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From Henry Ford to Joe Justice : WikiSpeed, Manufacturing in the Age of Open Collaboration

PEER PRODUCTION   OPEN SOURCE   OPEN HARDWARE

On **25 October 2012** *by* **Benjamin Tincq**

PARTAGER

If Henry Ford was still around, what would he do to disrupt manufacturing once gain in this new century? He would certainly join Team WikiSpeed, using Agile, Open Source and Modular Design to bring on a Third Industrial Revolution.

Ever since Michel Bauwens brought it to our attention, WikiSpeed has been one of the projects that excited us the most in the Collaborative Production field. We finally had the pleasure to welcome Joe Justice, founder and Team Lead of WikiSpeed, for a series of workshops and conferences in

Rome *(at Cowo360)*, Barcelona *(at FabLab and MOB)* and Paris *(at ENSCI with La FING)*. Here is a synthesis of the conversations and lessons learned from our time spent with Joe.

In a nutshell, **WikiSpeed is a social enterprise applying cutting-edge collaboration techniques borrowed from the software world, to rapidly solve problems for social good**. Their main project is a fast, reliable and ultra-efficient car, whose first prototype was built by a team of volunteers in only three months. This is manufacturing for the age of Open Source and Peer Production, two concepts that are embodied by open communities such as Linux and Wikipedia and are now being applied to the physical world.

A Call for Disruption

Traditional manufacturing was designed after the models of the first and second industrial revolution, in which large centralized corporations concentrate huge amounts of capital required to achieve economies of scale, and rely on intellectual property to protect these investments.

The simplest door of an average car is manufactured from an aluminum sheet, which is pressed in
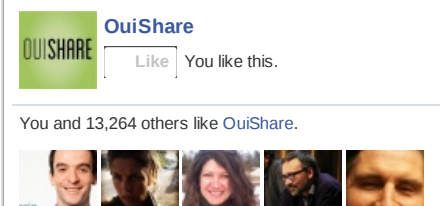
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machine that costs $10 million on average. **If an engineer had a better, safer, more efficient design for that door, the company would ask him to wait 10 years before implementing it**, in order to generate enough sales to pay off the existing door mold.
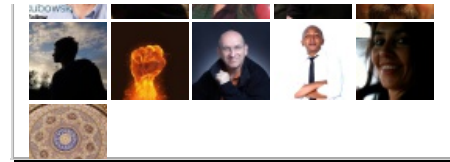
Hence, changes in the automotive industry occur incredibly slowly. Joe gives the example of a Honda hybrid car which, over a six year period, achieved a mere 0.3L fuel efficiency improvement from 4.6L per 100km to 4.3L. Same goes for the Porsche 911, whose parts have been developed over the last 10 years, and which will be around for the next 14 years:

> *In the "future", it would be possible to buy a new car, built after what engineers thought you might have wanted 24 years earlier.*

Meanwhile, WikiSpeed built a working prototype of a car that achieves 100 mile per gallon, or 2.35L per 100 km… in just three months. While "esthetically challenging" (the team called this first model "the orange shoebox"), it ranked 10th on the Progressive Insurance X-Prize competition, ahead of a hundred highly funded competitors such as Tesla, Tata Motors and MIT. Three years later, the WikiSpeed SGT-01 has a beautiful carbon fiber body, making it not only safe and ultra efficient, but also desirable. **You may wonder: how is all of this even possible?**

Open Source and Modular Design

From Joe's words, "this was only possible because the car was modular". Like modern software applications are comprised of several modules, **the WikiSpeed car is a combination of 8 parts that can be dismantled and assembled back quickly**.

