Makerspaces as a form of business incubation system: evidence from the UK and abroad

Declan Scully (University of Roehampton)

LiYing Meng (University of Falmouth)

Stephen O'Regan (University of Roehampton)

Corresponding author: Declan Scully,
Roehampton University Business School, London, UK
declan.scully@roehampton.ac.uk

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**Abstract**
It is well documented in entrepreneurial research that new businesses face considerable difficulties in getting established and statistically are unlikely to survive. It is against this backdrop that a wide range of incubation services aimed at improving survival possibilities have been created and offered to new businesses. Although many of these models have received some consideration in the academic literature, makerspaces have not received a proportionate amount of academic interest. This paper seeks to investigate the manner in which incubation services are offered to new businesses by makerspaces. The methodology utilised includes a systematic literature review and an open-access database made up of data on makerspaces operating within the United Kingdom. A convenience sample of both corporate and traditional makerspaces was also used. The paper identifies considerable over-lap between makerspaces and more established models of incubation support. However it is clear that although corporate supported makerspaces provide extensive, integrated incubation support, this is not true in the case of more traditional makerspaces where the communitarian ethos remains dominant.

Track: Business Support, Policy and Practice.

Keywords
Makerspace, Entrepreneurs, Incubation

## **1** Introduction and Literature Review

The establishment of a dynamic and prospering small enterprise sector is seen by policyholders as essential for the economic development of countries (Audretsch, 2002). Consistent evidence from many developed economies, does however, point to the many practical obstacles and challenges facing nascent entrepreneurs and their fledgling businesses. An extremely high level of business failure is unfortunately a characteristic of this sector and numerous authors have pointed to the need for aspiring entrepreneurs to be given greater access to resources during the crucial early stages of their ventures in order to overcome these obstacles ( Belso-Martinez et al., 2013; Honjo, 2000). In response to this need, various forms of incubation services have been made available to businesses (Bruneels, 2012). Some of the earliest initiatives were seen in the creation of the Stanford Research Park, California, established in 1951 and the Industrial Center of Batavia, New York, an incubator established in 1959. Globally, there are currently in excess of 7,000 incubator programs worldwide, one third of which are technology-oriented (Joshi and Apoorva, 2015, referring to NBIA data).

Bruneels (2012) traces the evolution of incubators from the 1980s when they first became commonplace in western economies. The first phase of incubators were typified as having the predominant aim of providing office space as a means of assisting agglomeration (Adkins, 2002). At around this time there was also seen the expansion of Science Parks (Smith and Zhang, 2012. According to Bruneels (2012), it was not until the 1990s that there was a widespread expansion of services away from purely one of accommodation to include intangible services in the form of in-house business support services. Additionally, it was also during this period that incubation services oriented towards assisting technology-based start-ups became more prevalent. Bruneels (2012) categorises these as a third generation of incubator. More recently, Pauwels et al (2016) identifies accelerators, in which the incubated firm will participate in a relatively short-term (typically thirteen weeks), boot-camp type environment aimed at rapid maturation of the business, as a new form of incubation system. Additionally, other forms of incubator, such as the virtual incubators (Nowack and Grantham, 2000) which do not have a physical location have also emerged over the past ten or so years. It is against this backdrop that makerspaces need to be considered as a form of incubation

Over the past decade, makerspaces have emerged as a global phenomenon with most developed countries having makerspaces. Makerspaces can traced back to the Center for Bits and Atoms at MIT which was established in 2001and the FABLAB movement (Gershenfeld, 2005, 2012), closely associated with its founder, Prof. Neil Gershenfeld of MIT, has grown to more than one thousand entities by 2018. Makerspaces sit alongside a general maker movement which has emerged in recent years and has been facilitated by the emergence of new technologies such as 3D printers, sharing of information and know-how by means of the internet and the creation of maker-faires as a venue for makers to offer their wares to the wider public (Hargadon and Sutton, 2000). A generally accepted definition of makerspaces is lacking but it is possible to define makerspaces as organisations that aim to foster the making of objects by providing specific services focusing on the provision of not only equipment but also education and general support. There is a strong communitarian ethos within many makerspaces in which social improvement within their communities, especially to the disenfranchised and in support of sustainability are a common aim (Kohtala, 2017). In providing their services, makerspaces constitute a resource which is potentially available to fledging businesses. They are fundamentally places in which collaboration takes place between individuals and other participants in the makerspace.

