Ways of Making: Artistic Making, Industrial Making and Toyota's third way (Version 0.1)

Why didn't the Greenland Norse eat fish? It's been keeping me awake at nights. I keep thinking about the Vikings and the Inuit in Greenland and it's scary. I just recently read a book[1] about how societies collapse and the Greenland Norse are one of their examples. Greenland nowadays is hardly every green it's mostly white. When the Vikings decided to colonise the west coast of Greenland around the start of the first millennium, it's possible that the climate might have been warmer, it's also, possible that the name is a thousand-year-old marketing ploy. The Vikings wanted people to colonise Greenland, so they made it sound slightly more inviting than "Covered in ice and snow for 10 months of the year" land, which would have been perhaps nearer the mark. People did go to Greenland and try to colonise it. They brought with them the ideas for a way of life that had been working in lowland Norway and Sweden, square wood and stone-built houses, Christianity and arable farming and the idea that ownership of cows was the most important symbol of status and wealth. Unfortunately the Vikings in Greenland fell victim to climate change and, it might be argued, monumental stupidity. The weather in Greenland got colder and colder and it became harder and harder to live in square-built houses and grow crops and keep cattle. The Vikings weren't the only people living in Greenland, there were the Inuit there as well. The Inuit lived in close-to-the-ground tents and rounded shelters. They lived a hunter-gatherer lifestyle. That might make them sound primitive but there were far from it. Hunting was exactly the right thing to be doing in that environment, in that climate. Agriculture, especially cattle that had to be kept inside 9 months of the year, was simply unsustainable in that terrain. The Inuit had kayaks and harpoons that allowed them to hunt seals more efficiently than the Vikings, the Inuit had a bigger version of a kayak called an umiak that allowed them to team up and use their harpoons to hunt whales. There's a lot of good stuff in a whale, especially in an environment that has hardly any trees. You can build things with whale bone (like more kayaks and umiaks) and you can use the blubber as a fuel for both cooking and heating. The archaeological evidence suggests that the Vikings and the Inuit were around at the same time, in the same small geographical area. It seems highly unlikely that they didn't to see, at least from a distance, how each other tribe lived.

Something very similar happened in Britain and America in the 60's. The car industries in both countries started dying. Part of the problem was that they started dying very slowly, so slowly that it took a long time for anyone to notice. Economic climate change felt very much like environmental climate change. Another part of the problem was their utter refusal – like the Vikings - to see a possible source of salvation that was sitting right in front of them. Admittedly part of the solution was hidden half-way around the world but part of it was plain for anyone to see in the cheap and reliable cars trucks and motorbikes that began to arrive from Japan. By the mid-sixties Toyota had already perfected most of the aspects of its lean manufacturing process and its many other innovation in ways of making that would eventually make it the biggest car company in the world.

First there was artistic making where every piece was different. The same parts on different guns, bicycles or cars could not be interchanged. Manufacture depended on skilled craftsmen. Every part was custom made. This happened all over the world but perhaps reached its most advanced stages in Europe. Then there was mass production. Mass production was developed first by Henry Ford and then by Sloan at General motors. Mass production is the model that we have in our head. For many of us, manufacture and mass production are the *same thing*. Mass production has been followed by just-in-time/lean manufacture which involves the introduction of a whole bunch of principles and management structures that were invented in Japan, at Toyota by the Toyoda's[2] (the owners and founders of Toyota) and by Taiichi Ohno[3]. Lean manufacturing is interesting for a bunch of reasons. It's more efficient than mass production and it generates less defects. It doesn't seem to be document/process oriented. It doesn't necessarily seem to be automation oriented. Some of the most productive lean companies are the least automated. In a lean/just in time process the majority of employees are adding value directly to the product.

In a lean production factory the employees have interesting and challenging jobs in which their skills are constantly being extended. One thing that contributes to this challenge is that each person on the

[1] Jared Diamond, "*Collapse: How Societies Choose to Fail or Survive*", Penguin Books, 2005.
[2] James P. Womack, Daniel T. Jones and Daniel Roos, "The Machine that changed the World: How Lean Production Revolutionized the Global Car Wars", Simon and Schuster, 2007.
[3] Taiichi Ohno, "*Toyota Production System: Beyond Large-scale Production*", Productivity Press, Incorporated, 1998

production line in a lean/just-in-time factory has a cord directly above their head that they can pull to stop the production line. Because the thinking is that nothing is so expensive as waste, anyone who works on the production line can pull the cord and stop the production line whenever they see anything wrong. When they do this the fault that's found is subject to the "5 Whys" method to discover why something went wrong. This one practice turns the management structure on its head. The result is that information flows from the factory floor to the management, rather than the other way round. Managers have to service the problems that are raised by stops in the assembly line. It simply isn't possible for a manager in a Toyota factory to say that everything is going well when it isn't because if things aren't going well the line won't be moving. One might think that this would result in lots of stoppages, and with new production lines, or runs of new products, it probably does. But in the long run lean production compares very favourably with mass production methods, approaching 100 percent efficiency.