> *I don't know whether we will need gasoline, electric or hydrogen cars tomorrow. I don't have to know, because I designed my car so that I can change the motor in about the same time that it takes to change a tire.*

This allows the team to iterate the entire car in hours, or to work on specific parts without impacting the rest of the work. For instance, as a result of feedback from their first crash test, a WikiSpeed volunteer and his son teamed up to build a better front crash structure. They came up

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with a better design in a few days. The whole car can transform from a race car, to a commuter car, to a pickup truck, by changing only the necessary parts.
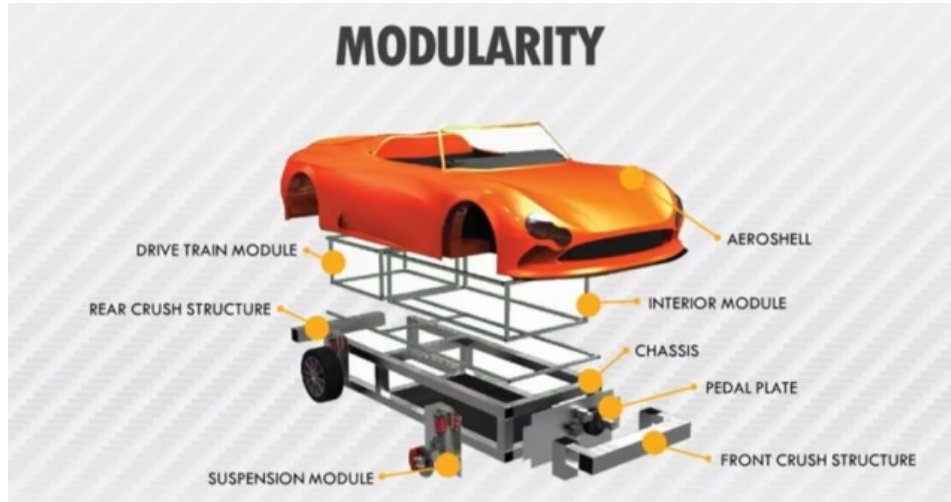
The eight parts are bound by **a modular contract, or a set of specifications ensuring that they will always fit together**, whatever changes are brought to one part or another. Joe also imagines customers or third party manufacturers coming up with custom parts that sit upon the chassis, through what you might call an **AMI, or Application Manufacturing Interface**. This "LEGO mindset" is reminiscent of other modular manufacturing projects, such as the OpenStructures manufacturing grid community, or the Objectomie project (modular kitchen appliances).

To enable interoperability, modular manufacturing calls for Open Source / Free Hardware. On this topic, which might scare your average engineer, Joe Justice is unequivocal:

> *I don't understand people that tell me that open source hardware does not make any sense from a business perspective. The minute they ship their blueprints to China for manufacturing, clones start popping up because there is no IP protection there. Since it's open source "by default", why not open up everything from start, build a true community around your product and co-design it for real impact ?*

With this mindset, the blueprints of the car, as well as the WikiSpeed methodology are shared freely with the community, so that anyone can start building a WikiSpeed car in their garage. Like Arduino, the only thing that is not open source is the brand – to ensure quality control.

Agile, Lean, Scrum, Kanban

In the software industry, projects used to take several years before the customer was able to lay his hands on the product he ordered. This often resulted in delays, cost overheads and disappointing deliverables. During the last decade, **the Agile approach has been taking over software projects management, shortening product cycles from a few years to a few days**. Guess what happens when you apply this to the building of physical products?

JOE JUSTICE PITCHING WIKISPEED

Agile is an umbrella concept encompassing several complementary approaches such as Lean, Scrum, or Extreme Programming / Extreme Manufacturing. All of these share and embody the values of collaboration, flexibility and "getting it done" from the Agile Manifesto:

- **Individuals and interactions** over processes and tools

- **Working product** over comprehensive documentation

- **Customer collaboration** over contract negotiation

- **Responding to change** over following a plan

Being Lean, WikiSpeed uses dramatically less resources to produce a car than your average manufacturer. While the latter uses a $100M CNC milling machine that would barely fit into our workshop room, WikiSpeed uses a $2.000 machine found in the average FabLab for 1/50.000th of the standard cost. While modern cars embed various costly, non-interoperable, proprietary

computers to manage various features ranging from airbags, to gas levels, to air conditioning, WikiSpeed uses a single $20 Arduino circuit board.