Extant literature on Makerspaces is located in several domains: articles can be found in journals devoted to library studies (de Boer, 2015) or to education (Kjällander, 2018) both of which reflect the presence and activities of Makerspaces, but within the literature devoted to business relatively little has been published. The opening premise from which this article proceeds is the following: Makerspaces, as a form of incubation, has not received sufficient consideration within academic literature devoted to the growth of businesses. A preparatory literature review discovered an example of a paper which encapsulates the current viewpoint towards makerspaces in the business literature. When *Technovation*, a leading academic journal devoted to technology and innovation, published a systematic review of the literature on technology-based incubation in 2016, its authors (Mian et al., 2016) operationalised incubation to include the following types of institutional support: science parks, technology incubators, innovation centres and accelerators. Makerspaces were not specifically included. In the last ten years or so, there has been a rapid growth in the creation of makerspaces. This has created a great diversity in terms of their aims and objectives. Recently, there has been seen the emergence of corporate interest in makerspaces. This article will review existing makerspace models with a specific focus on their incubation support

## 2. Research approach

Since the objective of this article is to compare makerspaces with other forms of incubation, existing archetypes of incubation are identified. They are treated as the unit of analysis. In order to ascertain the types of entity in existence which provide these services a systematic literature review was carried out using a protocol and following best practice (Tranfield et al, 2003). This included the creation of specific search terms, the identification of relevant journal articles where the dominant theme included examination of forms of incubation and the removal of irrelevant or insignificant literature. Additionally, relevant websites of key stakeholders such as governmental departments – both national and regional – were also checked. Interviews were conducted with active participants of FabLabs, site visits were made and the author participated at a major international conference on makerspaces at Toulouse in July 2018. Archival data from the websites of makerspaces was also utilized based on a convenience sample of five makerspaces which were chosen on the basis that they represented a cross-section of the types currently in existence. Corporate makerspaces organized and managed by Airbus and Barclays, a makerspace focusing on high technology based in Toulouse (Artilect) as well as two grass-roots makerspaces were researched, one in Manchester (MadLab) and another in Zagreb (FabLab Zagreb). Finally, data drawn from an open dataset (NESTA, 2016) compiled on behalf of a British innovation charity, NESTA during 2014- 2015 were examined. The data, based on a survey, interviews and desk-research, sets out information on 97 makerspaces operating within the United Kingdom. The identified data was analysed using a multiple case-study process (Eisenhardt,1989) of cross-case analysis in which dimensions and categories are initially identified followed by a process of identifying similarities and differences at the inter-case level.

The second stage of the analysis was to employ the design perspective proposed by Zott and Amit (2010) as a theoretical lens for identifying the primary design parameters of the different forms of incubation provider: this approach was adopted, in a similar manner by Pauwels et al., (2016) to analyse accelerators; for this article, it was applied on a wider basis to compare makerspaces with other forms of incubation. In recent years, the study of business model innovation has attracted considerable amounts of academic interest. Business models are seen as a form of architecture (Dubosson-Torbay et al, 2002) which can be used as a means of explaining the manner in which value is created and captured at an organisational level (Amit and Zott, 2001). Accordingly, business models can be seen as embracing ta range of activities

undertaken by the entity, in a holistic manner, which is depicted as the "heuristic logic" (Chesbrough and Rosenbloom, 2002 p.529) of the entity. Using a business model perspective is particularly appropriate for examining incubation providers since it allows us to identify common themes that are orchestrated across a range of business models. Zott and Amit (2010) advocate that in analysing business models it is necessary to focus on the design elements which represent the activity system.

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Table 1 about here

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**3. Findings and analysis**

The data was grouped into five categories to provide distinct elements which are common among existing models of incubation. The four categories are: (1) Offering package; (2) Access; (3) Funding(4) External Relations and (5) Governance. Each will be considered in turn. Data from the five makerspaces which were specifically researched is set out in Table 1. The design elements are applied to these makerspaces and the reported data can be found in Table 2.

