Journal of Open Innovation: Technology, Market, and Complexity

MDPI

Case Report

Cross-Border Open Innovation of Early Stage Tech Incubation: A Case Study of FORGE, the First UK-China Accelerator Program

Yunming Shao and Lei Shi *

State Key Joint Laboratory of Environment Simulation and Pollution Control, School of Environment, Tsinghua University, Beijing 100084, China; shaoyunming@mail.tsinghua.edu.cn

* Correspondence: slone@tsinghua.edu.cn; Tel.: +86-10-62796955

Received: 24 July 2018; Accepted: 13 August 2018; Published: 14 August 2018

Abstract: This paper is a case study of FORGE, the first UK-China cross border accelerator program, conducted in the context of TusPark Newcastle, an overseas innovation center by TUS Holdings in the United Kingdom. It engages with current research that examines the role of trust, particularly in the area of cross-border trade. We suggest that this is especially pertinent for early stage technology companies, since in many cases, their products, business models and even founder reputations, are more unformed. We also look at the topic of cross-border incubation, particularly with China as the target market, and provide new insights for understanding the channels and barriers for international commercialization in China for early stage tech startups. Finally, we provide some suggestions for policy-makers on both sides to better coordinate efforts to increase innovation relationships like FORGE.

Keywords: cross-border; open innovation; technology transfer; innovation ecosystems

1. Introduction

Between January and April 2018, TusPark Newcastle—a branch of TusPark UK, which in turn is a subsidiary of the Chinese industry group, TUS Holdings—held the first UK-China accelerator, named FORGE. It was held in partnership with Innovate UK, the innovations arm of the UK government's Department for Business, Energy, and Industrial Strategy.

The FORGE program selected, invested in, and incubated on the TusPark Newcastle premises nine early stage Internet-of-Things (IoT) start-ups. After two-months' training, the participants were brought over as internally conducted trade missions by TUS to Beijing, Shanghai, and Qingdao in China. Before the China trip however, the TUS team conducted Chinese market research on the domains relevant to the UK startups. Research was limited to only the three cities that the startups would visit. Nevertheless, these cities were key innovation and commercial hubs in China, and the matching of not just commercial partners, but also knowledge partners, such as with Tencent, a major Chinese technology company, and the Tsinghua University Graduate School in Shenzhen, were also sought. FORGE also provided access for the UK teams to Chinese local governments, which hosted and introduced them to favorable domestic policies.

FORGE also had two key delivery partners for the program: Dotforge, a UK accelerator, and Koobe, which is the European arm of Foxconn aimed at helping hardware startups to innovate. The former provided TusPark Newcastle with the know-how and UK resources to deliver an accelerator to a "Western" audience and the latter trained FORGE participants about the mass manufacturing process for which China, especially Shenzhen, is a key global center and hub of knowledge. All in all, the FORGE program sought to impart practical and social knowledge (and more often, in China,

the two topics are intermixed) to UK startup entrepreneurs, such as Chinese business culture, taxation, intellectual property protection, and legal forms of foreign company expansion to China.

Indeed, it can be surmised that what the FORGE program can be extended to not just the sub-categories to which its participants belong to (i.e., early or scale-up stage, technology, startups) but more generally to businesses of other stages of maturity, and other fields of innovation, or even domains of business. However, for the purpose of opening up the discussion on cross-border startup incubation, specifically to China, this article focuses on just the FORGE program and its findings.

It should also be stressed that FORGE exists as a part of the TusPark Newcastle offering, which in turn is based off a uniquely TUS concept of investees or incubatees leveraging its industrial framework and trust-base in China. This it does by mapping in the first-instance incubatees with its own "innovation clusters", that is, industry verticals that the TUS group has come to accumulate through previous portfolio success, current investments, and merger and acquisition work. Through these means, TUS can significantly help overseas start-ups gain a foothold within China quickly, through imbuing them with both formal and informal commercial and social networks of trust and friendship that are especially needed for success in China.

The ultimate goal of the discussion that this paper hopes to open up is therefore centered around developing a theoretical framework (through examining the FORGE case study) on how an offshore innovation center may operate as a beneficial tool to accelerate effective technology transfer across countries.

2. Research Scope: Cross Border Technology Transfer and Intermediary Behavior

Open innovation was first brought by Henry Chesbrough [1] to describe the collaborative innovations with external paths and resources to accelerate innovation and expand markets. In this paper, we explore the evolution of the innovation network brought on by the offshore innovation center. In the global innovation networks, it is important to focus on investing in people, nurturing cross-functionality, and offering a more open environment in the national R&D programs to break the growth limits of capitalism [2]. Many studies have discussed the growth limits of capitalism, figuring out that a closed innovation economy kills most investment opportunities with more monopolistic activities in large enterprises [3], while a healthy and open innovation network could bring a new combination between creative technologies and wide markets, offering opportunities for creative customers, companies, and investors [4]. Of particular note is that open innovation remains a powerful mechanism when it comes to technology transfer. Open innovation focuses on enhancing an organization's capabilities and competencies by putting it into a network with collaboration relationships. Yun et al. [5] have explored the shift of a city from an industrial to knowledge-based one via open innovation, even suggesting a new method for measuring open innovation using patent information [6]. Schiuma and Carlucci [7] have explored how in innovation ecosystems collaborations with universities can be established with the aim to develop innovation capabilities. Leydesdorff and Ivanova [8] have related Open Innovation to Triple Helix and synergy in innovation systems has been identified. However, the existing literature remains a blank area in the cross-border collaboration between developing countries and developed countries. In the Forge program, open innovation is also taken as one of the core initiatives to promote cross-border innovations and collaborations. By a single case study, we try to contribute to the literature and benefit the users and policy-makers.

