Source

A NEW MODEL OF PRODUCTION FOR A NEW ECONOMY

TWO CASES OF AGRICULTURAL COMMUNITIES

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This report presents emerging theory and case studies in the development of a new economic model. The model is interchangeably called both "Design Global - Manufacture Local" (DG-ML)[1] and "Cosmo-localisation",[2] and describes the development of an open design to localised production process. We argue it represents a fundamental shift in the economic production paradigm. This report begins by describing the model and providing emerging theory. The report then moves on to two case studies, FarmHack and L'Atelier Paysans, both examples in the domain of agriculture. The report concludes by considering strategic pathways for supporting this important avenue for human development.

INTRODUCTION

The basic features of DG-ML are based on the conjunction of open source / open design production logics at the global scale, which are coupled with local-network production at a regional scale. Traditionally corporate enterprises have solely owned the intellectual property (IP) they employ in the production of goods. They source the materials for the goods through national or global supply chains. They manufacture those goods using economies of scale in a set number of manufacturing centres, whereupon those finished goods are delivered nationally or globally. DG-ML is an inversion of this production logic. First of all, the IP is open, whether open source or creative commons or copyfair,[3] so it can be used by anyone. Secondly, manufacturing and production can be done independently of the IP, by any community or enterprise around the world that wants to. The advent of information and communication technologies (ICT) and the democratisation of increasingly powerful precision manufacturing technologies, such as 3D printers, laser cutters, CNC routers and automated systems/robots, but also basic and traditional manufacturing equipment, as illustrated in the cases that follow, potentiate this. This does not follow the logic of economies of scale (yet), rather it is focused on producing value for a critical reference group (CRG), a community who require such goods. Thirdly, distribution is localised to the CRG, or affiliates of the CRG.

Besides FarmHack[4] and L'Atelier Paysans,[5] other examples include AbilityMate, a company that supports people with disabilities to design and manufacture their own prosthetics and assistive devices,[6] Wikihouse, a foundation which supports people to design and build sustainable housing,[7] RepRap, an open source organisation that designs 3D printers designed to replicate themselves,[8] and OSvehicle, a company that supports the open source manufacture of vehicles.[9]

	Traditional	DG-ML
Intellectual Property	Held by company and protected by IP regimes	Open and globally distributed - any group can use

Production (and supply)	Produced by the company with national or global supply chains	Produced by anyone / any CRG that requires goods, preferably local supply chains
Distribution	Shipped nationally or globally	Used by local CRG community

Table 1: comparative logics - Traditional manufacturing versus DG-ML

DG-ML is not just the advent of new technologies that can be simply strapped on to the neoliberal globalisation machine. DG-ML in fact represents the instantiation and operationalisation of a new economic system that draws from an emerging worldview. Drawing from relationships and experiences with people involved in DG-ML, we believe it represents a substantive cultural shift in the orientation of material producers/consumers. It rejects the way in which industrialisation has decontextualised inputs and outputs and associated externalities. It is thus allied to the vision for building circular economies, the idea being that the production materials used in a DG-ML process are sourced as locally as possible, with waste outputs utilised as inputs elsewhere, eliminating unnecessary supply chain associated costs and impacts. It is also connected to calls for a post-growth economic model, sustaining livelihoods based on measures of wellbeing rather than corporate / economic growth.[10] It is interwoven with the open source movement, a vision for a digital commons where the legacy of human creativity is shareable. It draws from a planetary imaginary where local development work is responsive to the planetary challenges we face.[11] It is in fact part of a movement to create an alternative globalisation,[12] and an expression of an emergent worldview: global ecological integrity versus overshoot, peer worker solidarity versus national competition, value pluralism versus the monoculture of GDP.