Toyota don't have the kind of distant, antagonistic relationship with either customers or suppliers that are normal in the west. Suppliers are not chosen solely on price. When you begin to think about it, you begin to realise that choosing a supplier purely on price is a totally dumb thing to do, especially if the goods and services that are to be supplied are in some way unknown. Basically, if you choose the lowest of a series of tenders you're opting for a tender which is either stupid, dishonest, or both. Toyota develop long-term relationships with their suppliers in which they try to ensure that the suppliers make a reasonable profit. However, they also assume that over the life of a project that the supplier will get better making any particular part, so the price will go down. This gives the supplier an incentive to get better at making the part using all the skill and ingenuity that they can devote to it. If there's a problem with reliability – i.e. if too many faulty parts are being delivered Toyota don't just send back entire batch of parts (as is common in the west). But they do expect to be able to swap engineers with the supplier, and to work with the supplier to improve the process until it is acceptable. Toyota builds complicate networks of suppliers a network which is formed on the basis of continuing relationships. This large business family is known as a "keiretsu". Quite often, but not necessarily, this involves a small amount of ownership by Toyota in its suppliers. Some westerners might regard this close association as too cosy, anti-competitive or nepotistic. There's no doubt that it makes it difficult for newcomers to get into their markets. This is also a downside when companies such as Toyota seek to build factories abroad – their method of manufacture needs a "keiretsu".

Toyota in the past have had a dedicated sales force which sold cars door to door. This seems almost unbelievable to Western salespeople and it isn't necessarily how Toyota would want to do things in the future (maybe they don't do it now, the book is nearly fifteen years old). But this door-to-door selling isn't cold calling, it's calling back again and again and maintaining a relationship with faithful Toyota customers, understanding their family and financial situation and understanding when they will next want a car. Toyota also uses its network of salespeople as a way of giving the customer exactly what they want, both by feeding back customer suggestions into the design of new models, but by also offering a large number of customisation options on existing models. Almost every car that Toyota sells in Japan is unique and exactly what the customer wants, made to order in the factory.

One of the big problems with the western car industry is that it is cyclical. Demand for cars rises and falls. This means that at any given stage in the cycle western car companies are trying to let staff go or desperately looking to take on new staff. One flaw of the lean manufacturing methodologies that have been used by Toyota is that the methods do respond well to fluctuations in demand. Toyota's just in time methods create skilled problem-solving employees who are not easily replaced. Loyalty to the firm is based on the assumption that a job with Toyota is a job for life. This is not as much of a problem for Toyota as it might be because the car market in Japan isn't cyclical. This may be just luck, or perhaps the reason that just in time/lean manufacturing methods have flourished in Japan and not elsewhere, However, since holding on to inventory has been cited as the cause of the "Bullwhip effect" (dramatic rises and falls in demand for a product) and intimate knowledge of the factory of current demand has been cited as a way of flattening the bullwhip effect and reducing its cyclical nature, it may be that the Japanese are making their own luck.

One interesting thing about Toyota's relationship with both their customers and their suppliers is that they both obey a general principle that is voiced by Taiichi Ohno, that in manufacture there should be no "islands of information". Having a distrustful relationship with suppliers (i.e. one based entirely on a single figure of price) results in information hiding, the suppliers aren't likely to own up when they find that making that part is too difficult – they will hope to mask the extra costs of manufacture with

cost of living rises over the lifetime of the project, or by charging way over cost for alterations that are requested by the manufacturer. Neither are they likely to let the manufacturer know if they have figured out a way of making the part much more efficiently. Similarly, by trying to sell customers off-the-peg cars and not keeping track of their customers wants, desires and needs, manufactures are "hiding" from the information that their customers have to give them.

But there are other places that information can hide. Information can hide on the production line – Toyota combat this by allowing every person who works on the production line to be able to stop production if they see a problem. Information can hide in plans, documentation. Toyota try to stop this by communicating with their suppliers using a Kanban system – a system of plastic tags that can be written on that communicate to suppliers that more parts are needed. They also use public signs that can be seen all around the factory letting everybody know how the factory is running, how the company is doing. All parts are delivered on a "pull" basis. The suppliers don't necessarily need to know that the factory is making convertibles today. All they need to know is that when a request comes through for a set of parts they have to satisfy it. This means that the people who *do* need to know that the factory is making convertibles today can change their mind and make estates without having to ring round all their suppliers and tell them.

Often the explanations that people give for success are extremely unsophisticated. I've heard it said for example that Google has become a success because the people who founded it were very clever, had superior technology, and now they can somehow protect and ensure that success because they have so much money. Well of course, if that's the case, then there really isn't much we can do. We'd better just wait for death, like the Greenland Vikings.

Few people talk about the way they are organised. Google came out of Stamford University as did Sun Microsystems. Stamford have an enlightened intellectual property policy which provides researchers with help and support making application for patents but doesn't seek to gain control of resulting companies. Is it possible that this has something to do with the success of Google? Google has a very flat management structure with almost no middle management. Everyone in Google is tasked with devoting one fifth of their time to innovation. This is remarkable enough. What's even more remarkable, especially for anyone who has any experience of working in research is the speed that the products of this research make it out onto the net where they can be evaluated in "permanent beta." What if Google's success is down to these organisational innovations? Maybe that's something we can emulate.

Are there any other kinds of making? Or have Toyota found the final alternative? Looking at the internet might tempt you to think that there are many other ways. Massively complicated computer programs have been "arrived at" on the internet through a process known as open source. Enormous works of reference such as Wikipedia have been created through "crowd sourcing". Tasks that cannot be performed by machines but still require a human being such as translation or transcription can be divided up into tiny pieces and distributed all over the globe. Are there maybe other kinds of making still to be discovered? Have we really exhausted the possibilities?