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► **To cite this version:**

Wendy Cukier, Valerie Fox, Hossein Rahnama. Building Human Infrastructure for the Digital Economy: Ryerson's Digital Media Zone. 10th International Conference on Human Choice and Computers (HCC), Sep 2012, Amsterdam, Netherlands. pp.156-169, 10.1007/978-3-642-33332-3_15. hal-01525117

HAL Id: hal-01525117

<https://inria.hal.science/hal-01525117>

Submitted on 19 May 2017

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Building Human Infrastructure for the Digital Economy: Ryerson’s Digital Media Zone

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Abstract. Drawing upon the policy literature and empirical work, this paper proposes an ecological model in which entrepreneurial skills are a critical part of the human infrastructure needed to fuel national Digital Economy and Innovation strategies. While many countries around the world reference the importance of building a “culture of innovation” and some countries, such as Israel, are seen as having this deeply embedded, there are few definitions and fewer empirical studies assessing this. We suggest that the prevalence of individuals with entrepreneurial mindsets and a willingness to take risks will drive economic growth and development but that developing this is easier said than done, as complex factors shape values and aspirations. While University-based incubators have long been seen as important parts of the innovation ecosystem, we provide a case study of a unique incubator, Ryerson University’s Digital Media Zone (Toronto, Canada), and suggest that it not only offers short term outcomes but also offers a model that is critical to fostering a culture of innovation. We conclude that more needs to be done in Canada to promote this culture of innovation and that it needs to begin long before students reach university.

Keywords: digital economy, digital skills, Canada, ecological model, entrepreneurs, innovation, innovators, incubators

1 Digital Skills and the Culture of Innovation

Recent reports [36] lament Canada’s lagging global performance on innovation and recommend a variety of interventions at the policy or macro level. At the same time, the evidence is clear that the challenges are complex, also demanding attention at sectoral, firm, and individual levels and their inter-relationships. For example, the availability of venture capital [35], the social acceptance of entrepreneurs, and formal-informal networks all influence the development of entrepreneurial culture [4]. Comparisons of countries have focused on differences in tax policies, investments in research and development (R&D), and regulations [61]. Less attention has been paid to cultural differences [24]. The characteristics of individual entrepreneurs have been the subject of much research [71], [28], [29], [53], [85]. However, less research exists on the effectiveness of specific interventions aimed at developing entrepreneurs and entrepreneurial culture. While globally there are broad discussions of the need to

strengthen the “culture of innovation” [22], [27], [39], [49], [50], [51], [70], this is not well defined, nor has there been much attention to how it will be fostered.

Canada’s Digital Skills Strategy stresses the importance of a technological infrastructure, the need to strengthen ICT markets, the need to promote applications, and the importance of developing the human infrastructure. However, critical digital skills tend to be defined as basic digital literacy (to enable access and use of the internet for example) or on Science, Technology, Engineering and Mathematics (STEM) disciplines. Less attention has been paid to the importance of fostering entrepreneurial skills in order to grow digital companies [15].

Previous research [3], [19] [31], [67] has also explored social networks that constitute innovation ecosystems and the geographical clustering of technology company entrepreneurs in innovation hubs. Universities often play a critical role in these ecosystems and university-based technology transfer centres and incubators have been successful in effectively mobilizing research knowledge [52]. Stanford University in Silicon Valley and MIT in Cambridge, Massachusetts are key players in well-known hot spots for digital innovation and fostered many wildly successful high-tech companies [10]. University-based and other incubators have a long history in many nations in promoting local economic development and the creation of new businesses. Canada, for example, is home to more than 200 distinct technology incubators and accelerators, including at least ten specifically focused on digital media. In some countries, national networks of small business incubators are an explicit part of national innovation strategies [65]. Yet there are still numerous unanswered gaps in understanding the process of startup success and the role that incubators may play [59].