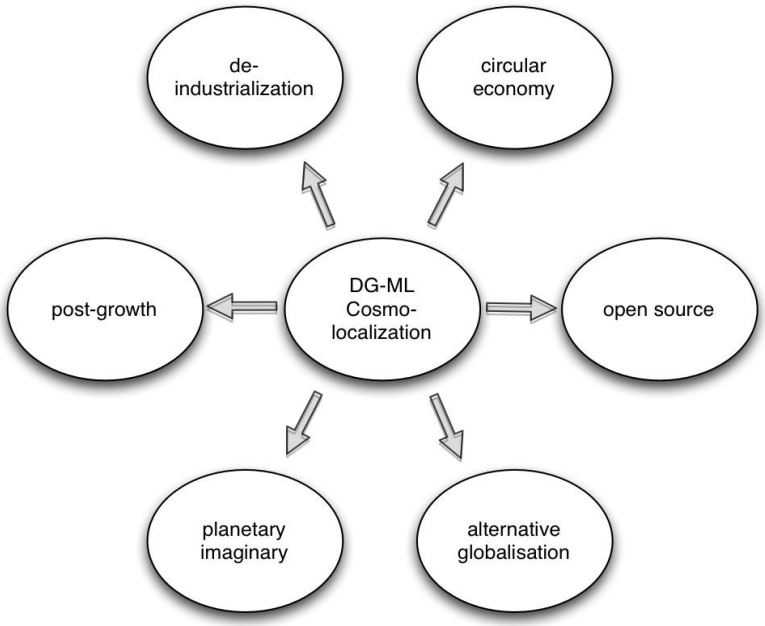

Diagram 1: paradigmatic cohort for DG-ML / cosmo-localisation

ORGANISATIONAL FOUNDATIONS

The organisational foundations of DG-ML fit strongly into our existing understanding of theories of the peer production of the commons developed by Bauwens and colleagues at the P2P Foundation.[13] In their explanation, there are three organisational forms that come together to form a symbiotic system: a producer community, a for-benefit organisation, and an entrepreneurial coalition.

- A **Productive Community** is a group of people who peer produce common and shared value. Resources such as designs, methods, software, etc.
- A **For-benefit Association** (an organization, trust, or foundation) provides institutional capacity to support and protect the efforts of the Productive Community - "independent governance institutions to support the infrastructure of cooperation and empower the capacity for commons-based peer production." [14]
- An **Entrepreneurial Coalition** translates the common resources peer produced by the Productive Community with the marketplace to "secure[s] either profits or livelihoods by creating added value for the market, based on the common resources"[15]

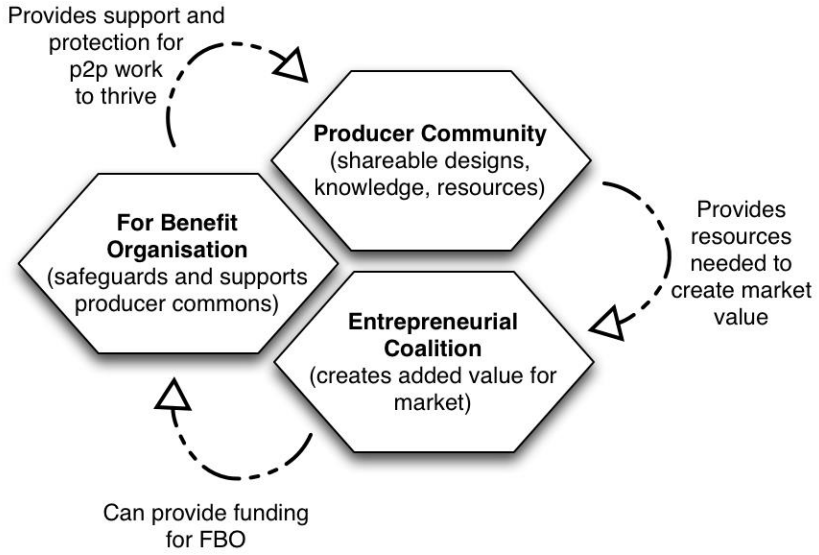

Diagram 2: the peer production system

The case studies we present show that, even with a burgeoning pool of global designs, a local design and production community sits at the heart of the process. These communities follow approaches similar to participatory action research, where they engage in cycles of problem solving for themselves in conjunction with a constellation of support systems. As with PAR, documentation is critical for enacting open source design principles. As with github and other open source efforts, without documentation there

can no open source design commons, whether local or global. Support systems include the platforms used for sharing and documentation, state support, open source software and hardware, "design sherpas" which can help the CRG find useful designs from the design commons, and can support / translate this into engineering for CRG applications.