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Table 2 about here

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**3.1 Offering package**

A wide range of services are offered through incubation. Traditional models of incubation focused on traditional business support services and progressed to offer more intangible services such as general business advisory services (Mian, 1996). It is also the case that business support may embrace other forms of support (Mian, 1996; Aernoudt, 2004). Incubators also have an intermediary role in connecting incubatees to other organizations through their external network (Bergek and Norrman, 2008: 24-5).

As incubation services have become more specialised, especially in the context of University-focussed incubators and Science Parks, the diffusion of specialised knowledge as well as technical support have become more prevalent (Bruneels et al., 2012: 111). The availability of support services varies: science parks typically do not provide extensive support services in the same way that conventional incubators might (NESTA, 2008). Another important area of resourcing provided by incubation providers is access to the benefits of networks (Schwartz and Hornych, 2010). The value of networks comes in the form of access to knowledge and to connections to parties who would otherwise not be connected. Other services which are offered by incubation providers which are designed to assist tenants include activities designed to enhance social capital : this is a core activity for all incubation providers. The provision of technical lab equipment is another core activity (Crittenden & Woodside, 2006; Mian, 1996). All of the makerspaces which were investigated offered a range of equipment together with training. Alongside the provision of services such as access to laboratory equipment, more specialised legal advisory services connected with not only intellectual property but also relating to connected matters such as patenting and licensing agreements have become more prevalent. However, there was no specific evidence that these types of services were commonly available in makerspaces. An exception to this is the Eagle Lab network which has been set up by Barclays Bank in the UK. Within this network, participants at the labs are offered access to a wide range of professional services, including advisory services (see Table 2).

The NESTA data and a literature review suggests that makerspaces offer an equally wide range of services but there is great diversity in terms of the extent of the offerings. Advisory services offered by makerspaces have an emphasis towards the provision of technical support services: these will often take the form of technicians assisting users to operate specialist machinery. In terms of more mainstream advisory services, such as guidance on business creation or on the production of business plans, it is less frequently offered. However, a particular area of business support which is of specific benefit to nascent entrepreneurs, is the assistance offered by makerspaces in the production of prototypes. Birtchnell et (2017) report on the Berlin FabLab where 80% of SMES use their facilities for rapid prototyping. Airbus (see Table 2) has a specific group of makerspaces located in a number of their factories which utilize the rapid prototyping approach to aid innovation.

In the case of equipment, according to the NESTA data based on activities within British makerspaces, approximately two-thirds of them offered more than five types of tools. Additionally, digital and manual tools were commonly available. Equipment designed to facilitate digital fabrication was found in 73 per cent of the makerspaces; general tools were found in 60 per cent, general hand tools and electronics at 60 per cent and woodwork at 52 per cent. Computer equipment was found in about half of the locations. Equipment designed to facilitate more specialised work such as photography or printmaking, ceramics and sculpture were found in a smaller number of makerspaces. The most advanced makerspace which was included in our study was the Artilect makerspace in Toulouse, France. Participants were offered, in addition to the normal offering of digital fabrication equipment, a wide range of services offered by specialized Labs with full technical support (see Tables 1 and 2). In one makerspace highly specialised equipment for biotech were found in a facility based in Manchester. Makerspaces, in the majority of cases, also offered a broad range of educational services: these were found to include inductions into using specific forms of tool but a wide range of educational courses were also available in more than 90 per cent of cases. School out-reach programmes were widespread with some 24 offering specialised educational programmes to Schools. Tools and equipment aren't the only things that denote a makerspace.

### 3.2. Access

Incubation activities are performed at a wide range of physical locations and the space and the amount of space occupied by the incubated firm can vary enormously: tenants of science parks may occupy substantial areas with little or very limited common spaces with other tenants. On the other hand, tenants of incubators who occupy shared workspaces are unlikely to occupy areas of spaces which are exclusive to themselves. Common elements among incubation facilities include shared space and the opportunity to work alongside other parties facing similar challenges (Hackett and Dilts, 2004: 57; Bruneel et al., 2012: 110). More recently, virtual incubators have been created which operate without specific physical locations (Nowack, 2000). Makerspaces share the same level of diversity as other forms of incubation. In some situations, especially where there is hybrid governance, such as in libraries under local government ownership, or universities, the location will be co-located within the parent organisation (de Boer, 2015). The NESTA data for UK makerspaces showed a wide range of diversity in types of location including mobile or temporary facilities. The actual size of the makerspaces also varied enormously with an average space of 209 square metres. Within the UK, it is not common for shared space to be offered to participants in the manner offered by incubators. One exception, at least in some of their locations, are the Eagle Labs created by Barclays Bank where space is available to rent in some labs.

