From Imagination to Innovation:
A Creative Development Process

Hsuan-Yi WU[a][1] and Vic CALLAGHAN[b]
[a]*National Taiwan University*
[b]*University of Essex, UK*

Abstract. This paper is concerned with models of the innovation process. It takes the perspective that innovation is a non-linear process where development paths emerge from the process of 'imagining' and 'doing', iterating around in evolutionary cycles until a satisfactory innovation emerges. To support this we have developed a model of the innovation process called Creative Innovation Development (CID), which integrates an evolutionary ideation process (an augmented version of science fiction prototyping) with agile development. The paper describes the working of the model and its components. We illustrate the operation of CID by describing how it is being utilised by a start-up company, LivingPattern Technology Inc. Finally, the paper concludes by presenting future directions for our work.

Keywords. Innovation, creativity, creative thinking, new product development, scenario, business model, science fiction prototyping, imagination workshop, entrepreneurship

1. Introduction

"Humans are pattern-seeking story-telling animals, and we are quite adept at telling stories about patterns, whether they exist or not." ― *Michael Shermer*

From one perspective businesses are all about stories. Often the birth of business starts as an idea in the founders' head that he communicates to others by describing his vision or describing it in a business plan. Other people listen or read this story and become convinced of the vision, coming on-board. Later the business may use other stories for marketing to present customer with persuasive scenarios that encourage them to buy their goods. Within the company organisation much of management is facilitated through stories such as sales-people reporting back on their experiences in the field or engineers explaining to management about problems being solved etc. Of course this is just one perspective on a company's operation, but an interesting one, that ties into broader theories of the role of stories in the development of society [1]. This paper builds on these ideas by identifying well-established theories and methodologies and combining them to create what we hope is a fresh and effective way to explore the innovation development process within companies large and small.

---

[1] Corresponding Author: d00741004@ntu.edu.tw

We argue that such work is particularly timely as, for example, recent report by PricewaterhouseCoopers, the largest professional services firm in the world, found that "*Five years ago, globalisation would have been the most powerful lever for growth and every business would have been talking about China. But now, the growth lever that has the greatest impact is <u>innovation</u>. Ninety three percent of executives tell us that organic growth through innovation will drive the greater proportion of their revenue growth*" [2]. Thus, developing tools that support business innovation in all its forms is foremost on the minds of company strategists. In this paper we focus on two related methodologies for business innovation, Science Fiction Prototyping [3] and Diegetic Innovation Templating (DiT) [4] which, respectively, involve writing bespoke fiction or using the output of professional authors through novels and films. Of course creating a successful product is more than just imagining it. It needs to be fitted into a development cycle that will turn it into a practical innovation which can be delivered as part of a company's business. Thus, this paper also explores the wider innovation development process. To contextualise this we provide an example of a recent start-up *LivingPattern Technology Inc.* who are using these methods as part of various business activities from service innovation through to marketing. In the following sections we describe the model and methodologies, showing how they combine together to create a novel and effective innovation development process that can be used by a wide variety of companies.

2. Fiction and Ideation

From one perspective, whenever we go about our lives, we are creating stories. Of course, unless we keep a diary, or we are very famous, those are unwritten stories. But even though we are not famous, our families and friends are often interested in those stories, describing how our day went, the people we met or the unexpected experiences we encountered. For instance, when we buy a new phone, we might tell our friends about how it improves our lives, which might persuade them to buy a similar phone. Thus stories have been powerful instruments of change since the beginning of time, helping people think about the future they may create. A striking tale from our times comes from the Intel Corporation who make the integrated circuits (microchips) that go into our electronic and computing devices. Typically it takes around 7-10 years to turn a concept for a new microchip into a product, in which time the needs for that chip have changed. Thus Intel had a need to get their designers to think about the future. The method they chose was to use science fiction as a language for innovation and futurecasting. That process is described in more detail in other publications [3]. However there are many styles of fiction, some bespoke that are written deliberately to describe innovations and others that were written to entertain. Likewise some fictions, such as science fiction, might be closely connected to a given market (eg technology) and other fictions (eg fantasy) might not. Thus it is necessary to have a way for representing the gap between fictional and realisable artefacts, which is more formally labelled the 'Diegetic Gap'.