Thus the DG-ML process is neither top down nor bottom up. As mentioned, DG-ML is not top down because the CRG is critical in driving design and organisational iterations for mutualised community problem solving. Likewise, DG-ML is not just bottom up, because manufacturing without the aid of a global design commons and expert assistance is a recipe for a harsh survivalist / life boat development approach. This brings to bear the central role of gatherings (conferences and jams), for linking and mixing the local with the global - highlighting the role of the organiser and community building. Overall DG-ML is a co-production between an emerging global design commons, software, hardware, peer to peer platforms for circular economy, machinery and production equipment.

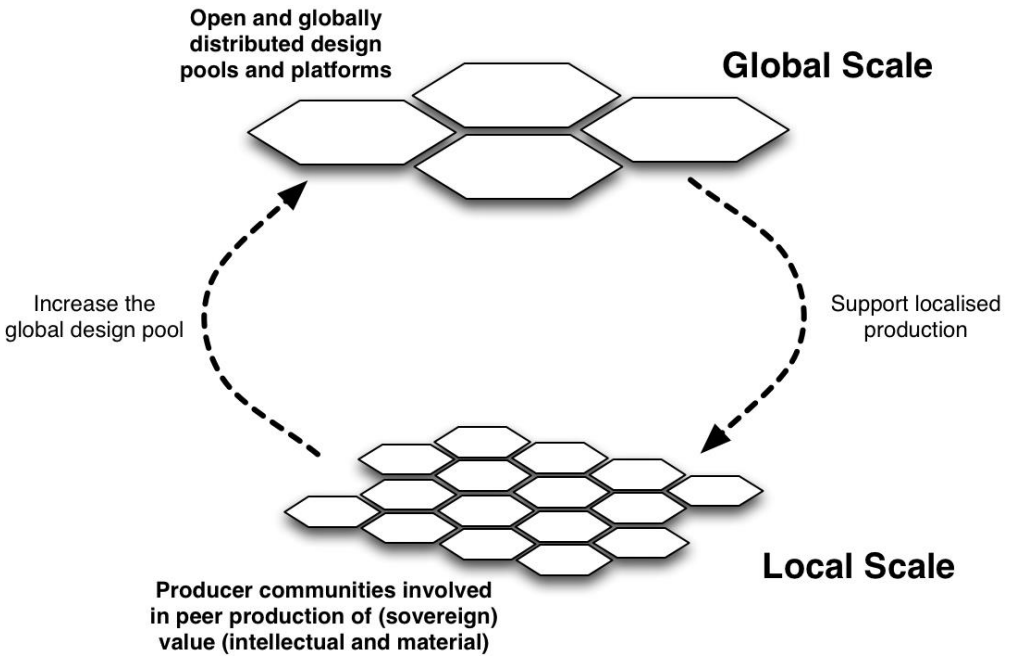

Diagram 3: DG-ML co-production model

BROADER SOCIAL TRANSFORMATIONS AND DG-ML

DG-ML connects two scales of community: the global scale, interweaving the commons of design through software platforms, conferences and other modalities that pool de-territorialised resources for common use; and the scale of the local where people pool embodied resources and create localised commons which potentiate livelihoods. At both scales people are peer producing commons. The transformations in web technology and the emergence of Creative Commons and GNU licenses as legitimate formats has meant

that it is fashionable to see commoning as digital and platform based. The case studies in this report, however, indicate that the localised process of commoning, revealed through processes similar to participatory action research, are both fundamental to an effective application of DG-ML, and they are co-constitutive of the global scale of commoning - that is to say that the global scale of commoning is not possible without the local/embodied. We can make the proposition that DG-ML co-mingles a very modern conception of commoning, the digital commons made possible by the network form, with an ancient conception of commoning reminiscent of early tribal peoples who depended on reciprocity and gifting systems for their survival.[16]

L'ATELIER PAYSAN: PEASANTS BUILDING THEIR OWN TOOLS[17]

