

Exploring the Essence of A Multidimensional Ecosystem for 3D Printing industry

-Evidence from Technology and Social Innovation

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1.0 Introduction

It is actually a reality today that we can download product data from a website, perhaps re-programme or personalise it to our own preference and taste, and have that information send to a desktop machine through which the product be

consumer-centric value logic. Meanwhile, the analysis of the business model components has become the trend of research. Cabirio et al. [3] emphasise the use of new 3D printing technology in design enterprises should be coupled with proper business model components. Besides that, 3D printing combines the industrial manufacturing with the structure of marketing, in which Jan et al. [4] referred that most manufacturing processes have been “subtractive” in that matter is removed (e.g. scraped, dissolved, turned, machined) from a substance in order to produce the desired product. 3D printing turns traditional manufacturing on its head in that it uses an “additive” process. In addition, without the feasible and practical business model, it will typically be a real barrier for the development of 3D printing. Thierry and Ludmila [5] figured out the pitfall situation made by the lack of effective business model, and they thought 3D printing technologies have the potential to change the way business model innovation, by enabling adaptive business models and by bringing the “rapid prototyping” paradigm to business model innovation itself [6]. Similarly, cost control, value capturing and the social cognisance like law and ethics have been the focused issues in the research. For instance, Christian et al. [7] identified AM enables the production of complex and integrated functional designs in a one-step process, and the adoption of AM allows a firm to increase profits by capturing consumer surplus when flexibly producing customised products. Meanwhile, legal issues, especially in the view of intellectual property rights, mainly occupied the dominant research fields in law [8]. Davis [9] pointed out that the DIY (do-it-yourself) community which consists of self-designed software programmes will be at the risk of infringing patent law and copyright law. Gerald [10] argued that the current arms control and transfer policies are adequate to cover 3D-printed guns, which proves that there is still “grey area” for 3D printing from the perspective of law and ethics. Social framework still needs to be

customer-centric structure, production en mass and small scale production, the ownership and lease of means of production, the difference of standard-settings, and so on. The comparison will reconstruct the current business model, legal system, even the social framework and the way of observing the world when the internet and the thought derived get involved (Figure 1).

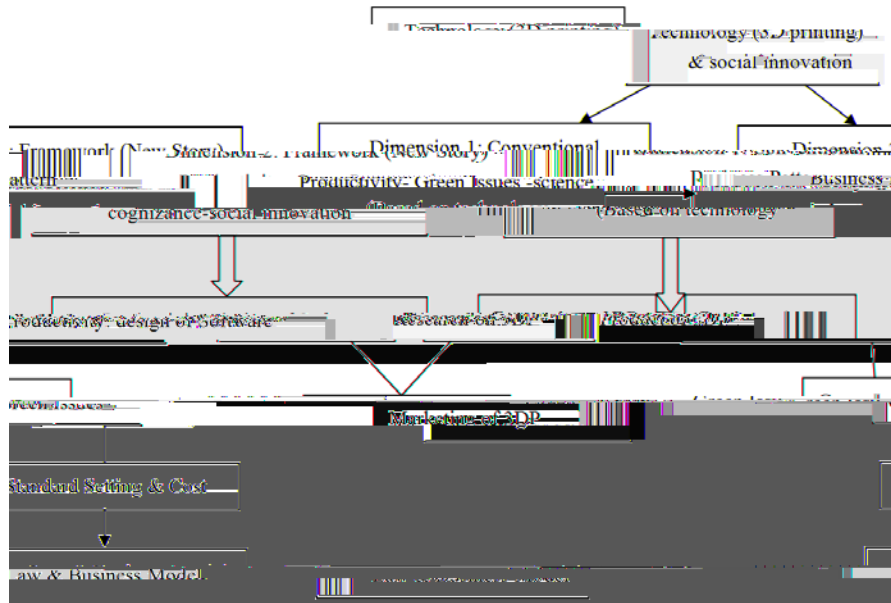


Figure 1: Reconstructed business model

Therefore, the multidimensional reconstruction of additive manufacturing, embeds in the system of internet network, reviews the conventional circulation by the traditional business pattern, and reorganises the potential framework which will happen in the future.