Our paper suggests that:

1. Entrepreneurial Skills and Entrepreneurship must be a critical part of national Digital Economy and Innovation strategies;
2. The prevalence of individuals with entrepreneurial mindsets and a willingness to take risks will drive economic growth and development, and are a critical aspect of a “Culture of Innovation”;
3. University-based incubators can not only offer short term outcomes such as the creation of technologies, companies and jobs, but are also a critical element in developing the skills and mindset needed to foster a culture of innovation.

We will first review the relevant research on entrepreneurs and entrepreneurship, entrepreneurial culture, building entrepreneurial skills and the role of incubators. We will then describe the Canadian context broadly and provide a case study of a Canadian digital media incubator at Ryerson University in Toronto, Ontario.

2 Entrepreneurs and Entrepreneurship

The ‘entrepreneurial mindset’ includes the ability to sense, act, and mobilize under certain circumstances – characteristic of entrepreneurs and entrepreneurial behaviour [32]. But the question of how this is defined and measured and, more importantly, where it comes from, is the subject of much debate.

There have also been efforts to define entrepreneurship and identify the characteristics of entrepreneurs through profiles [9], [81] or psychographic testing and surveys [8], [40], [73], [90]. Some scholars have focused on refining the measures and instruments used to assess entrepreneurial traits such as self-efficacy [55]. Various instruments purport to measure key entrepreneurial characteristics such as the need for achievement, a locus of control, and creative tendencies [13], [16], [63]. Non-psychological variables such as education, family, and life experience influence the tendency to behave entrepreneurially [17]. Donaldson [18] suggests that the single most important factor is an individual's belief that starting a business is a suitable course for them and this, in turn, is affected by many factors.

The prevalence of individuals with entrepreneurial mindsets and a willingness to take risks will drive economic growth and development [18], [88]. Entrepreneurial culture is defined as a set of "values, beliefs and attitudes commonly shared in a society which underpin the notion of an entrepreneurial 'way of life' as being desirable and in turn support the pursuit of 'effective' entrepreneurial behavior by individuals or groups" [25]. Social norms reflect the interplay of many variables including historical context, institutions [43], and political and economic systems [42], [47], which have a significant impact on the decisions to pursue entrepreneurial activities [30], [62]. Similarly, national culture, as reflected in institutions, laws, and policies, may also influence the propensity towards entrepreneurship [38], [41], [46], [66], [72].

Some studies attempt to measure the national culture of innovation [33] and entrepreneurship based on aggregate measures such as creation of new enterprises on a per capita basis or by national productivity [12], [37]. The Global Entrepreneurship Monitor (GEM) assesses country entrepreneurial attitudes and general societal attitudes towards entrepreneurship. Other studies consider the relationship between national culture and the characteristics of individual entrepreneurs, attempting to assess the values, beliefs, motivations, and cognitions of entrepreneurs across cultures [44], [87]. Building on Hofstede's [34] cultural indices, some scholars have attempted to link national culture with individual entrepreneurial characteristics. For example, Licht and Siegal [44] suggested that cultures that were ranked as more individualistic had a higher likelihood of an internal locus of control orientation, one characteristic often associated with an entrepreneurial orientation. This is also more likely in low uncertainty avoidance cultures. Rates of innovation are most closely associated with the cultural value of uncertainty acceptance, but a lack of power distance and individualism also are related to high rates of innovation. This research suggests that nations may differ in their rates of innovation because cultural and religious values [6], [11], [23], [56], [82].

There have also been a number of studies to assess whether or not, in addition to building knowledge and skills, entrepreneurial intentions are affected by education [83]. The findings make logical sense when one considers the relationship between knowledge, skill and self-efficacy, which are important traits of entrepreneurs. Although research has been specifically directed at developing entrepreneurial skills for engineers, scientists, and physicians [20], the impact of entrepreneurial training and education programs in promoting innovation is inconclusive [23], [78], [85].