L'Atelier Paysan literally translates as the "peasant workshop". It emerged in 2009 as a subgroup within an association for the development and promotion of organic agriculture called ADAbio in Rhone-Alpes (a region in the south east of France). It all began when the founders of this project Joseph, an experienced organic farmer and a member of ADAbio, and Fabrice, a very politically aware carpenter, realised that farmers could genuinely benefit from each other's tool-building experience and creativity. So they standardised, documented and disseminated three essential pieces of machinery that had been developed by Joseph along with other farmers and were utilised in permanent beds (one of the basic methods for soil management in organic agriculture). This effort was well-received by the farmers in their network so more tool-building knowledge was accumulated over the next three years from farms in the area. Sixteen farmer-build tools were standardised in total. Their designs were then printed in a comprehensive guide-book complete with blueprints and pictures, in order for more farmers to be able to construct them in their own farm.

Meanwhile, in 2011 the first workshop took place. The tools made by AP are, almost, entirely made of metal. Ten farmers attended the workshop to learn how to work metal (basically cut, drill and weld) and at the same time attempt to assemble some of the aforementioned tools. The workshop was quite successful with the farmers producing eight tools by the end of a week. At this point these farmers along with Joseph and Fabrice established ADAbio auto-construction, which was basically the branch of ADAbio that was promoting the self-building of machinery by farmers. At the same time, first utilising various internship programs funded by the French state and later through regional state funds they managed to hire people with specific sets of skills to assist in their endeavour, like for instance engineers and political economy graduates. After that, the first season of workshops began, where farmers learned metal-work and

built the first three machines. Initially this activity was exclusive to their region but later expanded to others.
While their workshops started attracting more farmers from all over France, the group began developing more tools along with farmers that were not limited to organic agriculture but included all types of small scale farming. For instance they worked with wine and fruit producers, cattle farmers and farmers utilising horse power. As their activity expanded significantly it became obvious that ADAbio could no longer facilitate this work so in 2014 L'Atelier Paysan (hereafter AP) was founded. As a legal entity AP is a cooperative whose stakeholders are the individuals (mainly farmers) and groups (other farming and solidarity organisations) that belong in the wider network of AP. The base of operations of AP is in the Rhone-Alpes region while one of the first engineers to work in the project has established a branch in the region of Brittany (north-west of France).

AP workshop participants prototyping a tool

ORGANISATIONAL FORM

As already mentioned AP was initially conceived by a group of farmers led by Joseph Templier and Fabrice Clerc. Their activity was institutionalised through ADAbio, the organic farming association they were all part of, forming ADAbio Autoconstruction. Within ADAbio they managed to secure funds for paid internships and later regional funding to initially employ an engineer and a development officer. This enabled them to expand their activity and the number of farmers involved. Over the years it became apparent that ADAbio could no longer facilitate this operation so the decision was made to create the not-for-profit cooperative that was named L'Atelier Paysan. The structure of the organisation could be illustrated as an inverted pyramid with the cooperative at the top; the core group in the middle; and the executive team in charge of implementing the action plans at the bottom.

The actors that were directly involved in the endeavour were invited to become shareholders in the cooperative in order to be able to contribute to the decision-making process. These actors, which basically form the AP network, include various active farmers, farming associations, solidarity associations, groups that assist farmers and individuals that are active contributors to the mission on AP. According to the French legislation the maximum number of shareholders for the current form is 100. Above that number the legal entity is required to switch into a public limited company. This is not deemed desirable due to the prescribed structure of such companies, hence potential shareholders are carefully selected. Groups are generally preferred over individuals since that way a single share may represent more people. The shareholders meet physically at least once per year. Their annual meeting involves discussing what has been achieved the previous year; plans for the next year; voting for the admission of new shareholders; and various activities and promotional events.

An AP meeting

Furthermore, the core group of AP convenes over the telephone, as the constituents are spread all over France, once per month to discuss current issues. This group is comprised of shareholders but often also others, such as people with a special skillset or insight on various issues, are invited to participate. These people may end up in the shareholder group if their contribution is considered valuable. For instance, a farmer with previous experience as a patent lawyer was invited in 2015 to provide counsel for a potential infringement case. He later became a shareholder as well. Similarly a farmer/web developer working on the AP website also became a shareholder.