4.0 3D printing: from Technology-changing to Society-changing

The advance of technology leads our way to the future and success, although we humans hardly meet the rapidly growing requirements. Currently, technology has been embedded into the entire facet of industry, from the industrial design to the physical production. Both the capital investors and engineers try to make the effort to create a win-win business pattern for benefit sharing. Nevertheless, the social framework brought about in the technology-oriented change fundamentally has got changed as well, resulting in a veritable innovation.

4.1 The Conventional Business Pattern 4

What aroused our notice is that all these 3D products are very intricate due to the quite extraordinary design. With the application of 3D printing skills, we can actually create structures that are more intricate than any other manufacturing technology, or in fact, that are impossible to build in any other way. The 3D technology skills can be applied successfully to produce moving components, hinges, parts with parts. So in some cases, we can abolish totally the need for manual labour. Today, architects could build the house which is almost three meters high by an architectural firm called Shiro. And it was built by depositing artificial sandstone layer upon layer in layers of about five millimeters to 10 mm in thickness slowly growing this structure. And on the other end of the spectrum, a microstructure could be created depositing layers of about four microns.

So, above all, what is the essence of additive manufacturing, 3D printing? We think the change of mode of production perhaps would not cover the features or traits of this technology while the combination with IT will give the new birth to the additive manufacturing. The process of the operation is visible because a consumer could stand aside the printing machine and watch the process of the

standardisation in the conventional pattern, customisation represents the trend catering for the target consumer group. As the design data of 3D transits via the internet, the productivity will be greatly released and enlarged.

5.2.2 Biological Adjustment: Green Issues

The additive manufacturing rather than the subtractive manufacturing, produces only the products without the waste. The role of human gradually forms the bridge which links the manufacturing and green issues. For example, 3D printing may inadvertently also help to achieve some of the most urgent environmental and resource goals facing the international community. The transportation and manufacturing carbon footprint of many products could be reduced as DIY designs by human, rather than products, are shipped around the world.

By significantly reducing waste in the manufacturing process, 3D printing also could enhance global “resource productivity”—that is, getting more “product” out of the same quantity of a given resource. This could ease the growing gap between supply and demand for non-renewable resources.

5.2.3 Technical Cognition: Standard Setting & Cost Control

Technical Cognition refers to the growing understanding which vastly depends on the development of technology and the application by the operator. Here the paper will clarify two issues, standard setting and cost control which fall into the category of technical cognition.

National standard and industry standard do always exist in the conventional industrial society, though how to make standard-setting has been the key focus of the 3D printing. With respect to the fixed standard in the old times, the standard setting in new times will be constantly flexible and diversified because of the human factor. It will soon prove that there are two levels of standard setting in 3D industry system which is apparently divided to fixation and flexibility. They are usually referred to as traditional standard and standard by DIY customisation.

In addition, the cost control in 3D printing will be much easier than in the conventional industrial manufacturing. That is to say, the means of production appears less important. For instance, it is hard to imagine that the student who would like to copy a book never goes to a printing plant on account of the cost control by the printer. As long as the industrial engine of printing machine starts, it will cause a money-loss resulting in no copy for the student anymore. On the contrary, in the circumstance of 3D printing, the customised products will never pass through the roaring machine, and they are just produced by the way of small scale production.

It is supposed that someone in Shanghai wants to buy a birthday gift for his friend who works in London now. This person could rent a 3D printer via online renting process instead of buying it. He can then customise the shape, colour or other

This kind of environment of 3D printing involving design of software, green issues, standard setting, cost control, legal system and business model profoundly change our way to adapt to the contemporary society. The multidimensional system is gradually evolving into a social organism with manifold contradictions. These conflicts are the essential elements integrating in the process of crashing and collision, in which we could find the conflicts between additive production and subtractive production, production en mass and small scale production, ownership

This involves having the right product at the right price in the right place using the right promotional methods. These are known as the 4 P's - product, price, promotion and place. The marketing mix elements have to be 'blended' by marketers in an attempt to satisfy customer needs and wants. 3D printing technology is currently changing people's understanding to 'Product' and making replacement available, which also arouse lots of changes in the other 3 Ps, i.e. price, place and promotion. Below are the examples which indicate how to integrate 3D printing technology application into marketing teaching. Below are the examples which indicate how to integrate 3D printing technology application into marketing teaching.