Diegetic is a term from the film industry that describes artefacts that the fictional characters perceive and interact with. A common example is music in films; music emanating from a radio being used by the characters would be a diegetic artefact

whereas the sound track music, which is not heard by the film characters, would not be. The film scholar David Kirby described these diegetic artefacts as a means of illustrating [5] how films can serve to introduce society to a technological change and opportunity. Later Schwarz showed such socio-cultural fictions had social currency that supported company sales since the ideas were often well established in a firms market [6]. Zheng adopted these concepts to create what she labelled *Diegetic Innovation Template (DiT)*, which can be regarded as a type of stencil or outline for an innovation that is derived deliberately as part of a product development strategy from a fictional narrative or film [4]. Our methods work with either Science Fiction Prototyping (writing bespoke fiction) or Diegetic Innovation Templating (using existing socio-cultural fictions).

Wu proposed the idea of 'innovation triangle' that acts as the foundation of creating so-called "*Imagination Workshop*" which aims to provide the means to induce technology-based innovation, entrepreneurship, and ultimately new ventures, by drawing on technologies, imagination, and creativity for building the vision of future business [7]. She describes Imagination Workshop as a visionary futurecasting method derived from Johnson's Science Fiction Prototyping (SFP) method [3]. Johnson designed SFP to test their innovative ideas within a realistic setting, comprising fictional people and society but described in realistic way. Wu extended Johnson's concept by proposing what she called 'cyclic SFP' which introduced non-linearity into the SFP creation process by introducing a series of feedback loops aimed at introducing more cross-pollination and incremental ideation, which she argued better mapped to the human creative process. She conducted this process within the framework of Imagination Workshop, which acts as a catalyst to create new SFPs inspired or used on existing DiTs. The principle of an Imagination Workshop is to gather together a group of participants, specify a goal (innovating some types of business or technology), provide a context (eg business, home etc.), set a timeline (usually ten or more years in the future) and offer support for brainstorming about possible futures. The aim of the workshop is to get the participants' to conduct a "mind simulation" of a future world (envisioning what the world might be like and the type of businesses and technologies that may exist, or they would like to exist).

SFP and DiT lever imagination to generate innovative perspectives. However, as companies need to implement these ideas, part of the process involves grounding the ideas in the practicality of what is possible. There are many approaches to this one good example being what we term an 'Ideation Grounding Spiral' that was proposed by Vavoula and Sharples as part of a methodology they called the '*Future Technology Workshop*' (FTW) [8]. The workshop was presented as a method for the design of future socio-technical system. In simplified terms the method works by the participants taking the idea and looking at it through a lens of multiple perspectives. For example participants may start by searching for idea in a future time (eg 10 years out) where technologies will exist that don't now, where needs (or applications) exist that don't now and then re-examining those in the context of now, making changes to the ideas to make them more practical. Then the cycle is repeated by taking this idea back to the future context and adapting it to what is likely to be possible, before returning to the present. This cycle is repeated until the idea stabilises. The Vavoula and Sharples model is more complex, involving two additional perspectives, but thy claim it stabilises in 2-3 cycles. The FTW uses a simplified version of this that alternates

between the future and present simply called the alternating ideation grounding cycle. Thus the process works by moving around a type of spiral moulding and reforming earlier conceptions to eventually ground the ideas in the reality of a compromise between what is possible and desirable. In short, FTW is facilitated by three steps; 1) brainstorming, 2) ranking and grounding, and 3) presentations. *Diegetic Innovation Templating*, *Science Fiction Prototyping*, *Imagination Workshops*, and *Future Technology Workshops* are all means to bring imagination from ideation to narratives that help innovation development.