Commercialization and collaboration between countries is inevitable with the rapid pace of globalization. Yet, research on programs fostering these is limited. Early stage, high growth tech startups participate in this conversation through "accelerator programs", which may be delivered at various points in a startup's growth trajectory: from idea, to initial traction, and (as in the case of FORGE) the scale-up stage, where the startup has already received some seed or Series A investment capital, has an idea about its business model, and is now ready to grow through adopting new markets.

Research on the role and efficacy of accelerator programs however is limited [9,10]. Mian S. et al. [11] provide a good survey of the practitioner landscape of Technology Business

Incubation (TBI) and represent a good start into the topic of incubation and acceleration, though there still is very little sight of incubation in the context of international technology transfer. And there is even less treatment on practical case studies about short, time delimited accelerator programs on a cross-border scale. However, this paper widens the view on accelerator programs like FORGE to include technology transfer (Section 2.1 below), and correspondingly treats the objectives of FORGE as essentially a technology transfer program, albeit limited to Early Stage "startup" technology companies.

Indeed, with this lens in place, questions should now arise, for instance: a comparison of the relative ease of cities within China for cross-border technology transfer with an overseas company; or indeed a comparison of target market expansion ease for Early Stage tech startups with other countries and innovation ecosystems other than China, such as with Latin America, India, and so on.

We also need to consider the role that an overseas innovation center like TusPark Newcastle (Section 2.2 below) plays in the context within which FORGE occurs. Here it functions as a consultant intermediary. At one level, as a consultant, this makes up for what Bessant and Rush had identified as an organization's (i.e., the startup's) lack of managerial capabilities: for instance language and an understanding of Chinese organizational and business development processes [12]. It is not possible for an early stage startup to have all this under one roof, especially since innovators tend to build solutions particular to their domestic market in the first instance. TusPark Newcastle therefore functions as a consultant for its UK incubatee companies, which includes the startups of FORGE.

2.1. Technology Transfer

A fundamental way of understanding the objectives of the FORGE program is that it is primarily occupied with the process of technology transfer. And although this takes place cross-border (as UK startups entering the Chinese market), the attendant culture, policy, and commercial barriers are simply part of the larger scope that is inferred when we mean "technology transfer".

Reddy and Zhao [13] suggest that this sort of technology transfer starts out as a mental and emotional proximity, but one which ultimately ends in economic value for both parties: "As distinct from the sale of machinery and equipment which embodies technology . . . the transfer of technology, in most cases, calls for a sustained relationship between two enterprises over a period of time, so that the receiving enterprise can reproduce the product with the desired level of quality standards and cost efficiency" (p. 293). I would like to suggest that—especially in the Chinese context—a framework of trust needs to have been pre-established to optimize this sort of value transfer. Reddy and Zhao go so far as to conclude that there is a "surprising neglect" of research into this sort of dimension and that work from social psychology on exchange theory, and sociology on interorganizational structures may be useful (p. 302). Bender and Fish [14] also touch on this, positing that knowledge is something transformed and "enriched by personal experience, beliefs and values with decision and action-relevant meaning" (p. 126). Therefore, especially in a cross-border technology transfer scenario, a good part of the knowledge which is to be transferred actually rests in the individual, or local holder of that knowledge: bringing into play the interpersonal nature of trust in cross-border knowledge transfer.

Moravcsik has already suggested a framework which I suggest we use to understand our case study. He proposes that there be three types of technology transfer [15]:

Firstly, the transfer of finished technological products to another country or jurisdiction. Although this seems like simply the case of an international sale of the company's products, a company could actually have multiple options on achieving this outcome, other than selling either Business to Business (B2B) or Business to Consumer (B2C) internationally. In fact, in most cases, the company would probably be more successful if it sold via an international distributor in China who already has its own sales networks (hence, B2B2C). This in turn, can be achieved by the establishment of a Joint Venture with a local company. The new Joint Venture vehicle then licenses the technology from the originating UK company, so that it is sold wholesale to the target Chinese market. This may have some advantages of protecting Intellectual Property, as the UK company may decide to keep its Research and

Development or Trade Secrets to itself, rather than sharing it with the Chinese JV vehicle. However, while this helps to allay one of the concerns of entering the Chinese market (where Intellectual Property protection is generally a concern amongst founders, especially), in many cases, localization of the technology is required by the Chinese vehicle to ensure successful market penetration.

Secondly, "the transfer of the know-how to make use of technology already invented and established in other countries" (ibid). Moravcsik cites the example of the establishment of a car factory in India to manufacture a car designed abroad. In fact, he suggests that even if the car was designed in India with no significant technology innovations (i.e., from India), the process still falls under the term "Technology Transfer". This suggests to us the idea that the process of cross-border transfer is in itself a "technology transfer", itself a type of know-how: specifically, the know-how to make use of technology invented in another country. In the case of Early Stage Technology startups on the FORGE program, where many aspects of a technology are still in a product or mental pipeline awaiting execution and refinement by the founding team, this places the key value of the technology being transferred in the Founders themselves. While most of Early Stage technology investment already places a good amount of consideration on the Founders (rather than the product or concept), we may conclude that successful cross-border technology transfer places even more consideration on the quality of the Founders, as they possess the know-how to not only build (or even localize for the target market) the startup's technology, but also the know-how of the transfer itself, both practical and soft knowledge to establish it within the new overseas market.

Moravcsik however calls a Third type of technology transfer, the most sophisticated type, which is the "ability to create new technology" out of a transferred technology. He suggests that countries seem to pass through the first two types of technology transfers on its way to this form and cites the example of Japan, which was able to leap frog other countries economically and technologically after a period of successful technology transfer from Europe.