Access was a point of divergence among the five makerspaces which were specifically investigated. In the case of the Airbus spaces, access was restricted to their own employees. These labs were created as part of a wider ecosystem of innovation within Airbus. The principal aim of the labs was to assist in rapid prototyping of new ideas (see Tables 1 and 2). In keeping

with the communitarian ethos of the FabLab Charter, two of the sample (the MadLab in Manchester as well as the Zagreb FabLab (see Tables 1 and 2) were open-access and aimed to offer inclusive environments.

A reduction in the time necessary to grow a business is a key objective of incubation (Clarysse et al., 2005). The period in which a firm engages with incubation services varies considerably. In the case of advanced technological businesses located within highly specialised bio-technology incubators of the kind described by Baraldi and Ingemans (2016) the stated period is up to fifteen years. In other situations, an incubation period of between three and five years is more typical (Mian, 1997: 281; Bergek and Norman, 2008). In the case of accelerators, the time period is often considerably shorter. According to Hochberg (2015), the normal period of occupancy within an accelerator is thirteen weeks. Makerspaces do not normally limit their services to specific periods.

### 3.3 Funding

Incubation providers are frequently collaborations between universities, industry and government (Etzkowitz, 2002). They have a wide range of organizational forms: in cases where the funding is provided by an established organization such as a university or library, control may be vested in the parent organization. In other cases, governance will be more autonomous, especially where the incubation provider is organized as a commercial venture. Over the past ten or so years there has been a sizeable increase in business models for incubation providers where revenues will be generated from for-profit activities. Among such forms of incubation, the provider cannot rely on public support to cover all of the costs associated with the provision of incubation services. Accordingly, it is necessary for revenue to be generated from commercial activities. University sponsored incubators often profit from spin-offs where profit can be generated from the shareholding held in sold-off incubated businesses (Clarysse et al, 2005) or from income generated from technology transfer activities from the exploitation of intellectual property created by incubated businesses. In another example of this profit-oriented model, accelerators will commonly require a small share-ownership to be granted to them at the outset of the program by all participants. With increased profit-orientation comes more focus on timelines for exits and performativity. In the case of science-based Incubators, such as the example of the Karolinska Institute put forward by Baraldi and Ingemans (2016), the incubated business will remain typically for between ten and fifteen years. Equally, in the case of accelerators the timeline is limited to thirteen weeks at the culmination of which the incubated firm will pitch for investment support from potential investors. There was no evidence that makerspaces sought to gain financial advantage from their participants. In the case of the Eagle Labs run by Barclays Bank, as well as the "grass-roots" makerspaces examples of MadLab Manchester and FabLab Zagreb, income came primarily from small fees charged for services but in both cases strenuous efforts were made to minimize charges or even to offer them free of charge at point of delivery. The NESTA data makes it clear that a monthly subscription model is the dominant approach within UK makerspaces.

### 3.4 External Relations

Makerspaces within the UK were found to be overwhelmingly embedded within their local communities (NESTA, 2015). This finding was mirrored in our own research, at least in the case of the non-corporate makerspaces. In these cases, such as the MadLab in Manchester, the Zagreb FabLab and Artilect in Toulouse, strenuous efforts were made to form bonds with their local communities. These activities were generally aimed at offering outreach to their communities in the sense that they aimed at attracting new users to their makerspaces. This was sometimes seen through events open to non-members such as that offered by Artilect in Toulouse (Super LUNDI – see Tables 1 and 2). These activities were also aimed at educational institutions but, rather conspicuously, these activities did not extend to attempts to attract fledgling businesses to makerspaces. Within the UK, NESTA reported that the majority of

makerspaces were community based within specific geographic locations. Makerspaces have been found to have strong linkages to local schools and libraries. Within the user groups of makerspaces there is growing evidence that they constitute a place where considerable social interaction and networking takes place. There was considerable evidence that members within makerspaces shared knowledge openly, frequently and unconditionally. Networking with government at a local and regional level was widespread.