3. Innovation Labs as Creative Thinking Environments for Business

The innovation-lab (i-Lab) concept arose from the UK Royal Mail's '*Futures and Innovation Group*' in 1997 who, when brainstorming future possibilities realised that the interactions within the groups, together with the conversational and session management tools played a significant role in the effectiveness of the sessions. This led to the idea for providing specialist environments to support these activities, the i-Lab, which entered the public domain through a series of three collaborative projects between the Royal Mail and several universities in the East of England (East Anglia, Cambridge, Essex, Bedfordshire and Anglia Ruskin) [9]. Their findings led to the description of a template that specified a minimum set of conditions to recreate an innovation-lab. In brief they proposed that an i-Lab should comprise three interlinking components namely the *environment*, the *technology* and the *facilitation mechanisms* together with s mix of the following activities:

- Icebreaker and reviver activities
- Discussion & getting other people's perspectives
- Brainstorming & voting
- Headlines, cut & paste collages and PowerPoint presentations
- Wall activities (collaborative writing, doodling etc)
- Scenario building
- Role play

At the core of the process was brainstorming, a technique for unleashing a flood of thoughts driven by members sparking ideas off each other, or carefully injected external stimulus. Having generated sufficient ideas, a group would go on to categorise, rationalise and vote on the suggestions. Implementing the ideas is more challenging and occurs beyond the i-Lab session.

This work was taken forward by two pan-European projects funded by EU Leonardo da Vinci programme, namely '*The European i-Lab Competences Development Programme*' (2006–2008) and '*The Innovation Laboratories for the Quality Assurance of Vocational Education and Training*' (2012-2014) [10] which produced the '*Innovation laboratory – Good Practice Guide*' [11] all of which aimed at the promotion of i-Lab use throughout Europe. Initially it led to the establishment of three innovation laboratories in Poland, Turkey and Romania and later over 100 globally-located i-Labs (from social to technical) created by organisations as diverse as the Standard Bank, Walmart, John Lewis, the UK National Health Service, Ryan Air and government (eg New York's 'Public Policy Lab' or the 'Social Innovation Lab for

Kent') [12]. In addition to expanding physically, the Internet has enabled a virtual expansion of the concept with the introduction of web-based software which provides anonymity while supporting ideation, voting and ranking process in addition to providing access to a rich range of information [13]. Moreover, the computerisation and online networking of i-Labs opens up intriguing possibilities for enriching the innovation process derived from the location-independence of participants. For example, in China it's being used to mix creative thinking, computer science and learning English language [14]. In the USA, it's being used to address global innovation problems such as internationalised business design and cross-border environmental issues. Later in this paper we will link in this computerisation of innovation to our future plans. In particular, in our variant of i-Labs we adopt the *Imagination Workshop* approach to the innovation that was described earlier in this paper. It is similar to the i-Labs described above except it uses science fiction and fantasy ideas to extrapolate forward current technologies, business and social practices.

4. Managing Innovation Development

4.1. An Innovation Process Perspective

Tidd and Bessant deal with the topic of innovation management, management of technology, new product development and entrepreneurship with a process perspective in their book "*Managing Innovation: Integrating Technological, Market and Organizational Change*" [15]. Many regard innovation as being a little unstructured in nature but in the view of Tidd and Bessant, innovation can be managed with a proper process. Before discussing managing innovation, it is helpful to have a shared understanding of what innovation is. Typical dimensions of innovation are product innovation, process innovation, position innovation and paradigm innovation. Generally, it represents changes in ways something (eg products/services) are created and delivered, in the context in which they are introduced, and in the underlying mental models which frame what the organization does. Innovation might occur when there is emergence of new market, new technology, or new political rules. Other influencers include competitive pressures, dramatic change in market sentiment or behaviour, deregulation/shifts in regulatory regime, fractures along 'fault lines', unthinkable events, and business model innovation, architectural innovation, and shifts in techno-economic paradigm (systemic changes which impact whole sectors or even whole societies). Tidd and Bessant's process model of managing innovation is quite complex, consisting of entrepreneurial goals and context, recognition of opportunity, finding resources, developing venture and creating value. They state that innovation is a learning process, not a single event and needs to be managed with building and developing routines across the core process [15].