The cooperative currently has ten full-time employees and three volunteers (paid) tasked with the various essential activities. While most do not have a background in agriculture, it was made obvious through interviews conducted with them, that they all seem to share the vision of the AP. Besides Joseph and Fabrice, who act as CEO's of the cooperative, there are three engineers, an architect, a web developer and five more individuals in charge of administration, development and dissemination. Several of these employees have become shareholders in the cooperative over the years.

The size of the operational group of the cooperative is considered to be the ideal in order to facilitate the amount of activities decided upon by the cooperative. Should the need for further expansion come up, the group is reluctant to increase the size and complexity of its activities. Instead they propose the creation of more similar groups which would form a network of cooperation and solidarity.

ECONOMIC MODEL

The AP cooperative is non-profit in essence. Its shareholders receive no dividends and the shares are not re-invested. Whatever positive balance the cooperative has every year goes into an indivisible reserve which funds their activities. Acquiring a share will provide the shareholder the capacity to influence the decision-making of the AP network. By redeeming it the shareholder will either receive the original value invested or less if losses have occurred. AP does not sell its services to individuals or other companies. Thus, in order to provide funds for its operations AP has developed a multifaceted support model.

At first mostly relying on the assistance of the founding farmers and some regional funds for rural development, over time the workshops became established providing an important source of income for the organisation. Contributions by farmers participating in the workshops make up for a large percentage of the budget. These contributions finance the development of new technology; the maintenance of AP's equipment; and support the participation of farmers that are unable to make a contribution. However, by tapping into a special mutualised fund for vocational training and skill development, AP manages to reimburse the contribution each farmer makes in most cases. At the same

time, they buy raw material and equipment in bulk and then resell them to farmers below market prices but still making a very small profit. However, they do not manufacture nor sell any of the machines that they produce, besides those manufactured in the workshops which are then acquired by the farmers that, in turn, pay for the materials.

Further, financial support comes from crowd-funding as well as various solidarity organisations. For instance, more than 20 groups belonging to the CIGALES association (solidarity financing groups from all over France) offer their support to AP. Last, important financial support (about 40% of the budget) comes from national and regional funds for agricultural development that have recognized AP's contribution to the development of agriculture in France. All of the financial activity is made public in the AP website.

MODE OF OPERATION

The activity of AP is two-fold: on one hand they engage in research and development of new technology and on the other they disseminate technological know-how.

Knowledge transfer

The first of the two main goals of AP is to enable farmers to create their own machines and tools. The AP is based is in the region of Rhone-Alpes along with its branch in the Brittany region. However, they own three fully equipped trucks that function as mobile workstations which enable them to transfer their activity all over France. They conduct workshops that last 3 to 5 days in farms and warehouses. The nature, location and time of the workshops are defined by the farmers themselves at the end of each year according to their specific needs and time availability. The workshops are usually conducted by one of the engineers working for AP. There, the farmers are initially instructed on and familiarised with metalworking (basically drilling, cutting and welding). Then they collectively engage in the manufacturing of one or more machines following the comprehensive instructions drawn up by AP. All participants are urged to engage in all stages of the manufacturing process in order to acquire the full skillset required to be able to recreate it and, more importantly, to experiment, modify, improve and maintain their own machinery.

An AP workshop

The farmers attending might have some previous experience but often they do not. They usually tend to be engaging in similar agricultural activity so the machines built in each workshop target certain needs of the specific group. The farmers that provide the funds for the materials get to keep the machine(s) in the end of the workshop. Some workshops are for prototyping purposes. In these, a certain piece of machinery is experimented upon and manufactured for the first time by the group of farmers that designed it along with the AP engineer that assisted them. The blueprints for the machine built each time are printed out along with lists of tasks and placed in a prominent position in the work space. These are used as points of reference by the farmers in the manufacturing process of the workshop. The level of detail allows the farmers to carry out the whole process themselves, with the engineer supervising and instructing when needed. Beyond observing and learning from each other, through these workshops, farmers can socialise and share ideas and tips with regards to their farming activity as these workshops are quite intensive and require them to spend several days together sharing meals and possibly lodging.

