throughout this paper I use the concepts of intermediate or appropriate technology to evaluate Maya Pedal’s production process and products. It is not my suggestion that the exact designs or methods of implementation used by Maya Pedal should be copied and replicated in other communities. Indeed one of the central teachings of appropriate technology is that the technology be tailored to the capabilities and culture of the local population and the materials available. It is my hope that the designs created by Maya Pedal will provide a jumping off point for technological innovation that is appropriate to projects around the world.

My intention in writing this paper is two fold: first, to share the technology being created by Maya Pedal. Maya Pedal’s pedal-powered machines or *bicimáquinas* are well designed and have broad application in sustainable development. Maya Pedal’s mission specifically calls for sharing the technology it creates and encouraging communities world wide to adapt and incorporate this technology to meet their needs. It is my goal to contribute to this mission through the publication of this paper and my participation in the market place session of the 2006 Velo Mondial conference.

Sharing Maya Pedal’s technology includes discussing not only the finished product, or the *bicimáquinas*, but also the production process. What materials does Maya Pedal use? From where do the bicycles used to make *bicimáquinas* come? How are the *bicimáquinas* made and is it an efficient and cost effective process?

Second, it is my intention to examine the successes and failures of incorporating bicitecnología into local enterprises and domestic production so that they benefit their users. Creating sustainable development requires more than a good product, it requires a network of services and innovations to assist a community in making the most of a given technology. As the representatives of Pedal have observed, the bicimáquinas created by Maya Pedal are not an end in themselves. "Each device is a tool, rather than a project unto itself" (Pedal 2006). During the two and half months I spent as volunteer at Maya Pedal in the fall of 2005 I witnessed Maya Pedal struggle to create organizational stability, market its technologies and provide users with the services necessary to provide holistic support for development.

Most of all, it is my hope that readers will take from this paper awareness of the range of possibilities for using bicycles to create power and to harness that power to support development that values economic, environmental, social and spiritual well being.

1.1 INTERMEDIATE TECHNOLOGY

Radical economist, E. F. Schumacher and three of his colleagues founded the Intermediate Technology Development Group (ITDG) in 1965. To this day ITDG continues to be one of the leading organizations working to bring intermediate technology to developing countries. The concept of Intermediate Technology was introduced to a wide audience in 1973 with the publication of Schumacher's first book, Small is Beautiful (ITDG 2006). From an economic point of view, intermediate technology can be understood as "infrastructural capital that is at least an order of magnitude more expensive than that prevalent in a developing nation but also at least an order of magnitude less expensive than that prevalent in a developed nation..." (My Wise Owl 2006). This definition, however, does not explain the situational factors that must be taken into account and adapted to for the technology to be successfully integrated. It is the consideration of these factors that explain why intermediate technology is also known as appropriate technology. The ITDG defines 'Intermediate' or 'appropriate' technology as, "intended to build upon the existing skills, knowledge and cultural norms of women and men in developing countries, while increasing the efficiency and productivity of their enterprises and domestic activities. By and large it also seeks to sustain the local environment" (ITDG 2006). The intermediate technology movement came about in reaction to the largely unsuccessful attempts to bring advanced technology to developing nations as part of aid projects. These projects were characterized by requiring large capital investments, requiring a few very skilled laborers but providing little training and skill development for the wider community, requiring foreign engineers and parts to maintain and repair the technology and not taking into account the broader social and cultural implications of the change that would be created by the new technology. In contrast, intermediate technologies are characterized by being small scale, labor intensive, energy efficient, environmentally sound, planned and controlled by the local community and simple enough to be maintained by the people using it (Hazeltine and Bull 1999). I will look at the appropriateness of the materials and production processes used by Maya Pedal to create its bicitecnología, as well as in the use of this technology in the local community.

1.2 DEFINITIONS AND USE OF TERMS

For the purposes of this paper I will use *Bicitecnología* to refer specifically to the technology created by Maya Pedal, and I will use pedal-powered technology or bicycle technology to refer to the field in general. Similarly, in the context of this paper, *Bicimáquinas* refers to machines designed and built by Maya Pedal. Pedal-powered machines will be used to describe these types of machines in general and any examples of such machines not built by Maya Pedal. Intermediate and appropriate technology will be used interchangeably.

