Open Manufacturing

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We are delighted to hear your thoughts about open manufacturing, Professor Tseng.

First, I want to thank Frank Piller, Anne Huff, Kathrin Möslein, and Ralf Reichwald, who brought this interesting idea to me. Honestly, I have been working on manufacturing issues my entire career, and of course I have read about open innovation. But I had not connected these two areas until they invited me to discuss open manufacturing in this forum. I treasure very much the friendship and intellectual stimulation they have given me over the years.

As introduction to the new idea of open manufacturing I will start with Figure 1. Many professors use this chart, first presented by Michael Porter from Harvard Business School, to talk about manufacturing. There are so many components in manufacturing. We need inbound logistics, outbound logistics, "operations" (which for us primarily means manufacturing), technologies, human resources, IT infrastructures – we need all kinds of different capabilities. And then, in the end, hopefully, the manufacturer gets some margin when final goods are delivered.

Figure 1: Manufacturing value chain
If you want to open manufacturing, conceivably you have different players from inside or outside the firm doing or contributing to these elements, right? Many players have expertise with at least some aspects of the process outlined in Figure 1. Some have expertise with inbound processes, some with outbound. Some organize and deliver goods and services to end-users. This will be the frame of our discussion. We have to start by thinking of multiple players who have multiple talents and unique capabilities. One of the challenges is how to orchestrate them.

**Conceptualizing open manufacturing requires thinking about coordinating interactions among multiple players with multiple talents.**

But what is open manufacturing? Let us start with many companies in the Fortune 500 – companies like Nike, Cisco, and Liz Claiborne. What do they have in common? They all outsource manufacturing; they don’t do many manufacturing operations themselves.

A similar case is IBM. You probably know that most of the different peripherals and components of the many different computers they sell come from various suppliers around the world. Some of them are even assembled, tested, shipped, and serviced by suppliers.

Conceptually, then, we can see manufacturing as a network of nodes where value-added activities occur. Activity at these nodes can be done by whoever is the most capable in providing the results with the lowest cost. If entry barriers are relatively low, the possibility of participating in the network is determined by the economic value provided, i.e., the value of capabilities offered, instead of other factors such as relationships or alliances.

But, in my opinion, companies like Nike or IBM, which stand for the very large number of organizations that outsource many of the activities in Figure 1, are not involved in open manufacturing. Their supply chains engage a limited number of selected participants; they are moving toward what we might call open manufacturing, but they are not really open yet.

**Can you give us a good example of open manufacturing?**

I am happy to share with you an example that could be at the forefront of what I see as a coming sea change. It involves a group of companies, each of which consists of a small number of employees; most of them only have 5 to 10. These companies form ad hoc networks to pursue business opportunities. The opportunities can be an underserved niche market, or a customer base with desires that normally are not served. Together they have been called “Shanzhai Manufacturing” in China.

The term “Shanzhai” originated in a Chinese classic, Shui Hu Zhan, commonly translated as *Water Margin* or *Outlaws of the Marsh*. The story is derived from events that happened in China around the 12th century. It portrays a collection of folklore legends about one hundred and eight men and women who band together on a marsh-girt mountain. They connect with the oppressed masses in small units. However, these seemingly independent groups are able to work together to become an outlaw army of thousands who fight bravely and resourcefully against well equipped but heartless tyrants. Their stories have been a popular theme of story tellers and enjoyable readings directed at all ages in China for generations.

Before I tell you about Shanzhai manufacturing today, I have to tell you a few things about the Chinese market for cell phones. We have around 200 million people who can afford to buy Nokia, Sony Ericson, and similar phones, including some local brands. Yet, there are more than 1 billion people who need mobile
phones even though they cannot afford to buy name brands with fancy features. To them, price is a very important decision factor. One key to Shanzhai's success in filling this gap is their recognition that every segment of the population has different needs. The companies work together to offer this much broader group of customers very different phones, a few of which are shown in Figure 2. Some are especially designed for children. Others are for farmers who happen to work far away from service and transmitter towers.

Shanzhai manufacturers form networks that aggregate and respond to unfilled market niches.

In harvest time, some farmers cannot get to electricity for several days. That means they cannot charge their batteries. How does a cell phone company provide service to them? Shanzhai can provide phones that go from 7 days up to perhaps one month without charging! Think of it. It is a phone with a heavy battery but for one month you do not need to charge it. Most of us have the nightmare that our phone might run out of battery when we need it. If we had one of these phones we wouldn't need to worry for a month – if we did not mind extra weight and potential safety issues, of course.

Other phones meet other needs. One is designed for people who work in a very noisy place. It has 6 speakers, so the user can hear clearly. Of course the noise bothers others, but sometimes that is not a primary concern. Do you know how much this phone costs? It can be bought without a contract for as low as twenty Euros.

That's the magic of Shanzhai manufacturing.