- Pricing topic and 3D printing impact: For instance, 3D printers are being used to create low cost prosthetics where they are most needed, especially to those who lost their limbs during the war and cannot afford a replacement. The idea to create cheap, customisable prosthetics that anyone can afford will become main stream and help transform the lives of the affected [13].
- Place topic and 3D printing impact: It is incredibly expensive if you plan to transport items to space. However, with 3D printing available, they can print out parts, tools or other items they need in the event of an emergency. NASA announced that they will ship a 3D printer for trial purposes to the International Space Station in August 2014.
- Sustainable marketing and green consumerism: Environmental sustainability aims at getting profits while helping to save the planet. Today's greening activities focus on improving what companies already do to protect the environment and look to the future. The majority of plastics used today is non-biodegradable and poses a threat to the environment. However, these plastics can actually be recycled into filaments used in 3D printing. It is found that turning your recycled plastics into spools uses less energy than conventional plastic recycling. That is to say, 3D printing can help save the environment.

New products are important—

8.0 Conclusion

Throughout the whole paper relevant to the emerging additive manufacturing, 3D printing is reshaping the world. The development of 3D printing technology and its application into different fields are actually challenging many so called mature and solid social science, legal and marketing concepts.

When delivering such as a unit of Marketing Principles, it is preferable to apply research-oriented teaching approaches during my marketing teaching delivery and link relevant 3D printing-related case studies with related marketing topics which are always followed by group discussions. What surprises and fascinates students is the power of 3D printing. Its existence has begun to push researchers, academics and even students to scrutinise the validity and reliability of many marketing concepts and framework.

9.0 References

- 1 Marcel, B & Ronen, H & Arne, B. (2016) Additive manufacturing for consumer-centric business models: Implications for supply chains in consumer goods manufacturing. *Technological Forecasting & Social Change*.102.p.225-239.
- 2 Thierry, R & Ludmila, S.(2016) From rapid prototyping to home fabrication: How 3D printing is changing business model innovation. *Technological Forecasting & Social Change*. 102.214-224.
- 3 Thierry, R & Ludmila, S & John, D. (2015) Co-creation and user innovation: The role of online 3D printing platforms. *Journal of Engineering and Technology Management*. 37.p.90-102.
- 4 Jan, K & Leyland, P & Pierre, B. (2015) Disruptions, decisions, and destinations: Enter the age of 3-D printing and additive manufacturing. *Business Horizon*. 58.p.209-215.
- 5 Christian, W & Robin, K & Frank, P. (2015) Economic implications of 3D printing: Market structure models in light of additive manufacturing revisited. *Int. J. Production Economics*. 164.p.43-56.
- 6 Gerald, W. (2015) Printing Insecurity? The Security Implications of 3D-Printing of Weapons. *Sci Eng Ethics*. 21.p.1435-1445.
- 7 Cabirio, C & Paola, P & Marco, P. (2014) The emergence of new networked business models from technology innovation: an analysis of 3-D printing design enterprises. *Int Entrep Manag J*. 10.p.487-501.
- 8 Ben, D. (2014) Intellectual Property Infringements & 3D Printing: Decentralized Piracy. In The Legal Dimension of 3D Printing Conference. San Francisco, Sunday 17th August 2014. San Francisco: O'Brien Center.

- 12 Sean, F. (2015) 3D printing ushers in a new age for prototyping. *MDTmag.com*. 3.p.18-19.
- 13 Owen, C (2012) Affordable 3D printing. *Theatre Design & Technology*. 12. p.10-19.
- 14 Shahrukh, T. (2012) Flight testing 3D printing. *R & D Magazine*. 4.p.14.