1.3 CONTEXT FOR MAYA PEDAL

Maya Pedal is a non-governmental organization located in the highlands of Guatemala, in the small town of San Andrés Itzapa. Guatemala is a developing nation in Central America with a population of approximately 12.7 million people (2004 estimate). The Human Development Index (HDI), a measure of development based on life expectancy, adult literacy and mean years of schooling, and income, ranks Guatemala 121 out of 171 countries. A similar measure, the Gender-related Development Index, which uses the same measures as the HDI but includes inequalities between men and women, such as in income and education, ranks Guatemala 98 out of a 144 countries (CIDA 2004). An estimated 75% of Guatemalans live below the poverty line (CIA World Factbook). The highlands are characterized by a predominately indigenous population, subsistence farming systems and low agricultural productivity. The major food crops are maize and beans. Maize forms the largest part of the local diet (Immink & Alarcón).

Maya Pedal is staffed by Carlos Marroquin, the head mechanic and designer, who has been with the project since early on. Additionally, there is an assistant mechanic position and at times an administrative assistant. Maya Pedal is currently looking for a new coordinator. The coordinator facilitates communication between the employees, the board of directors and outside contacts. The board of directors for Maya Pedal consists of seven members, all of whom use the Maya Pedal's bicitecnología. All of the staff and board members are Guatemalan. Maya Pedal also works with international volunteers.

1.4 HISTORY OF MAYA PEDAL

Maya Pedal grew from a collaboration between farmers in the highlands of Guatemala and PEDAL a Canadian non-profit that advocates for the use of pedal-powered technologies. In 1996 a local farmer built a geared, hand-powered water pump because traditional methods of irrigation were prohibitively expensive. Nearby another farmer combined an old bicycle with a grain mill. The farmers found that these machines required design improvement to be more efficient and less prone to break down. They contacted a local eco-development program that put them in touch with Pedal. In 1997 representatives from Pedal came to Guatemala, bringing skills, experience, bike parts and tools to assist the local farmers (Fox 2005). Their collaboration grew into an appropriate technology project that PEDAL coordinated from January 1998 until April of 2001 (Pedal 2006). In 2001, Maya Pedal became a separate organization, constituted under local control (Maya Pedal 2006).

1.5 MAYA PEDAL'S MISSION AND VISION AND OBJECTIVE

Maya Pedal describes its mission and vision in the following two clauses:

- 1) To be a non-governmental organization that promotes the use of bicycle machines through programs, projects, partnerships, activities, and actions, also promoting the use of alternative transportation using bicycles and tricycles
- 2) To support the basic family economy, through the design and distribution of bicycle machines, providing an efficient alternative for the rural development of Guatemala

These goals are further explained in Maya Pedal's list of objectives:

- 1) To recycle and reuse bicycles
- 2) To design and produce pedal-powered machines that meet the necessities of the community
- 3) To raise consciousness, to educate, and to inform communities about the use of pedal-powered technology as an element of ecological sustainability
- 4) To produce, promote, and commercialize bicycle machines and the products made with them, with the ultimate purpose of being a self-sustaining organization, and to help associated groups also achieve this goal
- 5) To establish alliances with national and international groups that have similar goals and that have the capacity to transfer pedal-powered technology to other areas of the world
- 6) To distribute pedal-powered machines for use in peasant agriculture, domestic work, and small business
- 7) To contribute to the local economy, to improve productivity, health, and the surrounding environments of rural families
- 8) To share the experiences of the organization through community-based environmental education, and print articles about the benefits of pedal-powered technology
- 9) To develop technology that does not rely on energy sources such as electricity, fossil fuels, or on agro-industrial techniques
- 10) And to conserve our environment (Maya Pedal 2006a)

2.0 METHODS OF PRODUCTION

Maya Pedal's objectives provide guidance for, and constraints on, its methods of production. The first objective is to recycle used bicycles. To be in keeping with the goals of Maya Pedal, production must be as environmentally friendly as possible. Finally, the fourth objective is to create a self-sustaining organization. This requires Maya Pedal to produce and market the technology efficiently so that it can be provided at a low cost to the community while Maya Pedal continues to pay its expenses and develop new technology. Maya Pedal in collaboration with a group of engineers based out of the Massachusetts Institute of Technology (MIT) is engaged in an effort to raise productivity while reducing cost of materials by applying methods of Lean Manufacturing based on The Toyota Production System.