3 Incubators

Specialized services and infrastructures (e.g., incubators, research centers, business parks, and technology transfer offices) can promote entrepreneurship and foster the commercialization of research and new ideas to stimulate scientific entrepreneurship [2], [14], [75], [77]. A business incubator is an organization designed to accelerate the growth and success of new entrepreneurial companies by nurturing them at their inception. Globally, there are high profile university-based incubators. For example, MIT in Cambridge, Massachusetts; Imperial College, London; University of Houston, Twente University; University of Monterrey and many others [5], [21]. Case studies which have documented the impact of individual incubators at universities including the University of Central Florida [69], the United States Market Access Center (USMAC) at San Jose State University [57], Northwestern and the University of North Carolina [58], in Sweden [68] and France [54], an Irish Dublin-based university campus incubator [1] as well as two in Canada [54].

Scholars have examined the evolution of incubators and research parks in the commercialization of research at universities [26], [58]. Many focus on their role in commercializing technology, nurturing firms and new products. However, incubators can also support broader objectives related to developing innovation ecosystems [60]. Among the benefits to client firms are access to student and faculty talent. Discussions of “entrepreneurial universities” in developing skills and attitudes have also emphasized their role in fostering technology entrepreneurs.

While the definitions of success vary, several studies have attempted to address performance issues [45], [74]. There are different ways to approach the question of effectiveness, the goal of the approach, the system resource approach, the stakeholder approach, and the internal processes approach [58]. The proposed University Technology Business Intelligence model included performance outcomes (program sustainability and growth, tenant survival and growth, contributions to the university mission, and community impacts). Management policies and their effectiveness particularly the effective use of resources (e.g. governance, finance and capitalization, operational policies, and target markets), services and their value added with a focus on the perceived value of the services provided (e.g. space, business assistance, human resources, and consulting) have also been studied. Sun et al. propose a framework of critical success factors [86] which includes environment-related, incubator-related and incubatee-related factors.

Bergek and Norma propose a model of incubator best practices that is contextual and goals-based [7]. They suggest that the incubator performs several functions 1) selection, 2) business support, and 3) mediation. In effect, the incubator is a mediator between the company and the external innovation system, acting as a bridge with the intention of leveraging talent and resources. Critical resources include knowledge and technology, capital, market-related resources, and human capital. Incubators may also engage in network mediation, matching incubatees with other actors, and institutional mediation by helping navigate and even shape laws, traditions, values, and norms.

One of the most important success factors to be considered for technology-based incubators is the selection of incubatees [84]. Support in the development of markets

and products are also key factors. However, other determinants of success lie within the incubatees and in their relationship with the incubator [86]. A common thread in the literature is that the major functions of an incubator, apart from subsidizing early stage growth, is to provide access to social networks, which in combination with intellectual capital, increase the chances of an entrepreneur's success [48].

Some studies have suggested that incubators simply prolong the survival of companies that would normally fail sooner. Rigorous evaluation early in the process by experienced entrepreneurs is the most effective way of increasing success rates by producing a survivor bias. This then raises questions about the role of the incubation process. Consequently, some research has focused on case control assessments of incubated versus non-incubated startups. The results, however, are ambiguous [1], [79]. The evidence on the value of specialization in incubators is also mixed [80].

4 Ryerson's Digital Media Zone

In Canada, there are more than 200 incubators that are members of the Canadian Association of Business Incubation. These incubators serve a range of sectors and purposes from general small business support, to fostering social enterprises in small communities, to large scale commercialization. They also operate across and within specific sectors.

The Digital Media Zone (DMZ) was established in 2010, at Ryerson University, a former polytechnic based in Toronto, Ontario, with deep roots in experiential learning and applied research. With more than 30,000 undergraduate students, Ryerson has one of the largest undergraduate entrepreneurship programs in Canada's largest business school (with more than 8,000 students). A high percentage of faculty members bring business experience along with academic qualifications. The University also has active student entrepreneurship clubs and competitions including Students in Free Enterprise (SIFE), Advancing Canadian Entrepreneurship (ACE) Canada, and Students Advancing Global Entrepreneurship (SAGE), which involve a substantial proportion of students and promote entrepreneurial activity.