2.2. Overseas Innovation Centre

Perez-Nordtvedt et al. [16] observes that "the majority of studies on knowledge transfer focus on either the relationship between the source and the recipient, the recipient itself, the source itself or the type of knowledge being transferred" (p. 715). There is even less study on the role an intermediary of trust plays, as this sort of influence may sometimes fall outside the scope of objective study. Their research examines international technology transfer (ITT) in terms of: comprehension, usefulness, speed, and economy. However, this still presupposes a common trust currency, a framework encouraging awareness of mutual knowledge, understanding of non-substitutability, trust of the players involved: all that is in fact necessary before going into an extended ITT process. Indeed, an important consideration could be the most practical one: if languages differ between host and recipient, how can capability development occur "unless the knowledge transferred is deemed to be useful and comprehensible" (p. 718)—that is, how could knowledge be comprehended in a cross-border scenario, when both parties are not aware of each other, or each other's capabilities, or the technical niceties of the technology to be transferred? Surely a framework of trust needs to pre-exist, firstly, to know and understand the other's position, and secondly, to understand the technology to be transferred and how it could become useful. Or, stated in economic terms: "Knowledge transfer follows the path of least resistance [17], and, if the knowledge being transferred is not framed in the language of the recipient, the transfer is likely to entail greater resources [18]" (p. 723).

Tech startups face challenges to scale at all points of their journey. This is all the more true in the cross-border technology transfer field. Recognizing that they are key drivers in a region or country's growth, local governments have sought to nurture them through various methods. This can range from favorable policies to accommodate starting up, entrepreneurship education through accelerator or even university course programs, and in many cases involve industry as funders of an accelerator program, or provide mentorship to a growing ecosystem. Pauwels et al. [19] cite a rough taxonomy of accelerators: corporate or "matchmaker" accelerators; investor led (such as YC or

Techstars); and "ecosystem" accelerators whose mission is to build or encourage a supply chain of innovation, usually within an industry vertical, and usually supported by government. In many cases, industry not only provides the role of a funder, through sponsoring accelerator programs, but also as a growth mechanism through conducting accelerated business development with startups of an accelerator program through internal channels. However, although efforts have been taken by countries worldwide to nurture domestic tech ecosystems, building up various forms of capacity within them, not a lot of work has been done cross-borders. This is probably because of a lack of ownership in the area of cross-border commercial interactions that can help nourish this sort of behavior. For example, governments tend to be local and prioritize local or regional growth. Unless there are policies in place for international "Scaling Up", with domestic policies in place to support this, it is usually outside the remit of governments to support cross-border outward expansion per se.

It has also been observed that tech startups, especially so of the early stage type where business models and sales channels—or even in some cases, a concrete definition of its product—need to address the role of trust where it concerns technology trading. As Jensen et al. [20] have observed. There has been little reflection in the field on what role trust plays, particularly in the field of early stage technologies. Jensen cites Mowery [21] and Pisano [22] on the erosion of confidence in a product to the point of a market collapse due to uncertainty, non-codifiability, and opacity. These features mark early stage technologies (as opposed to mature ones) for several reasons through the fact that they are by definition still highly uncertain: "property rights . . . can be fuzzy if the technology is so immature that it is subject to a primitive level of codification. As a consequence, it is hard to determine a price for the technology as it is not easy to articulate what is being bought and sold. Furthermore, assessing the quality of work done or knowledge provided is complicated in a technically complex area" [20].

In the case of the FORGE accelerator, which sought to bring startups from the UK into the Chinese market, in the early to mid-stages of its growth, these points are exacerbated by the cross-border and characteristics of the Chinese market, such as a lack of information about the domestic market, competitor pricing, supplier conversations with businesses that they sought to trade with, intellectual property rights and protection, and market analysis of their own innovations. Chinese business culture also places a very high value on the role of trust. Atsmon and Magni [23] have suggested that this originates in the close physical and mental proximity of the Chinese to friends and family. The population size of a country certainly makes trust-based decisions a deciding factor, especially where time is limited for both parties of a transaction. Pérez-Nordtvedt et al. [16] likewise observes that "Strong relationships not only make it easier on the part of the recipient to comprehend knowledge being transferred, but also make transfers happen more quickly and economically. A relationship based on trust and involving significant interactions between involved parties results in the creation of a 'common language' which facilitates knowledge transfer" (p. 735).

FORGE takes place as an accelerator program within the context of the overseas innovation center, TusPark Newcastle. As Jensen et al. [20] and Lewicki and Bunker [24] have observed, a feasible method of overcoming trust problems, especially those characterizing early stage tech startups, might be to construct an "umbrella of trust". This helps to bolster trust in three ways, Lewicki and Bunker suggest: firstly, a "calculus-based trust" type, which is each party knowing that reputational loss will act to limit the other's behaviors; secondly, an "identification-based trust" which is based on colleagues in the group understanding intuitively the values and motivations of each other; thirdly, a "knowledge-based trust" which comes from direct familiarity and experience with the other party. As Jensen et al. [20] put it pithily: "Knowledge-based trust depends on information, calculus-based trust depends on deterrence, and identification-based trust depends on selection".

TusPark Newcastle, by virtue of belonging to the TUS Holdings group, affiliated with Tsinghua University, which in turn is part of China's Ministry of Education, imbues its UK affiliates and startups automatically with calculus-based trust. Running programs like FORGE therefore, are instances of building knowledge-based trust between UK technology startups and Chinese businesses, by means of physically and remotely bringing the two parties into encounter with each other. It also has the

advantage of checking the quality of both the UK startups as well as their Chinese business partners: with TUS backing those UK startups as investors; and selecting or vetting Chinese partners for the benefit of the UK companies. It can then be said that knowledge-based and identification-based trust will follow along over time, and this long-term will be the primary role of the overseas innovation center. The FORGE program, in other words, initiates the cross-border contact between both sides, with the innovation center to provide an "umbrella" of calculus-based trust; but because time in-person contact is limited during the FORGE program, long term identification-based trust is continued by the center. Once the UK teams are back in the UK it is hoped that they will see through business and investment deals begun through the FORGE program.