2.1 SOURCES OF USED BICYCLES

Maya Pedal receives shipments of used bicycles and bicycle parts sent from the United States. Bicycle organizations collect donated bicycles and periodically send forty foot shipping containers filled with bicycles and bicycle parts to the Port of Santo Tomas de

Castilla on the Caribbean Coast of Guatemala. From the port, the bicycles travel by truck to San Andrés Itzapa. In December of 2005 Maya Pedal received a shipment of bicycles from Working Bikes in Chicago, USA. In the spring of 2005, Maya Pedal received a shipment of bicycles from Bikes Not Bombs in Boston, USA.

Shipping bicycles from North America has several drawbacks. First, the high cost of shipping is a burden for the non-profits that donate bicycles to Maya Pedal or must be covered by Maya Pedal. Over the years different strategies for reducing this cost through donation of services or various low cost governmental shipping programs have been attempted with varying success. Second, there is a great deal of bureaucracy for goods to enter the country. If all of the paper work has not processed when the shipment arrives the shipment is held and additional storage expenses are incurred. Finally, shipments contain approximately 500 bicycles. It is a great deal of work for the donating organizations to load the shipping container and an enormous strain on the employees and volunteers of Maya Pedal to unload and organize the shipment in a timely manner.

2.2 REPAIRING USED BICYCLES FOR SALE

When a container of bicycles arrives at Maya Pedal, the bikes are divided into groups: those that can be repaired easily and will sell well, and those to be used as raw material for bicimáquinas. Bicycles from the first group are repaired and sold at local markets at low prices to provide basic transportation. The sale of bicycles is in accordance with Maya Pedal's mission as it provides economically and environmentally sustainable transportation to the community. Approximately 70% of Maya Pedal's revenue comes from these sales. However, repairing and selling bicycles is time- consuming and costly because it requires driving to markets that are sometimes several hours away, and it takes time away from building and developing bicimáquinas. There is an on going discussion at Maya Pedal about the value of bicycle sales. Although, providing sustainable transportation is part of Maya Pedal's mission, there are several other organizations and businesses that are sources of refurbished bicycles. Maya Pedal is the only organization in Central America that is using bicycle parts to create appropriate technology with uses other than transportation. Currently, there is no alternative source for Maya Pedal's revenue apart from repairing bicycles and selling them.

2.3 COLLABORATION WITH MIT

In December of 2004, interested students brought the then coordinator of Maya Pedal, Mario Juarez, to speak at MIT (Maya Pedal 2004 Talk 2004). Since then a group, known as Maya Pedal Actives, has been working with Maya Pedal to improve its operation. An early assessment of Maya Pedal's situation explained that Maya Pedal's limited work force and a small shop space resulted in limited output. Maya Pedal representatives communicated the following needs:

1. Improving productivity and output
2. Introducing new tools and techniques
3. Estimating the lifetime of the machines based on the materials and processes used, and the stresses applied during operation
4. Developing new designs for human-powered machines
5. Documenting the operation of Maya Pedal

Based on this list as a starting point and information gathered over the course of three trips to San Andrés Itzapa to visit Maya Pedal, the engineers from Maya Pedal Actives have begun working with the staff of Maya Pedal to implement changes to the production process. The collaboration has focused on the construction of the Bicimolino/Desgranadora because it is the most popular machine. Researchers from MIT have carefully observed and documented every stage of its production. Using the information gathered during this process and the strategies of Lean Manufacturing, the team is making recommendations for changes that are the least difficult to implement while providing the greatest improvement in productivity. The group has recommended changes to the lay out of the shop and is exploring alternate methods and materials for building the machines that are faster and less costly.

In 2005 the Maya Pedal Actives group won a \$5000 prize in the IDEAS competitions at MIT for their design of a pedal-powered washing machine, or Bicilavadora, which they designed and built as part of the collaboration with Maya Pedal. Their goal is to work with Maya Pedal so that it can produce the Bicilavadora, making it available to the local community, which has already demonstrated great enthusiasm for such a product (Past IDEAS Projects 2004).

3.0 BICIMÁQUINAS

Over the almost ten years since the collaboration that started Maya Pedal, it has produced a great variety of machines that meet community needs. All of these machines rely on the extremely efficient production of energy created by pedaling and the fact that pedal power uses the most powerful muscles in the body: the quadriceps, hamstrings and calves (Erickson 2000). Some designs use pre-existing machines and attach them to a base made with bicycle parts to provide power. Other machines, although they may perform the same function as pre-existing machines, are entirely built by Maya Pedal using bike parts for power transmission.