How can they do it? Technically, most phones are built on top of chip sets made in Taiwan that power most cell phone functions. The Shanzhai finish up with case, user interface, battery, speakers, etc. to make complete products for the market. These phones can be cranked out in less than two weeks by companies symbiotically relying on each other's capabilities. The most complicated designs may take up to 2 months, no more. Think of it. Their prices are between 200 RMB to 1000 RMB. That's about 100 Euros at the top end, which is a very, very low price for making a connection with the world. Even farmers and poor people can decide to buy one of these phones. And Shanzhai manufacturing has a huge market. They now export to India, Pakistan, and other countries for these low prices.

In other words, this is not a small entrepreneurial effort that deserves to be off the radar screen. In 2007 Shanzhai manufacturers produced 110 million cell phones. The whole world market in 2007 was somewhere around 600 million phones. So they supplied more than 18% of the world's mobile phones two years ago.

Shanzhai manufacturers supply more than 18% of the world's mobile phones.

Even more amazing, these companies work with a very small amount of capital and cash flow, somewhere around 100,000 RMBS, or 10,000 Euros. With this amount of capital, they cannot afford to have very nice facilities, the latest machines, a lot of inventory, test equipment, or many human resources. They have to be very focused on their value contribution and make sure they are well connected to customer needs and asset returns.

Figure 2: Shanzhai cell phones
Is there something different about Shanzhai and other open manufacturers’ value chains?

The relationships that today’s big cell phone brands rely on are simplified in Figure 3. These companies find market needs, do their own product development, verify requirements, get order commitments, and then turn around to arrange their supply chain and order fulfillment with a network of small companies.

Shanzhai manufacturing works in a very different way, as shown in Figure 4. First, they sell the phone before they manufacture it. The purchase includes the number of units, specifications, industrial designs (perhaps to look like model xyz of a certain brand), usage, displays, special applications, etc. Based on these inputs, similar products or prototypes may be shown to customers to ascertain their final selections.

Because the business is run with a very thin margin, everything has to be done with tight cost control. In particular, the small company in charge of the customer interface and doing the selling has to make the selection of other players – specifying who will be in charge of making the phone case, who will make the printed circuit board, where to buy other components, who will assemble, and so on. The company arranging the deal has to be responsible for quality, delivery, and overall cost control. All this is done very quickly. Normally customers expect delivery within weeks and final payment will not be made until products are delivered.

These companies are increasingly formidable competitors in the global cell phone market. They engage in a type of warfare.

**Shanzhai manufacturers are small but formidable competitors that tightly control a limited amount of capital and work together to respond to firm customer orders.**

What is the quality level of these phones?

Although they take a lot of shortcuts, at the end they have to deliver “good enough” quality. Typically, performance is quite reasonable. Most Shanzhai groups cannot afford to retain many kinds of expertise. Players rely on information about which companies are very good at making circuit boards, who writes good software, who is good at injection molding to make the outside case, where to find good batteries, speakers at a good price, and so on. Weaker players do not last long.
Is it just piracy? Are they efficient because they copy existing phones?

Customers often do specify products based on similarity to existing phones. When someone wants a phone their idea may be based on a Nokia Model 2100, but (since they can specify their needs and wants) customers often ask for a different color, perhaps they like some capabilities but do not care about others.

The Shanzhai are also motivated to cut less desired features to keep their costs down. This is not a personalized product. Shanzhai orders have to be large enough to justify costs. Another saving is that companies do not have to worry about long term customer relationships in the way that the big cell phone companies do. They walk away from untenable requests. They have to.

A key point, however, is that Shanzhai negotiation to reach a product is very different from what the name brands do – companies that normally take the position of “take it or leave it.” In some ways, Shanzhai are closer to customers than the big brands because they are more aware of demand.

It might be said that Shanzhai are closer to customers than big brands that offer products on a take it or leave it basis.

Interestingly, a key player in “normal manufacturing” is missing. Typically distributors of name brand phones buy a substantial number of a certain model, often thousands – the number depends on price and volume negotiation. These middle men are responsible for selling the units they purchase. If they cannot sell them in a reasonable period of time, they have to take a loss and sell them at fire sale prices. Shanzhai do not need these middle men because they do not start manufacturing until they know how many phones of a certain kind to produce.

Do they advertise?

They don’t have commercials. Branding is not that important for their consumer group. But obviously word-of-mouth is important among those who are consolidating demand and making commitments on orders. Don’t forget there are hundreds of players in China involved in the Shanzhai manufacturing of cell phones. Reputation matters. If companies are not doing good jobs, they are likely to be dropped from the next value chain, either as integrators or capability suppliers.

End users are concerned about value, but they are not interested in paying for brand names. Normally, companies do not provide after sale service on a Shanzhai manufactured phone. Since branding is not emphasized, and the configuration of players changes rapidly, service would be difficult to carry out anyway.