The intermediary behavior of the sort that TusPark Newcastle and FORGE seek to perform has been historic and well-documented. For example, the growth of technology in the late 19th and early 20th century was helped along by specialized intermediaries such as lawyers and patent agents [25–27]. Accordingly, the role of the middlemen in international matters creates trust. Jensen et al. note that "The advantage conferred by the presence of trust does not mean that one party will automatically limit negotiations to parties with whom they have deep and strong prior connections. According to [28], if one is seeking to buy the best technology or sell their technology to the highest and most valuable use, then they will not want to be limited to a subset of exchange parties. Each party has before them a menu of possible exchange parties over which exists both a defined level of confidence . . . and a defined view of their technological capabilities and needs. In deciding with whom to enter negotiations, the initiating party will choose an exchange party that maximizes this combination of confidence and capabilities and thus maximize the expected gains from trade" (p. 342).

Therefore, it must be recalled that the Chinese commercial entities that FORGE seeks to broker relations with on behalf of its UK startups remain nevertheless commercial, and at the end of the day, will consider the technological capabilities that the UK startups are bringing to the table before either party enters into a trading relationship. But it is also significant that TusPark Newcastle overlays onto these companies in the first instance not only calculus-based trust as an intermediary, but an intrinsic (and in many ways commercially valued) type of trust by nature of its affiliation with Tsinghua University and the Chinese government.

2.3. Scope of This Paper

This paper only begins to explore the effectiveness of intermediary behavior through the overseas innovation center, TusPark Newcastle, and its accelerator program FORGE. For the sake of length, it will not cover the positive effects bought about by knowledge spillover; nor will it discuss at length the cultural and business resistances that needed to be overcome in the cross-border activity of this nature. We will touch briefly on the characteristics of the FORGE program but not delve in-depth on the advantages and disadvantages of its approach (or the overseas innovation center approach for that matter). And while it provides this case study, and the results of knowledge transfer are achieved, a fuller study and comparison of other similar cross-border programs would also be beneficial. It also does not treat at length the benefits and barriers to international collaboration, specifically with China, as (being a case study) participants entering the FORGE program would have been aware of this or have their own specific business interest.

Finally, while it is also very pertinent to the ongoing sustainability of such a center, we also will not in this paper, for considerations of length, be able to discuss the business model, sustainability, and trust-capital of the center, all things which the overseas innovation center must consider: because it is after all also embedded as a standalone actor within the business and startup ecosystem both within the UK and also within China. On this, it is useful to cite Brem and Radziwon's [29] recent study on how local ecosystems are built on trust: "Current relations reflected in existing networks and interdependencies could stimulate ecosystem members to stay transparent in their actions and make sure that they do not lose already existing trust and credibility within the ecosystem. Any forms of unfair attempts to gain a competitive advantage could result in lowering the chances for

potential partnerships and alliances . . . The entrepreneurial ecosystem does not evolve independently, but through the involvement of actors and social groups such as the socio-technical system [30]. In order to stimulate collective value creation and capturing a trust based interaction between ecosystem participants is necessary [31]".

This overseas innovation center therefore deals with three types of trust: that between each local jurisdiction it is situated in (i.e., UK and China), and that which is transnational (i.e., UK-China) as it embarks on cross-border programs like FORGE.

3. The FORGE Program

3.1. Characteristics

The model of FORGE is shown in Figure 1. FORGE was created out of two complementary desires from the UK and the Chinese side independently. For Innovate UK, it arose out of a desire by the British government to help support early stage IoT startups; for TUS, it was part of the organization's larger goal in setting up an international overseas innovation support infrastructure to guide non-Chinese startups into the Chinese market through expansion, sales, licensing, investment, or other forms of mutually beneficial collaboration.

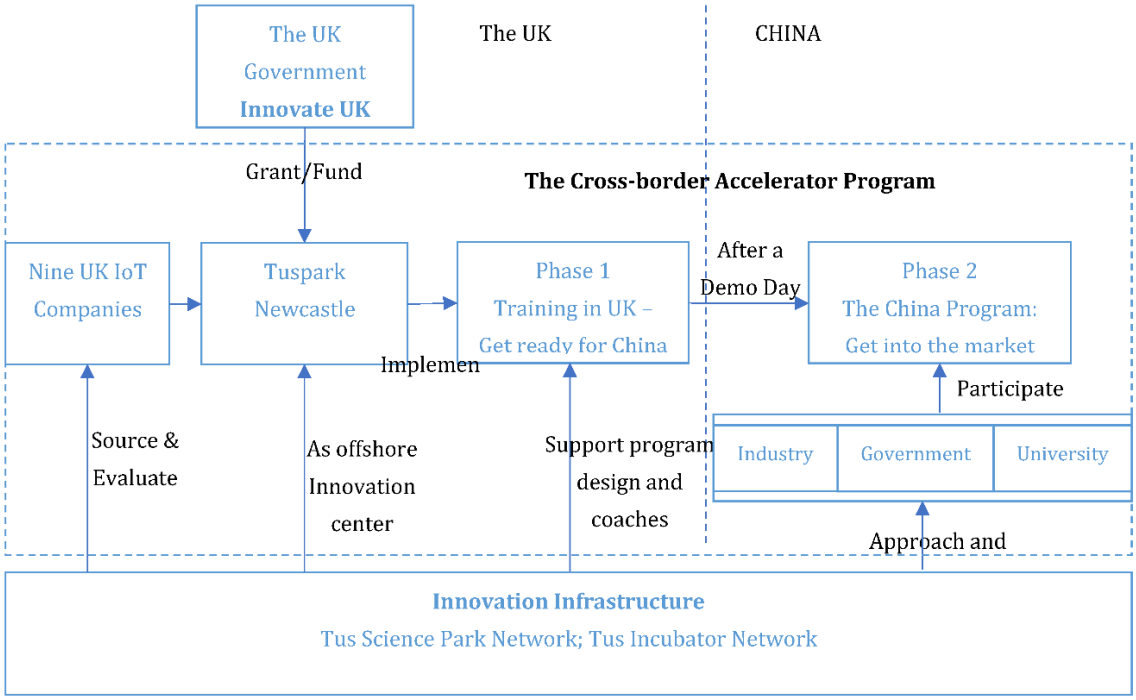

Figure 1. Model of FORGE and TusPark Newcastle as it fits within the overall TUS international innovation infrastructure.