> *The tools we use to coordinate ourselves at a global level are Skype, Dropbox, Google Docs, or Scrumy. All of them are free, and none of them existed 10 years ago.*

To organize collaboration, WikiSpeed relies on Scrum, a very simple and effective way to coordinate a team by distributing roles and responsibilities, and enabling the generation and circulation of new ideas. In Scrum there are three main positions:

- **The Product Owner** is the person who has the clearest vision of what should be the outcome of the project. This can and does change on a regular basis - and benefits from regular feedback. The whole team relies on the Product Owner to set this vision.

- **Self-Organizing Teams** deliver product increments during each iteration cycle (or Sprint). **All the work is done in pairs, to enable knowledge transfer from experts to newcomers**, drastically reducing the need for documentation and training, and thus saving time. This approach enabled WikiSpeed to build a car in 3 hours backstage at the Agile Alliance conference, even though relying on people who had never built a car before.

- **The Scrum Master** is a servant leader, helping the team to reach maximum efficiency by guiding them through the application of Scrum principles, while keeping them away from distracting issues. Joe compares it to a coach who brings water to an athlete when needed.

The entire project management system of WikiSpeed is comprised of a giant wall of sticky notes, called Kanban. This board maps all tasks necessary to run the project, from marketing to hardware development, to delivery or finance. Visualizing the task backlog allows any team member to get an instant grasp of what has been done (or pending review), what is happening now, and what is yet to be done, thus avoiding hidden delays. They know exactly how long a task will take, how much it will cost and what features are expected.

All team members pull from a unique backlog which is open to anyone (even the public), and all required tools are at hand in a WikiSpeed garage, enabling anyone to jump in and take ownership of a task at any moment. This includes personal objectives of the team:

> *"*
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> *We found out that when the team was happy, we were able to complete up to 10 times the amount of work we were delivering when the team was just feeling okay. For this reason, we treat our team members as customers. Making them happy is one of our top business priorities, and tasks that support the team morale are prioritized with other tasks in the same backlog.*
>
> *"*

Extreme Manufacturing

Treating hardware products like software by applying modularity and agility principles to the physical world, gave birth to a revolutionary process: **Extreme Manufacturing (XM)**. The name was coined after Extreme Programming (XP) software development by Joe Justice and Marcin Jakubowski, founder of Open Source Ecology. OSE has been developing a set of 50 open source industrial machines capable of building a modern civilization from scratch, and is now using XM after Joe gave an Agile crash course to Marcin earlier this year.

The Extreme Manufacturing approach enables maximum velocity and minimum cost of making changes by **adopting multiple short development cycles rather than a long one**, in order to recieve early and regular user feedback. While standard development cycles in the manufacturing industry take several years, **WikiSpeed has 7 day development cycles – called "Sprints"**.

Applying the mindset "working product is the deliverable", XM applies **Test-Driven Manufacturing**: before any work is done, the team defines the tests for quality goals on criteria such as road-legal safety, comfort or efficiency. Passing the tests while meeting the vision of the Product Owner validates an iteration of a working product. When tests are too expensive to carry out every seven days – for instance, road-legal crash tests – WikiSpeed replaces them by computer simulations, of which the accuracy is refined by real data whenever they can afford a crash test.