### 3.5 Governance

Makerspaces within the United Kingdom were found to be overwhelmingly self-organised structures run by volunteers. The dominant form of income was from subscriptions or from fee income from providing use of tools and equipment. Governance within makerspaces is over-whelmingly self-organising: not-for-profit structures are ubiquitous and a communal attitude to the management of the shared space is normal. Within makerspaces based on the MIT FabLab model there is agreement to operate in compliance with a charter which proposes a communitarian, not-for-profit approach.

### 3.6 Design Themes

The architecture of the makerspaces which we examined varied enormously and demonstrated tremendous diversity based on the design elements utilized. The following section sets out the second type of design parameter, the design themes which illustrates the common themes under-pinning four types of makerspaces and which characterize the orchestration of elements set out above (Zott and Amit, 2010). Utilising a cross-case analysis, we set out in Table 3 the design themes which map out differences between the makerspaces in our sample.

**"The Corporate Prototyper"**

This type of makerspace can be seen in the example of Airbus ProtoSpace. In this case, the makerspace is not open to anyone other than the firm's own employees. It operates within the innovation ecosystem of Airbus. Certain characteristics of this makerspace are noteworthy. First of all, the physical environment of the makerspace is made up of two specific areas: a design space where employees are encouraged to brainstorm on new concepts and to develop ideas on how they can be developed. The second space is devoted to prototyping where the emphasis is on rapid conversion of ideas into workable prototypes. The prototyping labs have extensive equipment. The membership of the makerspaces, although entirely made up of Airbus staff, will also include staff from other factories in order to encourage collaboration between the different sites. The Airbus ProtoSpace also has "Sprint" teams which use the makerspace environment to develop specific projects rapidly in a fixed period of 100 days. Numerous innovations have been created through this process.

**"The Hybrid Makerspace"**

The Eagle Labs set up Barclays Bank in the UK represent a hybrid form of makerspace. The makerspace is corporate owned and managed but it operates with a focus on offering its services to both internal and external users. It is also unusual in that the different labs focus on different activities. For example, the first lab which was set up in Cambridge focuses on offering mainstream makerspace services but the Notting Hill lab concentrates on innovation in legal

services, "LawTech". Internal users within the bank have access to work on their own projects. External users can, in some locations, rent space in shared accommodation. One common characteristic throughout their network is the availability of advisory services to both internal and external users of the Eagle Labs.

**"The Hi-Tech Makerspace"**

The makerspace which offered open-access to the public and which contained the most advanced technology was the Artilect makerspace in Toulouse. This makerspace, which is the earliest created in France, has strong external relationships with local high-tech businesses operating within this region of France such as Dassault and Toulouse. This makerspace has extensive outreach activities within the local community and holds regular "superlundi" events where interested potential users can attend an evening at the makerspace. The range of equipment available was extensive but also highly focused on specific areas. For example, specific labs were in existence to support endeavours in fields as diverse as building drones, biotechnology, textiles, music and robotics.

**"The Grass Roots Makerspace"**

These makerspaces are typified by the MadLab of Manchester and FabLab Zagreb. These two makerspaces represent the most traditional forms of makerspaces in the sense that they are embedded strongly within their local communities. They are focused on offering access to traditional tools and, more importantly, to digital fabrication equipment. Additionally, there are strong offerings in the areas of training and support for users. The makerspaces both have strong linkages with local education establishments and voluntary organizations.

## 4. Discussion and implications

The findings reported in this paper demonstrate the wide range of different forms of makerspaces in operation currently. In the case of corporate makerspaces of the type typified by Airbus ProtoSpace, there appears to be strong integration into sophisticated and well-developed innovation ecosystems. This is achieved by strong integration from the ideation stage which occurs within makerspaces and is then taken forward through systems of rapid prototyping. In the more traditional forms of makerspace, as seen in the case of the Manchester MadLab and the FabLab Zagreb, there are not structured incubation systems in existence. The labs offer entrepreneurs spaces for prototyping and for networking but these are largely informal and optional. The labs do not offer many of the services offered by conventional incubators such as shared workspace for the businesses (the Eagle Labs are an exception to this) nor do they offer access to venture capital and general mentoring to the extent found in more established incubators. The communitarian ethos remains the dominant ethos.