On the Chinese part of the program, which after all is the objective of the FORGE journey, the key "mentors" and contacts that UK entrepreneurs would be introduced fall into two camps: on the one hand, Chinese companies and local governments looking to upgrade their productivity through importing innovating, diversifying their business lines, creating market differentiation, or even exporting to the UK and Europe through TusPark Newcastle, on the back of the FORGE program. And on the other hand, Chinese investors and venture capital funds looking to invest in advanced innovations, possibly to bring into the Chinese market. Thus, capital and industry are highly intermixed considerations when interacting with the UK startups, since they could be both business partner or investee: the two things being quite fluid in the Chinese business environment.

3.2. Programme Design and Portfolio Selection

Program design and marketing (which are both linked to startups applying to the program as investees) was an important first issue to solve. Localization was the first challenge faced by TUS as it entered the UK. TUS Park was established in August 1994 as the former Tsinghua University Science Park. It was originally created as a hub in Beijing for the incubation of technology spinout companies from Tsinghua University. TusPark Newcastle is its first operational presence in the UK, and therefore had to overcome challenges such as the design and running of an accelerator program according to UK norms. It also needed to attach a group of mentors to the program, as well as its long-term work in the UK. Finally, it needed to scout for, assess and invest in early-stage tech start-ups.

The initial success of an accelerator program depends on the previous fame of its brand. For example, in the US, brands such as Y Combinator, 500 Startups, Angelpad and Techstars are big draws to applicants when it advertises applications for its new cohort. Indeed, the brand of an accelerator can be measured by its success, not only in investments, but also by the way that it grows the network of and provides mentoring advice to its investee start-ups. The first step towards the establishment of a cross-border program like FORGE, therefore, is in finding and attracting investee start-ups, as well as creating a UK network of mentors to associate with the program.

TUS solved this problem, that of localization, by firstly partnering with a local accelerator called Dotforge. Based in the North of England, Dotforge had run accelerators themed on social impact, healthcare, and general technology. It therefore had a pool of local mentors to call upon to educate and network its investees. This is also important because it was able to grow the local mentor network of the TusPark Newcastle overseas innovation center. Furthermore, mentors provide their helpful service for free to accelerators—most of them take time out of their busy schedules to "donate" their skills, experience, and personal network back to their local tech ecosystem, and therefore would prefer not to travel too far to contribute to what is essentially pro bono work. Another advantage of having a local accelerator as a partner is that mentors have been already vetted to some degree, in some cases through previous success and helpfulness in an earlier accelerator batch. Assuring the good quality of mentors is important for two reasons: firstly, time is limited during an accelerator program, and a poor mentor means a poor use of speaking time, or one-to-one time, for example where another mentor or speaker could have been deployed instead; secondly, the use of a poor mentor is potentially damaging to the reputation of an accelerator program, especially in the case of a new entrant to the UK tech ecosystem like TUS, as most news spreads quickly in the small circle of the early stage tech business community through reputation and word of mouth.

Program design also must consider the program's climax. Because FORGE needed to conclude in the UK and in China with a Demo Day (or industry roadshow), which is the expected end-goal of accelerator programs more generally, it was necessary to address this in the creation of the FORGE program: what level maturity of UK startups should come on board FORGE so as to achieve a meaningful outcome at its end? This also begs the related question of what sort of investors ought to be invited to the Demo Days, or introduced to the startups.

This ultimately led to a fundamental decision made by TUS to position FORGE as—not a pre-seed or early stage accelerator—but a "scale up stage accelerator" aimed ideally at post-seed or Series A companies looking to expand their market in China, as well as growing their investor network in China. The reason for this is the amount of capital already available either for free or inexpensively to fund start-ups in China: the types of start-ups that would qualify for an "accelerator program" in the UK or US, are considered too immature for the Chinese investor ecosystem, who are looking for a late seed, or Series A investment. Therefore, if this cross-border accelerator was to work as a program, it had to adjust its recruitment process to focus on more late-early or scale-up stage start-ups from the UK.

This led TUS to the fortunate discovery that there is in fact a good supply of Scale Up, or at least "late-early stage" companies in the UK, who are outputs either of other early-stage accelerators, or previously invested companies of Innovate UK, who are a grant-giving mechanism of the UK

government. The draw for these types of companies was simple: either they have hit a bottleneck in funding because there is a lack of late-early stage funding in the UK for them; or they are a going concern, and would like to expand their market reach, usually in China. Usually they experience both things: expanding their market reach would help them to secure a future financing round in the UK. The ultimately selected startups are shown in Table 1.

Table 1. Table of Ultimately Selected Startups.