AP participant working on a machine part

Technology development and dissemination

As previously mentioned, AP started as an attempt to gather, systematise and disseminate essential farm equipment created by farmers. This is still a primary goal for AP. For this reason, its people travel across the country, meeting with farmers and gathering information on farming equipment and as of recently farm buildings as well. This information is codified and uploaded in the AP forum for anyone to access them. Several groups and individual farmers have been inspired by AP and have created machines that were later uploaded in the forum. For instance the "Charimaraîch"[18] is a machine built by a group of small-scale vegetable farmers called ALADEAR which was then featured in the AP forum. The forum post includes the design and pictures of the various versions of the machine. There are over 500 posts in the forum containing instructions and conversations regarding farm machines, methods and buildings.

Beyond that, AP enables the creation of new technology from farmers. Machines that are either non-existent on the marketplace, too expensive or not suitable for small-scale and organic farming. These machines need to be modular, easy to replicate using materials that can be upcycled or easily sourced. However, in order for AP to engage in a project the ethical principles of the community must be met.

A photo of the Charimaraîch

A group of at least 5 farmers with a specific need or idea need to be gathered, since AP will not work with individuals. Then an engineer-facilitator is assigned to the project and the design process begins. After several meetings, feedback and exchanges a design is finalised and the prototyping process begins. The farmers need to be involved in every step of the way and the prototypes are produced after consensus is reached amongst them. The prototyping process is documented and uploaded in the AP forum. The farmers then test the prototypes in the field and, having acquired the necessary skills in the workshop, they make modifications and adjustments. After the testing phase is completed the AP engineer produces a complete and comprehensive blueprint for the machine which is then uploaded in the list of machines of the AP website. Yet AP points out that these designs are not final and it is up to the users to further develop them according to their needs and knowledge. Indicative machines are the "Dahu"[19], a machine specifically developed for wine-makers with fields in steep slopes which is currently tested by the farmers, and the "Sandwich"[20], a tool for orchard cultivation created in collaboration with an organic agriculture group called GRAB.

This process may also take place in order to improve or modify an already existing machine, like in the case of the "Neo-bucher"[21] which is a horse powered tool developed in the 1950s. The Hippotese association of farmers that work the land with

horses approached AP in 2013 to improve the tool. Several versions of the tool have been released since then. The tool, having been tested and standardised by AP, is featured in the website machines. Further, AP may work with other groups, beyond farmers, that produce tools for farming provided they share the same principles. For instance the "Aggrozouk"[22] a pedal powered tractor was developed by an independent group of makers called Farming Soul. AP was later invited to help improve the machine.

The Neo-bucher in action

FARM HACK: A FARMER-DRIVEN PLATFORM FOR KNOWLEDGE EXCHANGE[23]

Farm Hack (hereafter FH) emerged as a collaborative effort of farmer activists. It was first conceived as a gathering to brainstorm and produce ideas for various tool-related problems on farms. The first FH event was a big success, leading to the hosting of several more events in the USA and later all over the world and also the establishment of a large and decentralised community comprised mostly of farmers. From within the FH community emerged a digital platform that functions as communication, coordination, dissemination and, to some degree, a technology development tool. Primarily the platforms functions as a database of tools that have been built, modified and shared by the community. The tools are released under a creative commons license for everyone to use and modify freely, provided they will release the designs under the same licence.

FH was established in 2011 after the first event that was organised by the Greenhorns and the National Young Farmers Coalition (NYFC), non-profits that provide support for young and small scale farmers in the US, in collaboration with engineers from the Massachusetts Institute of Technology (MIT). Joined by a third non-profit named Greenstart, which focuses on resilient and sustainable farming practices, and individual farmers, FH inspired by the open source culture, would bring together farmers, designers, engineers, academics and activists in events to engage in dialogue; skill development; tool design, building and demonstration. The results were then documented in the FH platform in order for other farmers to access. Over time the platform was joined and enriched by farmers from all over the US but also other countries and currently features more than 500 tools. The content can be accessed by everyone and is open to improve or modify to whomever joins the platform.

ORGANISATIONAL FORM

FH had no legal entity of its own at the time of its conception, nor any type of dedicated organisation. Instead, support was provided by the aforementioned non-profits, which primarily organised the FH events and built the platform. It relied almost entirely on volunteer work from the expanding FH community in order to build the platform and run the events. Activity in the early years of the community was heavily centralised and guided by the participating organisations, specifically the Greenhorns and the NYFC.