3.1 BICIMOLINO/ DESGRANADORA

By far the most popular and widely used bicimáquina is the Bicimolino/Desgranadora. (See Figure 1 and 2.) A hand cranked Desgranadora – a machine that removes the kernels from a dried ear of corn and a hand cranked Molino – a miller for grinding corn into animal feed and flour are common in San Andres Itzapa and elsewhere in Guatemala. Large producers use electric machines to take kernels off a cob of corn and mill them. For subsistence and small farmers, the cost of this solution is unmanageable because electrical power is expensive and often unavailable. However, the amount of time required to process their corn by hand is a burden on the family, especially the women. The Bicidesgranadora can easily de grain between twelve and fifteen quintales (1 quintal equals approximately 112 lbs.) of corn per day (Maya Pedal 2006b). The Bicimolino has the capacity to mill three pounds of any type of grain per minute. In addition to yellow maize, the mill is used for soybeans and other elements that make up animal feed. If families are not able to mill their own animal feed, they are forced to sell their corn as a commodity to buy commercially-produced feed. In this scenario the family loses money on both sides of the transaction. When families are able to mill their own feed, they avoid using agro-industrial chemicals and can achieve completely organic production (Maya Pedal 2006b).



Figure 1: Bicidegranadora



Figure 2: Bicimolino

The Bicimolino and Desgranadora is one basic machine with interchangeable degreining and milling attachments. Switching the attachments requires loosening and retightening the two bolts that hold the hand mill or hand degrainer to the base. Figure 3 shows the basic machine.

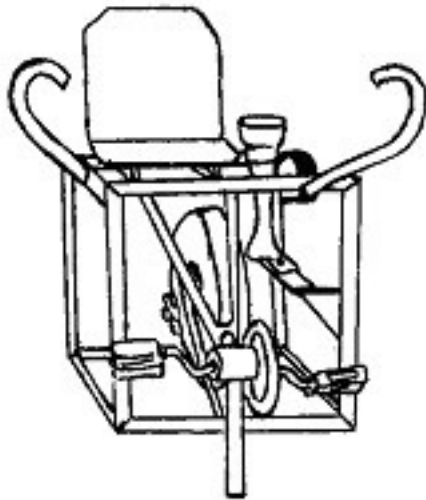


Figure 3: Base used to generate power for Bicimolino and Desgranadora

The operator of the Bicimolino or Desgranadora sits with the pedals in front of her/him. The drive chain from the chain ring connected to the pedals goes back, under the seat, around a cog on a freewheel on the (operator's) right side of the flywheel. A cog on the left side of the flywheel drives a chain up to a sprocket mounted on the shaft that turns the shaft of the Desgranadora or the Molino.

The construction of the Bicimolino/Desgranadora allows the rider to sit on a flat wooden seat with a backrest. The distance between the seat and the pedals can be adjusted to accommodate riders of different heights. Also the gear ratio on the Bicimolino/Desgranadora can be changed by a derailleur and a shifter from a bicycle so it can easily be operated by all family members. The rider does not have to straddle anything making the Desgranadora/Molino easily operated by women wearing traditional Mayan dress, which includes a narrow, ankle length skirt.

It has been my observation that repetitive work, like degrading corn, is worked on little by little throughout the day. Children play at the activity to learn the skill and gradually are able to contribute more and more to production. Also, while such tasks are being performed, families and communities often socialize. The Bicimolino/Desgranadora is appropriate technology because it works within the context of these cultural practices. The Bicimolino/Desgranadora can be set up anywhere that ground is relatively flat and there is reasonably easy access to shelter from the rain. In San Andrés Itzapa many families have courtyards that are partially covered where they wash dishes, do laundry, weave or work on other crafts and tend to their animals. The Bicimolino/Desgranadora is easily set up in such courtyard allowing the rider to participate and socialize with those performing other tasks. Also, there is no minimum amount of degrading or milling that must be done at a sitting, so a little bit can be done every time a family member has a moment.

Finally, because of the production capacity of the Bicimolino/Desgranadora, few small farmers have sufficient maize to need to utilize it all of the time. This makes the

Bicimolino/Desgranadora useful either to be shared by a community or to be rented out by the owner for others' use.