S/N	Name	Genre 1	Genre 2	Hardware?	Source
1	Skriware	Education	Hardware	Yes	Slush
2	SimplifAI	Smart City	ITS		Innovate
3	WifiPlug	Energy	Smart City	Yes	SEO
4	ThingTrax	Advanced Manufacturing	AI		SBC
5	Medicsen	Health	AI	Yes	Dotforge
6	StudyAtlas	Education	SAAS		TUS
7	Orxa Grid	Energy	Hardware	Yes	SEO
8	Beeline	Smart City	Navigation	Yes	Koobe
9	Porter	Smart City	Access Control	Yes	Slush

3.3. Programme Delivery

A Chart of the FORGE Program Schedule by Week is shown in Table 2. The FORGE program began on 15 January 2018, spending its first two months in TUS Park Newcastle (UK). This section of the program also featured expert talks by Foxconn, a well-known tech hardware manufacturer, going one-to-one with teams, plus delivering its knowledge about manufacturing.

The UK program (Weeks 1 to 8) also focused on preparing the IoT companies to do business in China through (a) understanding its requirements and what sort of partner the company needs to accelerate its growth; (b) basic legal and intellectual property topics, applicable to the UK, as well as some relevance to China; (c) learning about design for manufacture and the mass manufacturing process through Koobe, which is Foxconn's brand for working with startups in Europe.

The Chinese program (Weeks 9 to 12) then took the startups to three cities in China (Beijing, Qingdao, and Shenzhen) with the intention of expanding the startups reach into the Chinese market, and finding initial partners to seed their market entry. The companies therefore spent only an average of four days per Chinese city, meeting with pre-selected mentors and investors.

Table 2. A Chart of the FORGE Program Schedule by Week.

	UK								China			
	Wk 1	**Wk 2**	**Wk 3**	**Wk 4**	**Wk 5**	**Wk 6**	**Wk 7**	**Wk 8**	**Wk 9**	**Wk 10**	**Wk 11**	**Wk 12**
One on One with TUS												
Accessing Local Resources												
One to One Sessions on Legals												
Presentation on Legals												
KPI's and Startup Metrics												
Panel: How an Investor Thinks												
Investor Mentoring												
Production Line Management (F)												
The Foxconn Method of Production (F)												
Hardware Reviews												
Standard ODM Processes												
IP in China												
Product Design												
How FORGE Will Enter China												
Pitching Round Table with Teams												
Corporate Finance in UK vs China												
How to Use Wechat												
IP in the UK												
China Business Advise												
Pitch Practice												
Cross Cultural Branding												
Demo Day (UK)												
Visit to Yingli Solar												
Visit to Great Wall Car Manufacturing												
Tax Law in China (KPMG)												
Early Stage Investment in China (TUS)												
Intro to Intellectual Property in China												
Demo day in Beijing												
Jiaozhou IoT Conference												
Demo day in Jiaozhou												
Pitching in TusPark Shenzhen												
Ping An government business networking												

Table 2. *Cont.*

	UK								China			
	Wk 1	**Wk 2**	**Wk 3**	**Wk 4**	**Wk 5**	**Wk 6**	**Wk 7**	**Wk 8**	**Wk 9**	**Wk 10**	**Wk 11**	**Wk 12**
Visit to PWC Qianhai Training Centre												
Visit to Tsinghua Uni Grad School Lab												
Visit to Honghe Tech												
Visit to Rapoo Tech												
Visit to Tencent												
Visit to Baoshan business networking												
Demo Day in Shenzhen												

Chinese Business Skills—These are skills related to either business culture communications for doing business in China (soft skills), or legal knowledge about expansion of the UK Startup's company in China. **Education: Intellectual Property**—Knowledge related to IP (patents, trademarking) in either the UK or China. **Education: UK Business Skills**—Education about startup growth and corporate governance. This is considered fairly standard curriculum material for an accelerator. **Education: Fundraising Skills**—Ranges from general mentoring about fundraising best practices related to the startup (such as pitch review), and coaching and practicing about pitching. **Networking: Business Partner**—These are sessions where the startup founders meet businesses who can potentially partner with the startup, provide industry knowledge, or connect them with their network of other businesses who can help, or even investors. **Networking: Investor**—Events such as Demo Days or Roadshows, that aim to network startups with potential investors. **One to One with TUS**—Sessions with the TUS team to find out specific requirements of the startup, so that TUS can find relevant business partners and investors for them in China. **Design for Manufacture Knowledge**—Knowledge about how to plan and manage mass production of a hardware product.

3.4. Adaptations and Learnings

FORGE implemented several adaptations in the course of the first three weeks of the program based on feedback. For instance, it learned that because the Scale-Up target of the program took in more mature (post-Seed) type of companies, founders of these companies were busier with operational matters (e.g., working on tech and existing business development issues), and therefore required FORGE to have a shorter time-schedule each week, as well as to accommodate remote participants. The ability to accommodate remote meetings also extended the pool of participants, and enhanced investee engagement with the program.

There was also now a greater emphasis on business partnerships and actual scaling up relationship building and education, rather than early-stage startup educational content, which is normally the theme of traditional accelerators.

Also, FORGE learned to adopt a more tailored approach. Rather than a "general" form of education one normally finds on traditional accelerators, FORGE's startups had very specific requirements they needed to help them grow, usually based around finding a business partner in China to access the Chinese market. FORGE discovered that a common ask is to help find a credible distributor or partner in China, potentially for joint venture.

Consideration for cultural holidays on both sides are also important, and the FORGE program had to consider these in the delivery of its program, such as: the Christmas and New Year break affected the practical start date of the program in the UK; the two-week Chinese New Year holiday in China posed a challenge for communications and help for the startups in the middle of the FORGE program; the Easter and Qing Ming Holidays in April posed a problem in the Chinese section of the program, as there arose logistical issues around personnel and travel.

Frequent and deep communication between the UK and Chinese TUS teams was also critical for the FORGE delivery. The UK half of the FORGE program team had a good understanding of the incubate startups; but the Chinese half of the team understood better the local market and could select and recommend partners for the startups of FORGE. Indeed, this could be done even before the UK startups went to China, saving time and cost, and again is one of the advantages of the TusPark Newcastle "overseas innovation center" sort of model.