The Digital Media Zone (DMZ) was created by the President of Ryerson University, Sheldon Levy, in response to student requests. He invested in prime real estate and infrastructure with a clear focus on supporting students with ideas for new businesses. In April 2010, the University rented 6,400 sq. ft. at the busiest corner in Canada, Dundas Street East and Yonge Street. The location was then equipped with state of the art technology [76] and a rigorous application processes for students to qualify for entry was established. The goals of the DMZ evolved beyond meeting student needs, however. It aspires to become a critical part of the downtown Toronto ecosystem:

- To strengthen the collaborative community of entrepreneurs;
- To improve and promote commercialization of technology;
- To help build industry clusters (in areas such as context-aware computing, for example) that can compete globally; and
- To help keep intellectual property and talent in Canada.

In less than two years, the size of DMZ has more than doubled – it now consists of 16,450 sq. ft. with plans for further expansion. To date it has reported:

- 41 startups incubated and accelerated;
- More than 64 projects initiated;
- 382 jobs fostered and created through newly formed startups and market-driven research, plus 56 new jobs at Ryerson itself;
- Eight companies which have outgrown the space and since leased their own;
- One company has more than 50 employees, while one has failed; and
- Currently, the DMZ houses 161 innovators in 36 teams.

One of DMZ's principal differentiators is the focus on communications and outreach facilitated in part because of its location. In the past year, there have been approximately 430 tours to the DMZ including by government ministers and financiers as well as leading business people and industry associations. There has also been substantial press coverage, with over 600 instances of positive media coverage locally, nationally, and internationally. High profile presentations have been made at the Toronto Economic Club (a prominent business network) and at conferences and events around the world – including in India, Brazil, China and Russia.

4.1 The DMZ Approach

Like other incubators, the DMZ performs the three basic functions identified and proposed by [7]: 1) selection, 2) business support, and 3) mediation. Companies apply to enter the DMZ and must pass an initial evaluation, have a unique innovation in the prototype stage, and a strong business plan that demonstrates a clear market need. The selection committee consists of industry leaders, faculty experts, peers, and mentors. Prior to entering the DMZ, prospective entrepreneurs typically have some experience with a project as well as coaching on basic business planning, provided via SIFE.

The DMZ provides open, flexible workspace, equipment, utilities, and services such as business plan counseling, mentoring, and workshops. It also provides training. While the typical DMZ company has entered the Zone with strong training and technical skills in their discipline, they receive support with business plan development and have ongoing access to coaching and training. Increasingly, there is a focus on progress monitoring with mandatory check-in meetings scheduled every few months to provide guidance and advice, monitor progress, and ensure companies are receiving the help they need to achieve their set milestones. Companies must submit monthly reports to ensure the DMZ has current information. The DMZ also helps provide human resources to companies including funded internship and student employees. Finally, as noted above, the DMZ provides extensive marketing and communications support including key marketing and communications materials such as sell-sheets, website pages, news releases, video pitches, and photoshoots.

In terms of “mediation”, the DMZ actively promotes networking through special events, networking sessions, workshops, etc. for incumbent entrepreneurs. This helps companies tap into resources which include experienced serial entrepreneurs or men-

tors, financing, customers, other incubators, and media (which fuels access to the others). The DMZ provides a directory of available mentors and profiles networking opportunities through a variety of events and tours. The DMZ identifies sources of funding and assists its companies with grant applications as well as with finding and securing other forms of financial support, such as Angel Investments. Given its high profile, the DMZ ensures a steady stream of prospective corporate customers. It also organizes joint events with other incubators as well as complimentary passes to startup related events in Toronto. Finally, a dedicated Media Relations Officer pitches stories, fields calls, and helps Zone companies with media training and PR strategies in order to build profile and fuel traffic. Apart from the formal services, there is ample anecdotal evidence of peer-to-peer mentoring and collaboration across companies.

4.2 The Results

Although a formal evaluation is yet to be undertaken, the DMZ has produced tangible results in a short time frame. Table 1 (next page) provides a brief description of some of the DMZ companies and results that they have achieved.