4.2. A Development Process Perspective (Agile Development)

As has been noted by various researchers, innovation is often a non-linear process [15]. For example Ulrich and Eppinger describe the product development process as a

structured flow of activity and information. Three types of process flow diagrams are proposed for different types of products; the generic process flow diagram depicts the process used to develop market-pull, technology-push, platform, process-intensive, customized and high-risk products. Whereas quick-build products enable a spiral product development process whereby detailed design, prototyping and test activities are repeated several times. For development of complex systems, the decomposition is designed into parallel stages of work on many subsystems and components. [16] Wu's Cyclic-SFP supports complex cycles that are associated with a process of continually revisiting and refining a design. Such flexibility is important to any creative process as is often evidenced where artists continually modify their designs until achieving something they are satisfied with. The technical equivalent of this is Agile Development, which provides flexibility as its core principle allowing requirements and solutions to evolve through self-organizing collaboration between cross-functional teams. In this way it achieves enormous flexibility and promotes adaptive planning that enables continuous improvement or response to change. This lack of a rigid plan can present risks, such as development never drawing to a conclusion, so generally there is a balance involved between setting and measuring high-level goals while allowing freedom to the design team. This balance is down to particular companies and in the case of LivingPattern Technology Inc. is synchronised to the science fiction prototyping innovation activity to form an Agile Cyclic-SFP based Innovation Process that will be illustrated below.

5. Creative Innovation Development - A Holistic Model for Product Innovation

In the preceding discussion we have introduced some powerful ideas to support the innovation process ranging from the use of science-fiction (to inspire creative thinking), through a Cyclic SFP-based innovation process (as part of an Imagination Workshop), Agile Development (as a flexible iterative means of evolving software design) and Innovation-Labs (as an environment that is conducive to creative thinking). In terms of innovation, these methodologies share the principle that development (systems or stories) is a non-linear process.

Table 1 Creative Innovation Development Phases and Activities

CID PHASES	CID ACTIVITIES
1. Pre-condition	Set the scope of the ideation to match the firms needs
2. Ideation	Brainstorming that conforms to the Imagination Workshop methodology
3. Feature Listing	Scenarios & the innovation are mapped into features. Features are assigned values; 0 if the feature is undesirable, 1 if the feature is nice but optional to have, 2 if the feature is essential. Points from an assessment panel are aggregated which prioritise the features and help select best option.
4. SFP building	Scenario building that conforms to the Imagination Workshop methodology
5. Test & Development	Start development and assess difficulty in realising features (and feedback relative difficulties to earlier phases for options to be revisited)
6. Delivery	Refine the product to deliver to customers.
7. Market-tuning	Use feedback from customers to make small improvements

Whether it is a story or a system that is being constructed, these processes involve shaping ideas in both iterative and evolutionary ways. Moreover we see a duality