4. Discussion

4.1. Impact on the Startups: Trust and Business Development

The FORGE startups spent an average of four days in each Chinese city. One challenge that the TUS team faced as organizers was coordinating the presence of the startup members with the Chinese program. This is due to two factors: as the startups were at a Scaling Up stage, they were still not sufficiently well staffed to handle business development in two countries, or to split their founding or technical team. Two of the startups, for instance, swopped between co-founders to be present at various points of the Chinese program. None of them were able to stay for the full four weeks, but all arrived for the Demo Days in each of the cities.

A table of results from the China trip is shown in Table 3. Five of the nine startups were able to begin discussions with Chinese companies that they realistically can envision turning into a partnership in the long run. All the companies, however, on returning to the UK at the end of the FORGE program, resumed their "normal" startup-building work rather than international expansion plans. Chinese expansion is a long term goal rather than a short term tactic. Or—to use Jensen et al.'s framework—since calculus-based trust has been acquired, and in consideration of a startup's ownership of scarce resources, they are not able to commit fully to growing knowledge- and identification-based trust.

Table 3. A table of results from the China trip (average: 4 Days in each city).

S/N	Name	Partner Found?	Investor Found?
1	Skriware	Yes	No
2	SimplifAI	Yes	No
3	WifiPlug	Yes	No
4	ThingTrax	Yes	No
5	Medicsen	No	No
6	StudyAtlas	No	Yes
7	Orxa Grid	Yes	No
8	Beeline	No	No
9	Porter	No	No

Although pre-selection of the potential Chinese partners was essential, unforeseen connections were found during meetings between the UK startups and the Chinese companies. One example was the impending creation of a Zero Carbon Institute by a Chinese company, which fit well with the technology and know-how created by a UK startup. This too has the potential to grow into a knowledge-based trust. Indeed, several of the UK startups saw the potential to enter the Chinese market by joining up their technical know-how with that of a Chinese partner. Capital strain however is the main consideration forcing the behavior of the startups to focus nearsightedly on their current markets. Ironically, it is as Saggi [32] terms an "arbitrage in knowledge" coupled with the accumulation of calculus-based trust which stems technology transfer in the short-run.

Part of this "long term thinking" on the part of the startups also relates to the fact that they are pursuing joint ventures with their partners. That is, the form of a Chinese expansion for them, is a deciding factor in their behavior. Saggi [32] points out that "joint ventures (as well as technology licensing) lead to more local involvement and therefore greater spillover to local agents", or in other words, the longer term goal of joint venture would lead to the building up of knowledge and eventually identification-based trust.

The FORGE program ends off with the UK startups continuing their relationships with the newly acquired potential partners mediated by the overseas international center, sheltered still, figuratively speaking, by the "umbrella of trust".

4.2. Impact on the Overseas Innovation Centre

FORGE brought visibility to TusPark Newcastle in the eyes of not only UK but also Chinese partners. This need to be a credible actor in both ecosystems so as to achieve a third (i.e., the transnational, UK-China) is important in its brokering of mutual trust. For instance, it has gained a high-profile partner from the UK who will become part of the TusPark Newcastle. As well as retaining the tenancy within the center of a local venture capitalist. This has become a boost to its sustainability as an independent center.

It has also begun building its reputation within the UK, leading to more innovation funding and projects, as well as becoming a beacon for other high tech Scale Ups, especially those seeking to enter the Chinese market. Further collaborations with central UK innovation funds as well as regional ones have also been envisioned, as TusPark Newcastle begins to run incubator services domestically in partnership with other nationally well-known technology companies.

For the Chinese side, the innovation center will play host to visiting delegations, including the one that played host to FORGE in China. This too can lead to operational sustainability of the innovation center, as representatives from the Chinese side (i.e., government or industry) may help sustain the center in hopes of future technology transfer from the UK. Through FORGE, the center has also discovered other Chinese partners for its UK business, such as co-investors, and businesses who seek to expand to the UK and Europe.

5. Conclusions

I have described in this paper the case study of a cross-border technology transfer incubation program. This study should not be generalized, but rather be taken into one part of a study on cross-border programs, specifically: something which is country-specific (in this case China and the UK), sector specific (in this case, IoT, or at least software/digital), and even stage-specific. These three factors should be taken into consideration whenever the efficacy of a cross-border technology transfer program is being considered. From these will come factors that other writers have already discussed, such as language, culture, government policies, intellectual property protection, industry supply chain, and so on. It should be mentioned however that the nature of digital technology startups necessitates a more cautious take on technology transfer. This therefore means a slower speed of expansion on the UK startups' side, with a higher emphasis placed on trust.

I have also demonstrated the importance played by the overseas innovation center, both during and after the program, firstly as an outside broker of trust, particularly of the calculus-based kind, and then after, as a continuer and mediator of trust on both sides, so that eventual technology transfer is achieved. Accordingly, the spillover effects of the center in both countries are the main long-term benefits that the center brings in its local setting. Thus, this paper concludes that the TusPark Newcastle overseas innovation center lends FORGE and its startups a calculus-based type of trust-factor, which helps to motivate good behavior in all actors during the program; however, genuine technology transfer and spillover effects will take place in the long run aided by how embedded the center is within its own local ecosystem when itself it seen as one of many interdependent actors. Out of these two independent belongings in two independent ecosystems of trust, the transnational nature of its cross-border efficacy is generated as a third.

Author Contributions: Conceptualization, all authors; Data curation, Y.S.; Discussion, Y.S. Supervision, L.S.

Funding: This research was funded by the Tsinghua University Initiative Scientific Research Program (No. 20121088096).

Conflicts of Interest: The authors declare no conflict of interest.