3.2 BICILICUADORA

The Bicilicuada (see figure 4) uses a simple kitchen blender connected to a handmade stationary bike. This stationary bike is made by using the back wheel, axle and drive train of an old bicycle. The handlebars and seat are moved, so that the wheel is in front of the person pedaling. The blender vase sits on a table above the wheel and a front axle which is modified to drive the blender sticks up through the table. The other end of the axle has a rubber wheel, about one inch in diameter, which is in contact with the tire such that it is driven at a large multiple of the speed of the person pedaling.



Figure 4: Bicilicuada

The Bicilicuada has the potential for being useful in the production of consumer products. Licuados, or blended fruit drinks, are very popular in Guatemala. The Maya Pedal website suggests using the Bicilicuada to sell licuados at football games, festivals and parades although transportation of the Bicilicuada can be an issue. The Bicilicuada can be lifted by the seat and rolled on its front wheel like a wheelbarrow. However, for long distances it might be more practical adapt a design like those developed by Dr. Job Ebenezer, by which a bicycle could be temporarily converted to a blender with components that could be carried on the bicycle while traveling (2005).

3.3 BICIBOMBA

The Bicibomba pumps water by circulating a rope with beads tied onto the rope at a given interval through a pipe that extends down to the water source. (See figure 5). Members of the Maya Pedal Actives group have observed there are still some kinks that need to be worked out with this design as varying results have been achieved in different locations where the Bicibomba has been installed. One reason for this is that the diameter of the pipe and the beads still have to be optimized for different depths. In the

more successful installations, the Bicibomba it has demonstrated the capacity to pump water from depths of up to thirty meters at a rate of five to ten gallons per minute. Traditional electric pumps can only pump from depths of up to twelve meters. The Bicibomba meets the need for irrigation and drinking water in communities that do not have a reliable supply of electricity (Maya Pedal 2006).



Figure 5: Bicibomba

3.4 BICITEJA

The biciteja produces vibrations necessary to force air bubbles out of a sheet of concrete that can be molded to create roofing tiles. Concrete roofing tiles are more durable and insulate better than the corrugated metals roofs common in Guatemala.

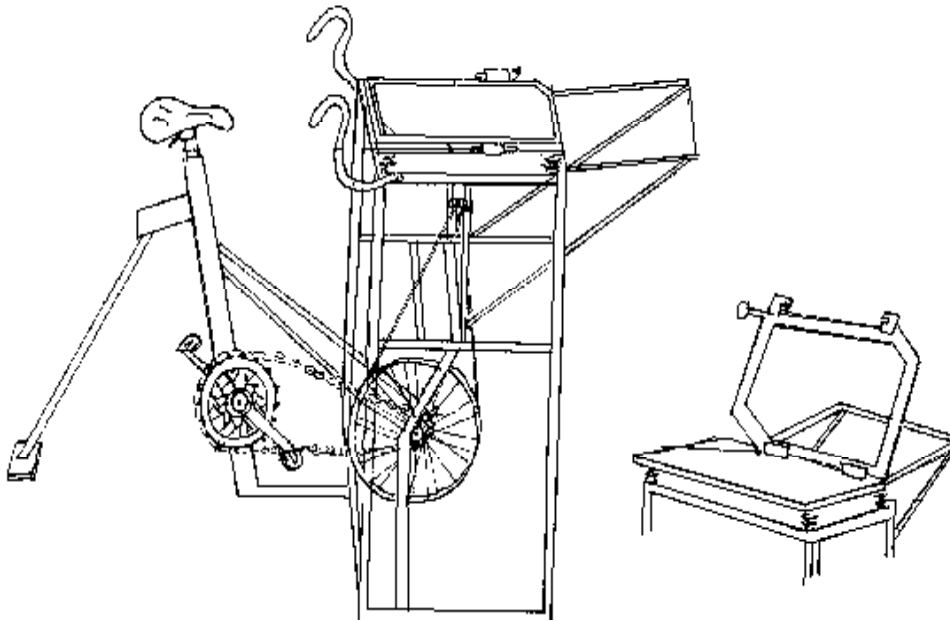


Figure 6: Biciteja

3.5 BICIDESPULPADORA

The Bicidespulpadora removes the outer shell of the coffee bean. This allows small farmers to roast their coffee in the sun. The most recent model of this machine has the capacity to process one hundred pounds every quarter of an hour (Maya Pedal 2006).