We practiced XM during the workshops in Rome, Barcelona and Paris, where Joe guided a bunch of

improvised Product Owners among us through the process:

- **1) Defining the product vision** (role of the Product Owner)
- **2) Crafting user stories** to make the vision tangible for everyone
- **3) Defining the tests** required to validate each user story for the product
- **4) Defining the tasks** that need to be done to iterate the product on each user story
- **5) Prioritize the user stories** (features) : some may need to come before others
- **6) Planning the demo time** to showcase the new current state of the product
- **7) Planning the work time** (including tests) ahead of demo, and assigning tasks

The last two steps basically consist of "Planning a Sprint", in other words: figuring out the leanest

thing that can be done to successfully iterate the product before next week. For this purpose, WikiSpeed hosts a 1 hour weekly standup call with the global team which is distributed across several countries. A short YouTube video of the current state of the product is shown, then people assign themselves tasks; each garage relies on its own Kanban board to optimize its workflow during the week, and all boards are all synced on a weekly basis with Scrumy, a free online tool for backlog management.

Scale or Scope ?

A recurring question from workshop participants was: **is this Extreme Manufacturing or Extreme Prototyping?** In other words, **how does it scale?**

Firstly, scale is not relevant to WikiSpeed. **Cars are produced on-demand**, when a client offers to

pay for it. This implies almost no capital investment upfront to produce a SGT-01 commercial unit, which costs $14K for a $25K price tag. The new WikiSpeed commuter car will be sold around $17K, and Joe is already thinking about a future $1.000 "mini car". R&D being carried out along the way, its costs are supported both by sales and donations made via the WikiSpeed homepage.

WikiSpeed does not grow, it distributes itself. This development model is pioneered by Open Source Ecology and puts the open, independent replication of its business model at the core of its operational strategy. Shared knowledge and radical collaboration allows economies of scope rather than economies of scale, and quality is ensured by common tests and a shared kanban.

> "
>
> *The Distributive Enterprise model is an expression of human-centered economics of collaborative production, where people regain their autonomy in a complex world.*
>
> "

To distribute even more quickly, WikiSpeed members are currently practicing to build cars within a rectangular space marked on the ground. By achieving this, **micro factories could be encapsulated within containers, and shipped to where there is demand for local production**. Once the work is done, a micro factory could be moved to a surrounding area to meet new demand.

The Big Shift

WikiSpeed does not have the ambition to become the 21st century General Motors and produce tens of thousands of cars, even locally. As a matter of fact, at first Joe Justice tried to make Wikispeed an NGO, but the application was rejected in the U.S. under the argument that designing and producing highly efficient cars necessarily entails a 'for profit' motivation.

As its infamous baseline *"rapidly solving problems for social good"* suggests, **WikiSpeed is not just**

As its infamous baseline *"rapidly solving problems for social good"* suggests, **WikiSpeed is not just about cars. Its goal is to use Agile methodologies to rapidly solve humanity challenges**. Energy efficient transportation is the first one they tackled, but the team members have already used their knowledge to deploy the polio vaccine or to build low cost medical centers in countries that need it the most. And that is only the beginning.

"The Big Shift", as the *Deloitte Center for the Edge* named it, is about Culture. **A Culture of Sharing, Openness, Collaboration, and a sense of Higher Purpose**. Modeled after the distributed structure of the internet, WikiSpeed and Open Source Ecology are highly committed to these principles. Other examples include MakerPlane, an open source aviation community similar to WikiSpeed, or Protei a company that builds open source sailing drones to clean the oceans – among others potential uses.

As the most significant crisis of our time continues – the crisis of capitalism as we know it, large-scale and vertical - our greatest challenge may be to reinvent our relationship to goods and knowledge. The *P2P Mode of Production,* propelled by projects like WikiSpeed, may help us achieve this and take first steps towards an Open Source and Collaborative Economy.

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OuiShare Co-Pilot. Former strategy consultant, I now study, write and speak about the rise of P2P alternatives and the Collaborative Economy, fueled by the transformative power of communities.

PROFILE →

2 COMMENTS

ODILE *26 October 2012 à 19h16.*

Really interesting, refreshing read: thank you!

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1

GOOGLE *21 April 2013 à 18h17.*

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other colloids, so it has a selection dial.
These caused localized argyria due to the topical application.
When the H1N1 scare hit the headlines, Web experts saw an instant
thirty fold increase in the registration of Websites with
the "swine flu.

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