between stories and real-life where narrative scenarios can function as prototypes, having equivalence to physical prototypes. In these ways there is a complementary symmetry that could be exploited by bringing these concepts together to form a holistic model of the innovation development process. However, before we do this, we need also to consider how these processes can be brought together in a way that grounds them in the practicalities of introducing a new product to the market, which is, of course, the ultimate aim of these methods. To do this, we have refined Wu's original Imagination Workshops concept in two main ways; first we introduced a '*pre-condition stage*' to the beginning of Imagination Workshop that allows the scope of the brainstorming to be set to meet the company's aims, which includes the product domain and timescales. Second we have added a '*retro-action stage*' that enables the post-ideation outputs to be modified as part of an evolutionary cycle that grounds the product concepts in the practical constraints faced by the firm. Table 1 describes the various stages in this new and more holistic model of the innovation product development cycle that we refer to as *Creative Innovation Development* (CID). A diagrammatic version of this model, CID, is shown in figure 1.
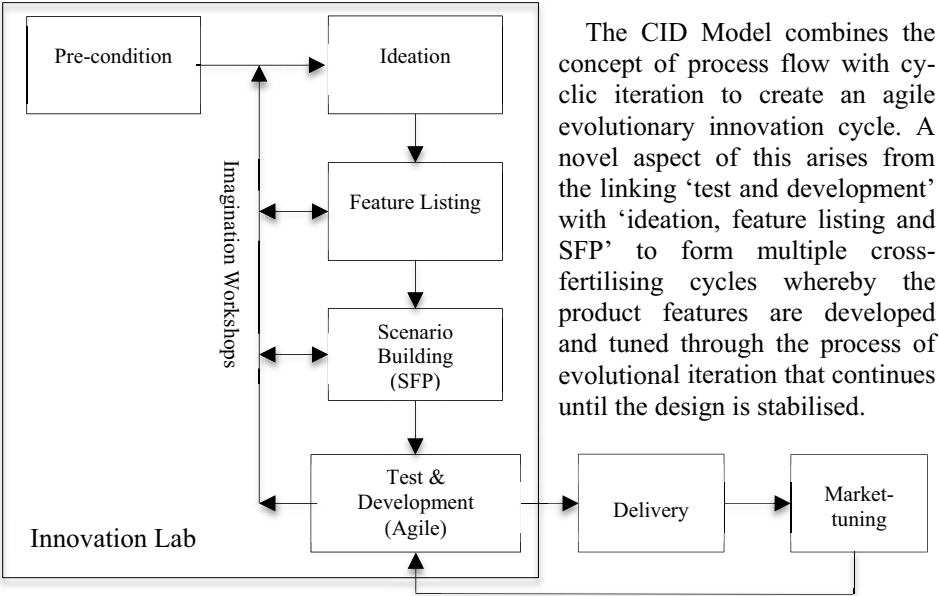

The CID Model combines the concept of process flow with cyclic iteration to create an agile evolutionary innovation cycle. A novel aspect of this arises from the linking 'test and development' with 'ideation, feature listing and SFP' to form multiple cross-fertilising cycles whereby the product features are developed and tuned through the process of evolutional iteration that continues until the design is stabilised.

Figure 1 - The 'Creative Innovation Development' (CID) Model

From another perspective it can be seen that 'agile development' forms a bridge between the technical and conceptual development teams since both work in a cyclic and reflective way where the work of one influences the work of the other. The model is independent of the environment but it may be seen as being compatible with the innovation-lab concept since it can be set inside either a physical i-Lab environment (as described earlier in the paper) or a virtual one (eg someone's office).

6. A Case Study: LivingPattern Technology Inc.

6.1. About LivingPattern Technology Inc.

LivingPattern Technology Inc. is a start-up company focusing on profiling living patterns to introduce products and services that supports people's everyday life. The company has created a cloud platform that collects data from Internet-of-Things devices to provide commercial services for home automation, security and healthcare applications. The start-up has the backing of a large electronic manufacturing service company and an experienced security sensor manufacturer. In making the case for funding, and as part of its marketing, the start-up created various scenarios to help investors better understand the benefits of the technology and how it could support people's life. The company's vision is to provide innovative, simple, affordable, consistent and fun solutions for its customers, conveying the image of a better tomorrow. In achieving its goals, the company applies agile development, CID as an innovation strategy to explore how people might harness living patterns to improve their everyday life. The company believes that technology is only useful and meaningful when it can serve the needs from people and their lives and CID helps the company and its customers connect to those shared values.