Figure 7: Bicidespulpadora

The Bicidespulpadora, like the Molino/Desgranadora, is made using a pre-made depulper, which is then attached to a stand and connected to a drive train so it can be powered by pedaling. Like the Molino/Desgranadora, the quality and price of this machine is greatly dependent on that of the pre-made depulper. There has been some discussion of fabricating the depulper at Maya Pedal, but right now there is not time or money available to develop this idea.

3.6 BICIDESCASCADORA

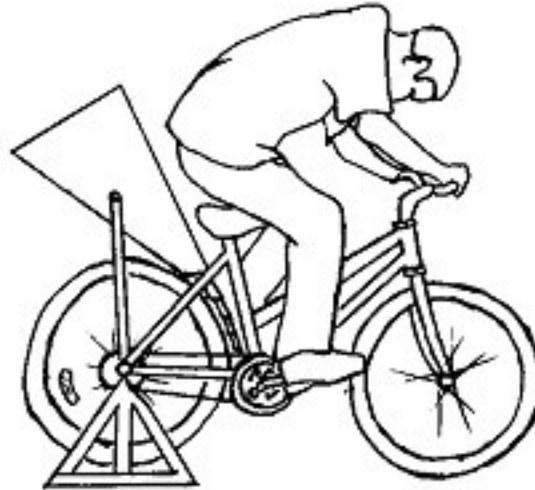


Figure 8: Bicidescascadora

The Bicidescascadora, which removes the outer shells of macadamia nuts, is a regular bicycle, its back wheel is elevated with a stand and fender-shaped piece that has rows of tines. Macadamia nuts are feed between the rear bicycle tire and rows of tines. The design requires further refinements to be able to accommodate a variety of sizes of nuts and to channel the shelled nuts so they can be easily collected and do not get dirty or caught in the wheel. Despite the need for these improvement, this design is promising because of the ease with which the design could be modified so that the descascadora is a temporary attachment allowing the bicycle to still be used for transportation.

4.0 MAYA PEDAL TECHNOLOGY IN USE

As mentioned earlier, bicimáquinas are only tools. To be useful they have to be appropriately integrated into communities. The following two examples demonstrate how some of Maya Pedal's bicimáquinas are being used and how successful the technology is at improving the well-being of its user.

4.1 BICIMOLINO AND DESGRANADORA

Degrainng and milling are necessary tasks for many families in Guatemala. Finding productive uses for the Bicimolino/Desgranadora is not difficult; however, the technology could be made more available if it was actively marketed and if the price could be

reduced. In the September/October 2005 issue of Orion Online publication, an article follows one family's use of the Bicimolino/Desgranadora. For many years, Everilda Tubac, an indigenous farmer in the Guatemalan highlands used a hand-cranked mill to grind corn to make feed for her animals, after loosening the kernels from the corn cob with a stick and picking them off by hand. It was exhausting and time-consuming work, but her family could not afford an electric or gas-powered mill. For several years during the 1990s, Tubac was able to buy commercial feed, but rising prices forced her to return to the producing her own feed, a task that took more than a week. In recent years she has purchased a Bicimolino/Desgranadora and is able to process the grain to make feed in a day and half. When Tubac is not using her Molino/Desgranadora for domestic production, she charges her neighbors 5 quetzals (approximately 65 cents) a sack to grind corn for them (Fox 2005).

4.2 BICILICUADORA

Although a blender can be useful for cooking and other types of domestic production, it is not a necessity for families in Guatemala. For this reason more support is required for the Bicilicuada to contribute to development or poverty alleviation. Maya Pedal works with a regional project called Women for Development in Action, San Andrés Itzapa. The women in this collective, two of whom are also board members of Maya Pedal, produce one hundred percent organic aloe shampoo. The women grow aloe plants in their gardens and use a Bicilicuada to blend the aloe and other ingredients to make shampoo. Unfortunately, the collective only has the opportunity to sell their shampoo to neighbors, at the local market and to Maya Pedal customers, so although the product is good and the production means are efficient and environmentally friendly, this enterprise is not creating significant financial rewards. (I examine possible methods for improving sales in section 5.1)