## 5. Conclusions

This paper demonstrates, perhaps for the first time, the range and variety of makerspace entities in operation currently. The implications for business incubation are equally varied.
It is clear that many of the more traditional labs do not regard incubation services as a priority: the exceptional cases are those with corporate management and control. The Airbus example, as well as the Eagle Labs of Barclays, demonstrate that it is possible to intregate makerspaces

with broader innovation ecosystems and with networks of advisers. Currently, among traditional FabLabs, there is a communitarian ethos which seems to de-emphasise business incubation. In discussing incubation with makerspace managers, the authors of this paper found that they all had some experience of participants from their makerspaces who had developed businesses but they were nearly always referred to as being exceptional. The dominant theme of these makerspaces is still to support the hobbyists, the curious-minded and the tinkerers rather than to support the incubation of businesses. The implications for policymakers are clear. Makerspaces currently lack a systematic approach to supporting new business. Users of makerspaces who are offered additional services aimed at nurturing entrepreneurial activities may be more likely to translate their projects into active businesses.

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Table 1
Case Descriptive

| | Name | Acronym | Location | Founding Date | Membership | Equipment | Incubation Support |
|---|---|---|---|---|---|---|---|
| 1, | Articlect | ART | Toulouse | 2009 | Open | Digital Fabrication BioLabs, DroneLab LabTextile, LabArchi | Links with Local Government and prominent local businesses such as Airbus and Dassault |
| 2 | MadLab | MLM | Manchester | 2009 | Open | | |
| 3. | Airbus Protospace | ABP | Toulouse, Hamburg, Ottobrun, Bremen, St. NAzaire, Filton, Nantes, Getafe | 2014 | Closed Access | Prototype Lab | Internal linkages with Airbus innovation ecosystem |
| 4. | Eagle Lab (Barclays) | ELB | Cambridge and 18 other UK locations | 2014 | Hybrid: Open membership and Internal corporate | Site dependent-focus varies between locations | Full access to Barclays range of internal innovation systems as well as external incubation support |
| 5. | FabLab Zagreb | FLZ | Zagreb, CR. | 2013 | Open | Digital Fabrication and IT Tech support | Informal linkages |

Table 2
Design elements based on Data collected

| | Design elements | Constructs | Representative Data |
|---|---|---|---|
| 1, | Offering Package | Basic woodworking tools<br>Digital Fabrication tools<br>Biolab equipment<br>Prototyping<br>Venture Capital<br>Shared workspaces<br>Mentoring<br>Software Development<br>Training courses | "shared tools and space"(MLM)<br>"We also offer bespoke services which include laser cutting, 3D printing, and vinyl cutting". (MLM)<br>Courses on laser cutting, vinyl cutting, 3D printing, website building, grant writing and coding.(MLM)<br><br>"The Fab Lab is organized by different Labs that mix according to projects and desires: BioLab, DroneLab, FabTronic, LabTextile, MusiqueLab, LabRobot" (ART)<br><br>"3D Printer - Arduino - CNC - Trotec - Epilog - Laser Cutting" (ART)<br><br>"Access to a fully equipped Maker Space, fabrication tools and onsite Technical Support, used for rapid prototyping, projects and workshops. The Lab also has a function area and boardroom available to hire for events and meetings." (ELB)<br><br>Ask the Expert sessions on Digital Marketing, Cyber Security and Business Operations (ELB)<br>"Cambridge Maker Space<br>From accelerating UK business to enabling collaborative innovation and digital empowerment for all, our Labs are a space to create, innovate and grow." (ELB)<br>"Rapid Prototyping<br>We're proud of our maker heritage and how we've helped businesses develop using the very latest technology combined with our outstanding talent" (ELB).<br><br>"Collaborative spaces and prototyping labs organised in global networks… Design places, in which employees can brainstorm on future concepts and develop them. The rooms are designed to foster creativity and cooperation." (ABP) |