How does innovation play out in this setting?

That is a good question. For example, someone might come up with a solution for extending battery life, and it might be cheaper or last longer. Luckily the market for a new battery is not limited to a few big companies. There are a lot of small companies that are willing to try new components in order to be more competitive. An inventor is therefore more likely to find a buyer in the world I have just described.

It appears that inventions have a greater chance of coming to market in a Shanzhai environment.

Openness here means there is a lower entry barrier for a vast number of potential buyer-supplier relationships. These involve not only component suppliers but things like assembly.
Do you have other examples of open manufacturing?

Another case involves a company providing living space design. Many people who buy a house or an apartment want to hire an interior designer. Most designers are very creative, but many are not very good in implementation.

The innovator in this second case is working with interior designers but then turning around and lining up a bunch of component sources for curtains, lights, chairs, and so on. Customers can go to the middleman’s website and select what they want, working with an interior designer to decorate their house.

It is even possible to customize, and here is my third example of open manufacturing. For example, Frank has a very beautiful desk that is custom made. A customizer could just cut the wood for him and he could assemble it himself. Alternatively, the company could assemble it for him. In my case study the customer works with a designer provided by the customizing manufacturer who comes up with CAD drawings of desired furniture; these are then given to a satellite fabricator.

Another effort I just heard about is called builditwith.me. The focus of this company is on web development, but the “build” logic is very compatible with what I have been talking about. Their website says:

Build It With Me is a tool that connects design & development entrepreneurs. It exists to make creating apps easier by connecting you with like-minded designers & developers with the same goal: create cool & useful apps.

Getting funding for your app idea is hard and often unrealistic. Most of the time you may just need to connect with a partner who has a skill set you lack to finish off your app. This is where Build It With Me comes in, connecting you to those people.

Skip the funding. Build It With Me will help you bootstrap your ideas into actual apps. (http://builditwith.me/about/)

What is interesting about these examples is that they are based on very simple business ideas. The interior designers already exist. The desk designers already exist. The companies that transform raw materials into products exist. There are many computer programmers. Entrepreneurs have always existed and are increasing in number around the world. What has happened recently is that new, open interfaces are becoming available to connect these players and then link them with much larger groups of customers than they could reach before.

Perhaps it is better to say that “more open” interfaces are becoming available. Few companies are targeting every user. They are targeting users who have specific capabilities. In my third case the designer has to use CAD software to create new solutions. Today there are more and more of users with these skills. The reason is that in the last few years it has become possible to access manufacturing platforms that allow people to directly realize new ideas that were much harder, if not impossible, to finalize in the past.

The underlying driver is important. It used to be that a big part of the cost of production was in fixed costs dominated by equipment and set up costs. Now economies of scale are changing. Flexible manufacturing equipment is becoming more available. It is more and more possible to charge the same amount of money to set up for 20,000 units as to set up for 200,000 – they cost the same. Let me use the analogy of a copy machine; now you don’t need to pay for the cost of type set, stencils etc. The cost of printing the first copy is more or less the same as printing the thousandth copy. This is drastically different from what used to be.
Greater access to manufacturing platforms with enabling technologies reduce economies of scale and make open manufacturing increasingly feasible and attractive.

Perhaps the future role of manufacturing is to be a simple copy machine. If you can follow the manufacturers' formats, you can create a product virtually, transmit the specifications, and then download to a machine to get the physical reality you desire.

Are you concluding with what we have long been able to do in a traditional craft shop, now computerized?

Not really, though there are some overlaps. In open innovation the discussion is primarily about 3 players:
- Who has the problem?
- Who provides the solutions?
- Who operates the market?

In open manufacturing, it is very similar. You have a vast number of customers who have needs to be fulfilled. There are vast numbers of manufacturers and suppliers who can provide solutions and then vast numbers of operators who are willing and eager to compete to operate the market.

The numbers involved point to one important difference between craft operation and open manufacturing. Further, the difference between open innovation and open manufacturing appears to be in the hierarchy of provider-customer relationships.

The hierarchy, vast choices, constraints of time, and limit on costs, may lead to mission impossible because of complexity. In the Shanzhai case, a common platform,

a critical mass of players, and a very strong entrepreneurial spirit, quickly organize and reconfigure to overcome complexity and potential transaction costs to make it all work.

The key question seems to be who selects players. In true openness, we can imagine that almost anyone could be the coordinator of open manufacturing. Whoever I am, wherever I am, whatever role I played in the past, does not matter much if I have done a good job. What matters is that a critical mass of other players are convinced that I will bring the best value to the network. Therefore, if my capabilities are coordination and orchestrating, and I have ambition, someday I may become a market coordinator. This is a very interesting extension of what has been said earlier today about open leadership.

Open manufacturing offers successful participants the opportunity to coordinate, or lead, later offerings.