5.0 RECOMMENDATIONS FOR FACILITATING THE USE OF PEDAL-POWERED TECHNOLOGY TO CREATE SUSTAINABLE DEVELOPMENT

Maya Pedal currently works with several international, national and regional projects to provide training about implementing pedal-powered technology. Working with these organizations has been a great benefit to Maya Pedal, allowing them to share their innovations and sometimes resulting in large orders of bicimáquinas to be used as part of development projects. However, the potential for new projects is enormous. Several times a week during the period that I spent working at Maya Pedal, one of the employees, other volunteers or I would comment that it would be great if we could add a _____ program. Working at Maya Pedal one constantly sees what other services are necessary for Maya Pedal's bicimáquinas to be integrated into sustainable enterprises or domestic production. Currently, it is not possible for Maya Pedal to add any additional programs. Maya Pedal is already struggling to raise money to continue its work and to manage its workload with its small staff and volunteer core. Using Maya Pedal as an example, I discuss programs that that would be natural partners for bicycle technology projects to support the integration of pedal-powered technology. Alternatively, organizations already working in the following fields might look for a partner organization that works with bicycle technology or, in an area lacking such a project, consider creating its own program.

5.1 MICRO-CREDIT AND MICRO-ENTERPRISE

Although, Maya Pedal makes every effort to provide bicimáquinas at reasonable prices, the cost of the machines is more than many families can pay. At times Maya Pedal has tried to provide credit, but it lacked the structure and services to make that a viable option. A program that provided micro credit could make possible the purchase of machines by the people who need them most. Also, with advise about micro enterprise and saving bicimáquinas can quickly provide return on investment. The machines can easily be shared and thus are an ideal investment for a group.

5.2 SALES AND TOURISM

Pedal power produced items have a tremendous possibility for consumer appeal, especially with tourists who can make consumption decisions based on the environmental and social impacts of products. However, as can be seen in the example of the group Women for Development in Action, San Andres Itzapa, creating a product is not enough. Several times while I was working with Maya Pedal, we discussed the possibility of finding Guatemalan tourist hotels that would use the pedal power-made shampoo in their bathrooms. This has the potential of being lucrative for the producers and providing hotel owners with shampoo, a needed product, and with the extra benefit that the hotel can advertise its support of local indigenous enterprises and its use of organic products. Many hotels in Guatemala already promote an image of social and environmental responsibility; pedal-powered shampoo would be a logical next step. Also, bicimáquinas, by virtue of their novelty draw interest, which could be used to promote the shampoo, Maya Pedal's other projects and the hotel. I imagine a photo of one of the grandmotherly Mayan women who head Women for Development in Action, pedaling furiously on the Bicilicuada with a brief description of the project sitting by the shampoo containers in the bathroom or greeting visitors at the front desk. (See Figure 9).

Unfortunately, neither the Women for Development in Action or Maya Pedal have the resources to pursue this project. An organization that worked to place locally produced products, or the non-profit arm of a hotel or tourism company, would have the contacts and experience to help place the pedal-powered shampoo in by hotels or stores featuring local crafts and perhaps even as an export good.



Figure 9: Women for Development in Action group member making shampoo on a Bicilicuada.

5.3 EDUCATION

A tenet of intermediate technology is to build on the pre-existing skills in a community and teach those who use the technology new skills. Maya Pedal could greatly benefit from a collaboration with an organization working in the field of education. Students, learning bike mechanics, marketing or administration as a job skill could intern at Maya Pedal.

Representatives of Maya Pedal conduct *capacitaciones*, or workshops to teach individuals and organizations about bicitecnología. Unfortunately Maya Pedal can only provide capacitaciones to the organizations with which it has contacts. Working with an organization already involved in bringing educational programs to local communities, Maya Pedal could increase its audience as well as learn valuable skills on how to make its presentations more effective.

6.0 CONCLUSION

Maya Pedal's bicimáquinas have made significant contributions to sustainable development in the Chimaltenango region of Guatemala. Bicitecnología works with small scale production; it is labor rather than capital intensive; it is environmentally sound; and it is designed and produced by the community it is intended to serve. In all of these things it fits the criteria of an intermediate technology. Another criterion for intermediate technology is that it relies as much as possible on locally available

materials. The wisdom of this is clear in light of Maya Pedal's difficulties in receiving shipments of used bicycles. Despite these difficulties, the benefits of employing used bicycles, which are surplus in many developed nations, as the raw material for machines that aid in sustainable development in other locations make persistence and further innovation in this matter more than worth the effort.