6.2. Exploring New Living Pattern Opportunities

"To live on a day-to-day basis is insufficient for human beings; we need to transcend, transport, escape; we need meaning, understanding, and explanation; we need to see over-all patterns in our lives. We need hope, the sense of a future. And we need freedom (or, at least, the illusion of freedom) to get beyond ourselves, whether with telescopes and microscopes and our ever-burgeoning technology, or in states of mind that allows us to travel to other worlds, to rise above our immediate surroundings. We may seek, too, a relaxing of inhibitions that makes it easier to bond with each other, or transports that make our consciousness of time and mortality easier to bear. We seek a holiday from our inner and outer restrictions, a more intense sense of the here and now, the beauty and value of the world we live in." ― Oliver Sacks

During the Chinese Smart Home Expo during 19th and 21st of May 2016, experts pointed out bottlenecks in the smart home industry. For the last two years smart home products have encountered problems of falling sales, homogeneity, poor user experience and other issues. In China, there is no established industrial standard, the smart home is not intelligent, user demand has remained flat, and the enterprise business model is not clear [17]. In contrast, in the USA, Amazon Echo and the forthcoming Google Home are bringing a revolutionary experience to the home market. People are expecting new technologies to create new sensations in their life. Without proper tools and techniques, it is difficult to think beyond now, not to mention the change of behaviour that new technologies will enable. By creating new stories of people's daily life that describes new patterns of individual's lifestyle, LivingPattern Technology Inc. is creating scenarios that open people to the possibilities and benefits, which their technology can provide.

6.3. Deploying CID in LivingPattern Technology Inc.

As described above, a central aim of LivingPattern Technology Inc. is to harness the habitual behaviours of people (living patterns) to create novel services and business opportunities. The services LivingPattern Technology Inc. provides are largely created by writing software that customises Internet-of-Things hardware to provide beneficial services (meeting needs) wrapped in an attractive experience to customers (making the product attractive). By way of one example LivingPattern Technology Inc. held a CID session where the pre-conditions were defined as setting the scope to Smart Home Technology that was implementable in the next 6-12 months. A brainstorming session identified a vision (concept) where '*the smart home is a container of memories*'. In this, living patterns (behaviours) become analogous to picture images creating a framework where the two can be intertwined to create new, attractive and useful service (these are not disclosed here since they are still under development and confidential to the company). To provide an insight to what is involved, before adopting CID, the ideation and feature listing process consumed (intermittently) a period of some 4 weeks and the team found it difficult to narrow down the scope. However, with CID, the team took only 2 hours to run the Imagination Workshop from ideation to the discussion of scenario building, and eventually successfully prioritised the top 6 features to be developed from a list of 23 features. The practice has helped the team shorten the time from ideation to development. From the company's experience, we found that the advantage of these methods to a startup is that they are not dependent on the pre-existence of any innovation structures and all members can readily participate without costly training (everyone can understand the concept of stories!). While we haven't implemented CID within more established organisations, we hypothesis that these techniques would work well to re-innovate failed products or to create new generations of existing products, giving them an innovative edge.

In the longer term we are considering the benefits of integrating CID into marketing campaigns (getting feedback from potential customers) and utilising an online i-Lab, which would give the methods greater global reach [9].

7. Conclusion

In this paper we introduced the idea of using stories as a core instrument for business innovation. We discussed how stories already play an important role in company planning and communications and explained how through the use of diegetic prototyping, stories can be extended into business innovation practice. Moreover the paper noted that innovation is not a linear process and proposed a new holistic model for driving innovation from imagination (conceptualisation) through to market deployment using a model we refer to as *Creative Innovation Development* (CID). We explained how CID was derived from the earlier Cyclic-SFP model of innovation and the overarching Imagination Workshop innovation process. In linking the ideation and implementation processes together we have also been inspired by the agile development methodology. We have illustrated the operation of CID through a case study, describing how it is used in a start-up company, *Living Patterns Technology Inc*. From this experience we suggest that the CID model is especially useful to startups as