While the community grew however, FH acquired a non-profit status in 2013. Having a legal form it managed to receive some funding through grants to make improvements on the platform and provide funds for the short term employment of two of its constituents, who worked on community outreach. After this point the community became more independent and decentralised and relied entirely on the support and time of its constituents as well as its partnerships with other organisations, rather than attempt to secure funding to employ people and acquire resources. This has, inevitably, led to reduced momentum, given the fact that everyone is contributing their time voluntarily. Yet the consensus in the community is that it should keep relying on the constituents' voluntary contribution rather than employ workers for its operations.

FH lacks any formal structure. As a non-profit it has a board of directors, however its role is mostly nominal. Instead, every member of the community is free to contribute to the decision making process. Practically, this means that the constituents most engaged in FH activities end up being the ones most involved in the organisational structure. It is a "do-ocracy" of sorts, as a FH member with a software development background put it. At the same time the platform has been incrementally improved over the years in order to provide a more easy and independent use to the users. Thus making, for instance, the tool documentation process better as well as providing a detailed template for users and affiliated organisations/groups to organise FH events autonomously.

ECONOMIC MODEL

FH, as a non-profit organisation and a community, does not engage in any type of financial activity. For its operations it relies mostly on the contributions of its constituents and initially on the resources of the participating organisations. After acquiring the non-profit status its collaborations with other groups allows it to utilise their resources as well. There have been instances, as previously mentioned, where some small grants have been acquired in collaboration with other organisations. These funds were directed towards employing community constituents, who were already volunteering their work to FH, to work more intensely for short periods of time, namely on improving and maintaining the platform and community coordination. A topic under consideration within the community is whether acquiring funds to employ individuals for more systematic documentation of tools should be pursued.

Having said that, some of the most active farmer-inventors contributing tools in the platform have invested a considerable amount of their time and resources in prototyping and documenting. An important topic of discussion within the community is how to enable a business ecosystem to thrive around the platform that may provide sustainability to individuals and groups dedicated to the FH principles. Individuals are free to engage in commercial activities. As long as the basic principle is maintained, that of openly sharing, users may add in the description of their contributed tools, and they can also sell them or some sort of service to those that would prefer to purchase them rather than invest the time and effort to create the tool themselves.

A FH workshop

The FH platform features an "open shops" component where "businesses and organisations invite other users in to see what they have been working on, the events they have hosted or will host, the tools they've worked on, and the conversations they've been involved with". Their ultimate goal with the open shops is to provide a simplified toolset for users or groups to sell their tools or components or even certain services. Commerce is considered important according to the FH ethos as "regionalised manufacturing makes for resilient economies and tools which are customized to a farmer's particular needs".[24]

MODE OF OPERATION

FH's operations revolves around activity in the platform and the events, with the documentation of the event resulting in the platform.

Farm Hack events

As previously mentioned the Farm Hack events were in the early years mostly organised and facilitated by the organisations involved with FH. Over time, as the community grew more independent and decentralised, a detailed guide for events was developed and featured in the platform to enable the constituents and affiliated organisations to host events. Certain requirements should be met for a successful FH event and the guide offers various suggestions to meet them. In general, these events are problem-solving oriented with various specific goals. For instance they may involve conceptual meetings to brainstorm new tools; collaboratively design, build, or document tools; skill and know-how transfer; software hackathons. Documentation of results, despite the type of activity, is always encouraged in order for the entire community to benefit from these events. Further these events are opportunities to attract new adherents and constituents and for existing ones to socialise.

A brainstorming session

Farm Hack platform and The FarmOS

The Farm Hack platform is a software platform developed by community constituents with software development skills and it is based on various other open source tools. The platform serves both as a coordination and collaboration tool for the community and as a tool database for the ones that have been individually or collective produced. These may not only be operational machinery. It might be a ready commercial product, a prototype, a do-it-yourself fix, a concept design or even an idea submitted for collective brainstorming. While there has been a steady influx of users and tools, the platform has not been very successful as a collaboration tool, with most of the coordination happening "behind the scenes" and the collaborative tool development taking place in physical spaces, like the events, rather than digital. Further, proper documentation of both processes and tools is an issue that the core group is trying to improve, as it is a time and effort consuming process. Updates in the platform are driven by community feedback as well as other content featured, like for instance the FH blog.