Maya Pedal is a product of the local culture and so is able to identify and meet community needs. On an ideological level, Maya Pedal creates technologies that allow people to stay close to the land and the family, both important in Mayan culture and necessary to prevent social dislocation. On a practical level, Maya Pedal's designers take into consideration, perhaps subconsciously, factors, like the long, narrow skirts worn by local women, that often determine if a machine will really be used. This first hand cultural knowledge is central to Maya Pedal's success, but it has limitations. For this reason, working with partner organizations, interns and volunteers is a great benefit. There are different cultural assumptions in professional transactions and working with North American volunteers facilitates applying for grants and donations from North American foundations and businesses. The designers and mechanics at Maya Pedal are very skilled but self-taught. Working with engineers with formal education provides an opportunity to learn the formalized language that allows bicitecnología to be recorded and shared.

The greatest opportunity for improvement for Maya Pedal, and the key to the continued growth of bicycle technology worldwide is making bicycle technology part of holistic development programs so that the economic, communal, environmental, educational and business issues are all being addressed with an interconnected network of support. There is plenty of room for improvement of Maya Pedal's existing designs, a handful of prototypes that need to be developed, and nearly endless possibility for new machines. Maya Pedal does not lack ability, insight or passion for these projects, but the time and money to pursue them fully. This can be improved by creating a network of support for bicitecnología in the development community.

Bibliography:

CIA – The World Factbook. 2005. Guatemala. [Online]. Available: <http://www.cia.gov/cia/publications/factbook/geos/gt.html>. [10 January 2006].

CIDA. 2005. Guatemala: Facts at a Glance. [Online]. Available from: <http://www.acdi-cida.gc.ca/CIDAWEB/webcountry.nsf/VLUDocEn/Guatemala-factsataglance/> [11 January 2006].

Ebenezer, Job S. Ph.D. 2005. Standard Bicycle with Pedal Power Attachment (Dual-Purpose Bicycle). [Online]. Available from: <http://home.messiah.edu/~jebeneze/PedalPowerReport/PedalPowerReport.htm> [9 January 2006]

Erickson, Ben. 2000. Pedal Power: Spinning for the Future at CCAT. [Online]. Green Trust. Available: <http://www.green-trust.org/2000/humanpower.htm>. [5 January 2006].

Fox, Conrad. 2005. Pedal Power: Recycled bike-machines give new life to Guatemalan farmers. [Online] Orion Online. Available: <http://www.oriononline.org/pages/om/05-5om/Fox.html> [5 January 2006].

Hazeltine, Barrett and Christopher Bull. 1999. Appropriate Technology: Tools, Choices, and Implications.

Immink, M.D.C. and J.A. Alarcón. Household food security and crop diversification among smallholder farmers in Guatemala. Food, Nutrition and Agriculture – 4 – Food Security. [Online]. Available from FAO of the United Nations. (<http://www.fao.org/docrep/U8050t/u8050t06.htm>) [10 January 2006]

ITDG. 2006. Frequently Asked Questions. [Online]. Available: <http://www.itdg.org/?id=faq>. [5 January 2006].

Maya Pedal. 2006a. About Us. [Online]. Available: http://www.mayapedal.org/informacion/contenido_in.html. [5 January 2006].

Maya Pedal. 2006b. What are bicimáquinas?. [Online]. Available: http://www.mayapedal.org/bicimaquinas/contenido_in.html. [5 January 2006].

Maya Pedal. 2006c. Projects. [Online]. Available: http://www.mayapedal.org/proyectos/contenido_in.html. [5 January 2006].

Maya Pedal Actives 2004. Maya Pedal. [Online]. Available from: http://miters.mit.edu/mediawiki/index.php/Maya_Pedal [5 January 2006]

My Wise Owl. 2006. Intermediate technology. [Online]. Available from: http://www.mywiseowl.com/articles/Intermediate_technology. [5 January 2006].

Past IDEAS Projects. 2004. Bicilavadora. [Online]. Available from: <http://mit.edu/ideas/www/pastprojects.htm> [11 January 2005]

PEDAL Power. 2006. What is Maya Pedal [Online]. Available from:
<http://www.pedalpower.org/maya.html>. [5 January 2006].

Schumacher, E. F. 1973. Small is Beautiful: Economics as if people mattered. Hartley & Marks Publishing Inc. Vancouver, BC.

Welcome to Bikes Not Bombs. 2006. [Online]. Bikes not Bombs. Available from:
<http://www.bikesnotbombs.org/>