these agile innovation methodologies lend themselves well to companies that have no established procedures or expertise in these areas and who need to rely on a handful of competent, but overworked individuals for their creative input. Furthermore we argued that these methods would also be effective for companies wishing to upgrade existing projects with new features to give them a competitive edge. In terms of future work we would like to enlarge our case studies exploring more diverse products and companies together with exploring how we might better harness the power of the Internet through, for example, implementing CID within an online innovation-lab environment. While CID is still at an embryonic stage of development, we hope that at least from a theoretical perspective, the method can be seen to have much potential.

Acknowledgements:

References

[1] Yuval Noah Harari "*Sapiens: A Brief History of Humankind*", Published by Harvill Secker, 2014, ISBN-13: 978-1846558238.

[2] R. Shelton, D. Percival, "*Breakthrough innovation and growth*", PricewaterhouseCoopers report, September 2013

[3] Johnson, B. D. (2011), *Science Fiction for Prototyping: Designing the Future with Science Fiction*, Morgan & Claypool Publisher. April 2011, ISBN: 978-1608456550

[4] Zheng P., Callaghan V., "*Diegetic Innovation Templating*", Creative Science 2016, London, UK, 12-13 September 2016

[5] Kirby, D. (2010), "*The future is now: diegetic prototypes and the role of popular films in generating real-world technological development*", *Social Studies of Science,* 40, 41–70

[6] Schwarz, J. O. and Liebl, F. (2013), "*Exploring Future Business Visions Using Creative Fictional Prototypes*", *Futures* 50 (2013), 66–73.

[7] Wu, H-Y., "*Imagination Workshop: An Empirical Exploration of SFP for Technology-based Business Innovation*", Futures, 2013

[8] Vavoula G.N., Sharples M.,"*Future Technology Workshop: a collaborative method for the design of new learning technologies and activities"*, International Journal of Computer Supported Collaborative Learning, 2(4), pp. 393-419. 2007

[9] Callaghan V., Davies M., Zhang S., "*An Online Immersive Reality Innovation-Lab*", iLRN'16, Santa Barbra, USA, 27th June - 1st July 2016

[10] Susnea I., Pecheanu E., Tudorie C., Cocu A., "*The education for creativity–the only student's tool for coping with the uncertainties of the future*", Multidisciplinary Academic Conference on Education, Teaching and E-learning (MAC ETEL 2014), Prague , 16-17th October 2014

[11] i-Lab2 Partnership"*Innovation Laboratory - Good Practice Guide*" Institute for Sustainable Technologies, Radom, Poland, October 2014, ISBN: 978-83-7789-322-7

[12] Rockefeller Foundation "*2014 Innovation Labs Survey*", Bridgespan Group / Rockefeller Foundation, September 2014,Bridgespan.org/Publications-and-Tools/Innovation-Labs-Insight-Center.aspx

[13] L. Powell "*The where factor: New Environments for Innovative Thinking*", White paper available from https://www.facilitate.com/

[14] Zhang S., Callaghan V., "*Improving English as a Foreign Language Education in China with Science-Fiction & Immersive Reality*", 2nd Int'l Symposium on Future Intelligent Educational Environments and Learning (SOFIEE'16), London, 12-13th September 2016

[15] Tidd, J. and Bessant, J., 2013, "*Managing Innovation: Integrating Technological, Market and Organizational Change*", 5th Edition, Wiley

[16] Ulrich, Karl T. and Eppinger, Steven D., "*Product Design and Development*", 5th Edition, The McGraw Hill Companies, Inc., 2012

[17] Jinan USR IOT Technology Limited, Smart home vendors fought channel bottleneck still seek breaking, website accessed 24th May 2016, http://www.usriot.com/smart-home-vendors-fought-channel-bottleneck-still-seek-breaking/