Some community constituents are also involved in the development of FarmOS, a web based tool based on Drupal, which is also open source software. FarmOS allows farmers to keep records, plan and manage their farms. Contrary to other similar proprietary platforms, farmers do not have to sign off their data in order to use the service. Yet, the idea here, much like with the FH platform, is to share the data in order for everyone to benefit from the common knowledge as well as share them with researchers and service providers in order to receive expert help.

CONCLUSION

These two cases provide a window into an emerging economic model that we are just beginning to understand. The cases demonstrate the peer production of shared value and common resources. However, unlike the open software movement, the mode of co-production within these cases are highly localised, members are collaboratively prototyping, designing and experimenting with machinery. These cases can be considered to be prefigurative, they are potential indicators of things to come. The logic of peer production has hit an important threshold, it is now instantiated through physical / material production.

Yet the cases also demonstrate growing pains. For Farm Hack questions still remain concerning their financial viability and the challenges of sustaining the producing communities. Is a weak for-benefit organisation enough to facilitate the healthy growth of their network of peer producers? For L'Atelier Paysans, there are less problems with financing the operation, but more questions about how an entrepreneurial coalition is activated.

Looking ahead, what might we take away from these case studies that may allow us to see the faint future outlines of an alternative political economy?

The emergence of the network form and the logic of commoning embodied in DG-ML practices as demonstrated in these case studies, provide us with some of the seeds from which to begin to imagine an alternative future for political economy. DG-ML challenges the logic of zero sum competition, which is at the heart of our nationally based (and globally connected) capitalist systems. In the current system we are used to national governments supporting national industries to compete globally, win market share and take the lead in technology and innovation. The DG-ML model is part of the birth of a globally cooperative system, the design innovations from one community in one part of the world can be used and adapted for a community in a wholly different part of the world. Instead of systems of competitive advantage and capturing of market share, technological adaptation is community-based and meant to sustain the livelihoods of critical reference groups. While there is theoretical scope for larger industrial scale DG-ML which is able to produce for regional markets (cities of 4-20 million people for example), the examples in this report show a commitment to the adaptation of design and technology for local critical reference groups, rather than competitive marketing strategies.

This then can also help us to reconsider the role of the state with respect to industry and material production. If DG-ML helps regions to rupture from the zero-sum logic of competition, states may develop policies in which support is given to both scales of the DG-ML coproduction system - global and local. At the scale of the global, national policy can orient knowledge production to be open in a way that potentiates industry in material production society-wide and indeed worldwide. At the scale of the local state policy can support communities and local regions in bootstrapping enterprises and productive communities that can instantiate the potential and value of DG-ML processes, through participatory action research processes. This has been referred to as a partner state model.[25]

Finally, because DG-ML is growing from within the dominant capitalist economy, it is important that the value of a global design commons is not simply captured by capitalist industry as a way to lower its operational costs, without having to reciprocate by entering into the coproduction of the commons. It's important, therefore, to begin to consider how to create virtuous cycles in the value exchanges between different actors in the global DG-ML meta-system. Some ideas in this vein may be the development of copyfair licences (commons-based reciprocity license),[26] useful for trans-nationalising a generative circulation of value across commons based initiatives - a form of "open cooperativism",[27] and through which the capitalist/corporate sector would need to concretely reciprocate into if it wished to draw upon it in the first place. This would

conceivably require new global institutions that would be able to provide legal and administrative power in supporting, enacting and protecting an open cooperativist regime of knowledge and value exchange.

The potential for DG-ML is to liberate the human heritage of knowledge and design, so that communities and people anywhere have the full array of technologies and capabilities to address their living economic and ecological challenges. If we want to accelerate the human capability to enact sustainable development strategies across the world, the right to global designs and concrete support for building local livelihoods are fundamental pillars. The case studies presented here provide hope grounded in practice. Building on these courageous pioneering efforts will be the next challenge.

ENDNOTES

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