References

1. Chesbrough, H. *Open Innovation*; Harvard Business Press: Brighton, MA, USA, 2003.
2. OECD. *Open Innovation in Global Networks*; OECD: Paris, France, 2008.
3. Schumpeter, J.A. *Capitalism, Socialism and Democracy*; Routledge: London, UK, 2010.
4. Yun, J.J. How do we conquer the growth limits of capitalism? Schumpeterian Dynamics of Open Innovation. *J. Open Innov. Technol. Mark. Complex.* **2015**, *1*, 17. [CrossRef]
5. Yun, J.J.; Avvari, M.V.; Jeong, E.-S.; Lim, D.-W. Introduction of an objective model to measure open innovation and its application to the information technology convergence sector. *Int. J. Technol. Policy Manag.* **2014**, *14*, 383–400. [CrossRef]
6. Yun, J.J.; Jeong, E.; Yang, J. Open innovation of knowledge cities. *J. Open Innov. Technol. Mark. Complex.* **2015**, *1*, 16. [CrossRef]
7. Schiuma, G.; Carlucci, D. Managing Strategic Partnerships with Universities in Innovation Ecosystems: A Research Agenda. *J. Open Innov. Technol. Mark. Complex.* **2018**, *4*, 25. [CrossRef]
8. Leydesdorff, L.; Ivanova, I. "Open innovation" and "triple helix" models of innovation: Can synergy in innovation systems be measured? *J. Open Innov. Technol. Mark. Complex.* **2016**, *2*, 11. [CrossRef]
9. Hochberg, Y.V.; Fehder, D.C. Accelerators and ecosystems. *Science* **2015**, *348*, 1202–1203. [CrossRef] [PubMed]
10. Malek, K.; Maine, E.; McCarthy, I.P. A typology of clean technology commercialization accelerators. *J. Eng. Technol. Manag.* **2014**, *32*, 26–39. [CrossRef]
11. Mian, S.; Lamine, W.; Fayolle, A. Technology Business Incubation: An overview of the state of knowledge. *Technovation* **2016**, *50*, 1–12. [CrossRef]
12. Bessant, J.; Rush, H. Building bridges for innovation: The role of consultants in technology transfer. *Res. Policy* **1995**, *24*, 97–114. [CrossRef]
13. Reddy, N.M.; Zhao, L. International technology transfer: A review. *Res. Policy* **1990**, *19*, 285–307. [CrossRef]

14. Bender, S.; Fish, A. The transfer of knowledge and the retention of expertise: The continuing need for global assignments. *J. Knowl. Manag.* **2000**, *4*, 125–137. [CrossRef]
15. Moravcsik, M.J. The role of science in technology transfer. *Res. Policy* **1983**, *12*, 287–296. [CrossRef]
16. Pérez-Nordtvedt, L.; Kedia, B.L.; Datta, D.K.; Rasheed, A.A. Effectiveness and efficiency of cross-border knowledge transfer: An empirical examination. *J. Manag. Stud.* **2008**, *45*, 714–744. [CrossRef]
17. Reagans, R.; McEvily, B. Network structure and knowledge transfer: The effects of cohesion and range. *Adm. Sci. Q.* **2003**, *48*, 240–267. [CrossRef]
18. Borgatti, S.P.; Cross, R. A relational view of information seeking and learning in social networks. *Manag. Sci.* **2003**, *49*, 432–445. [CrossRef]
19. Pauwels, C.; Clarysse, B.; Wright, M.; Van Hove, J. Understanding a new generation incubation model: The accelerator. *Technovation* **2016**, *50*, 13–24. [CrossRef]
20. Jensen, P.H.; Palangkaraya, A.; Webster, E. Trust and the market for technology. *Res. Policy* **2015**, *44*, 340–356. [CrossRef]
21. Mowery, D.C. Economic theory and government technology policy. *Policy Sci.* **1983**, *16*, 27–43. [CrossRef]
22. Pisano, G.P. The R&D boundaries of the firm: An empirical analysis. *Adm. Sci. Q.* **1990**, *35*, 153–176.
23. Atsmon, Y.; Dixit, V.; Magni, M.; St-Maurice, I. China's New Pragmatic Consumers. *McKinsey Q.* **2010**, *4*, 1–13.
24. Lewicki, R.J.; Bunker, B.B. Developing and maintaining trust in work relationships. In *Trust in Organizations: Frontiers in Theory and Research*; Sage Publications: Thousand Oaks, CA, USA, 1996; pp. 114–139.
25. Lamoreaux, N.R.; Sokoloff, K.L. *Intermediaries in the US Market for Technology, 1870–1920*; Cambridge University Press: New York, NY, USA, 2002.
26. Rubinstein, A.; Wolinsky, A. Middlemen. *Q. J. Econ.* **1987**, *102*, 581–593. [CrossRef]
27. Biglaiser, G. Middlemen as experts. *RAND J. Econ.* **1993**, *24*, 212–223. [CrossRef]
28. Boschma, R. Proximity and innovation: A critical assessment. *Reg. Stud.* **2005**, *39*, 61–74. [CrossRef]
29. Brem, A.; Radziwon, A. Efficient Triple Helix collaboration fostering local niche innovation projects—A case from Denmark. *Technol. Forecast. Soc. Chang.* **2017**, *123*, 130–141. [CrossRef]
30. Geels, F.W. From sectoral systems of innovation to socio-technical systems: Insights about dynamics and change from sociology and institutional theory. *Res. Policy* **2004**, *33*, 897–920. [CrossRef]
31. Iansiti, M.; Levien, R. *The Keystone Advantage: What the New Dynamics of Business Ecosystems Mean for Strategy, Innovation, and Sustainability*; Harvard Business Press: Brighton, MA, USA, 2004.
32. Saggi, K. Trade, foreign direct investment, and international technology transfer: A survey. *World Bank Res. Obs.* **2002**, *17*, 191–235. [CrossRef]