| | | | |
|---|---|---|---|
| 2 | Access | Entry criteria: open access<br>Entry criteria: limited to corporate employees<br>Hybrid entry system<br>Exit criteria set out | "MadFabLab is an open-access workshop for Manchester's hackers, makers, and tinkerers" (MLM)<br>"Our aim was to make a diverse and welcoming space for all." (MLM)<br>"The main feature of a FabLab is its "openness". It is intended for entrepreneurs, designers, artists, do it-yourselfers, students or hackers of all kinds, who want to move more quickly from the idea to th realization." (ART)<br>"SuperLUNDI, how does it work:<br>Visit for new members and curious people: One evening, every first Monday of the month to presen the FabLab and current projects.(ART)<br>"Eagle Labs plays a pivotal role by fostering innovation and facilitating inclusive, shared growth fo all across its communities." (ELB)<br>"Help Barclays colleagues become the most digitally savvy workforce in the UK" (ELB) |
| 3. | Funding | Corporate Funded<br>Subscription funded model<br>Hybrid corporate/subscription model | "MadLab offers free space to community groups, as well as organisational support (setting up meetin rooms, free use of technical equipment, promotion). Those able to donate are encouraged to do so i order to make the space available to other groups who are not (our "grassroots guarantee")" (MLM)<br>"As a not-for-profit, we heavily rely on the kindness of the people we interact with. We greatl appreciate donations" (MLM)<br>"Cutting and Laser Engraving<br>Full price: 0.58 € for 1 minute". (ART)<br>Internal linkages with Airbus innovation ecosystem (ABP) |
| 4. | External Relations | Linked with external VC<br>Linked with business advisors<br>Linked with local authorities/central government<br>Linked with educational institutions<br>Community outreach activities | Support from local authority, local voluntary groups (MLM)<br>"Informing the public about the development and application of digital fabrication in the economy development of international cooperation programs and inclusion in the work of various age and soci groups, from young people, unemployed to persons with reduced mobility, all with the aim of the additional education for self-employment or employment" (FLZ) |

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| | | | "We've teamed up with MyMiniFactory to bring you some 3D inspiration and the opportunity to find and connect with designers and makers across the UK." (ELB)<br><br>"ProtoSpace also aims to connect employees with renowned entrepreneurs and innovators from across the world through regular conferences on outstanding projects and breakthrough topics, to stimulate new thinking and new ideas, as well as to capture additional potential for Airbus." (ABP) |
| 5. | Governance | Corporate owned and operated<br>Self-governing | "MadLab is run by a board of Directors" (MLM).<br>"FabLab association, the association for the promotion of digital fabrication, was registered as a non-profit, non-governmental civil association, on March 1st, 2013 in Zagreb", (FLZ).<br>"The FabLab association and is part of the international association FabLab organization , based on the idea of MIT" (FLZ) .<br>Owned and operated by corporate entity (ELB) and (ABP). |

Table 3

Design Themes with supporting data

| | Corporate Prototyper | Hybrid Makerspace | Hi-Tech Makerspace | Grass Roots Makerspace |
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| | Design Theme | "Having observed the rise of rapid prototyping in companies and start-ups outside the aviation industry, Airbus nurtures such practices within the company and takes inspiration from MIT's "fab labs" (ABP) | "collaborative innovation and digital empowerment for all, our Labs are a space to create, innovate and grow." (ELB) | "The Fab Lab is organized by different Labs that mix according to projects and desires: BioLab, DroneLab, FabTronic, LabTextile, MusiqueLab, LabRobot" (ART) | "Our aim was to make a diverse and welcoming space for all." (MLM) |
| | Access | Restricted to corporate members and fully integrated in the innovation ecosystem of Airbus | Open to Barclays staff and local communities | Open-access | Open-access |
| | Funding | Corporate funded | Corporate funded by also pay as you go model for some services | Some governmental and corporate support but also pay as you go model for some services | Some governmental and corporate support, income from space rental but dominant ethos of free delivery as far as possible |
| | Incubation Support | Not specifically included | Access to full range of incubation services | No specific offering but informal networks | No specific offering but informal networks |

| | | | |
|---|---|---|---|
| Airbus ProtoSpace | Eagle Labs (Barclays) | Articlect | MadLab Manchester |