5 Conclusions

Based on a cursory assessment of the data, Ryerson's DMZ appears to produce a high number of companies and jobs relative to similar initiatives. While longer term tracking is needed, along with additional empirical analysis, it seems that among the key factors affecting positive outcomes are the rigour of the original screening process and the heavy emphasis on outreach and communications which, in turn, ensure that the companies are exposed to a wide range of investors and customers. This is also facilitated by the central location of the incubator site.

However, beyond the specific results with respect to firm and job creation, the impact of the DMZ seems to be broader in terms of fuelling a culture of innovation. The importance of the educative effects of the experiential learning in the DMZ along with the influence of the DMZ in shaping entrepreneurial intentions among the broader Ryerson community (students and professors) should not be overlooked. Further research is needed to explore this in detail.

The research on entrepreneurship and a culture of innovation suggests that shaping entrepreneurial intention is a complex process. It is reasonable to assume that the publicity around the DMZ and its companies, as well as the competition to enter the DMZ, plays a critical role in building culture by shaping values and narratives of entrepreneurial successes (and failures). Culture is about stories and values and can, therefore, play an important role in broadening the aspirations of young people. We need to understand how this can be done earlier, as many students in the DMZ have self-selected themselves based on earlier experiences. More work is needed to push this experience upstream, so that young people are exposed to these opportunities earlier and see the full range of entrepreneurial opportunities. Exploring this will be the focus of further research.

Table 1. The DMZ company summary

Company	Outcomes (number of employees, sales etc.)
<p>500px <i>DMZ Graduate</i> Founded in April 2011, 500px is a fast growing photography website.</p>	<ul style="list-style-type: none"> • Their iPad app is one of the top free photography apps in iTunes. • Voted the number one startup in Toronto in January 2012 by Techvibes, Canada's leading technology media property. • Has 16 employees; left the DMZ in December 2011.
<p>Bionik Labs <i>Currently Incubating</i> Founded in March 2011, Bionik Labs is a medical engineering research and development corporation with a focus on prosthetics and rehabilitation devices.</p>	<ul style="list-style-type: none"> • Working with major hospitals in the United States and Canada on clinical trials related to assisted technology for paraplegics. • Has over 20 employees.
<p>Finizi <i>Currently Incubating</i> Founded in February 2011, Finizi is a free online platform where financial institutions bid for the business of customers in live auctions.</p>	<ul style="list-style-type: none"> • Recently completed a three month beta pilot for GICs during which it processed over \$Can 30M in auction requests and \$Can 2M in completed sales. • Finizi has been featured in the Financial Post, Investment Executive, Business News Network, Yahoo Finance, and several other online finance and technology publications.
<p>Flybits <i>Currently Incubating</i> Founded in April 2010, Flybits is a Canadian leader in mobile context-aware computing.</p>	<ul style="list-style-type: none"> • Developed Toronto's GO Transit's first official mobile application. • The app was downloaded over 150,000 times in its first eight weeks. • Their software solution running on Motorola Golden-I product, the world's first hands-free and wireless headset computer received Motorola's Golden-idea Award. • Developed the first Connected Vehicle Mobile Solution as part of a research project for the Ontario Ministry of Transportation. • Department of Foreign Affairs and the Ministry of Economic Development and Innovation selected it as a top 10 Canadian company to present at the Mobile World Congress in 2012 and CTIA Wireless in New Orleans in the United States; has 17 staff.

HitSend*Currently Incubating*

Founded in April 2010, HitSend is a community crowdsourcing tool for gathering, prioritizing, and executing ideas. It integrates these into existing online communities.

- Chapters/Indigo Canada's largest bookstore uses their technology as part of its recently launched *Indigo Ideas* campaign for improving customer service.
- Has five staff.

HugeMonster*Currently Incubating*

Founded in April 2011, HugeMonster builds casual social games that blend traditional storylines with interactive and viral elements.

- Approximately 3,000 players play their game, Code of War, daily.
- Has 12 staff.

Shape Collage*DMZ Graduate*

Founded in September 2010, Shape Collage is an online collage maker that optimally arranges photos into collages of different shapes.

- The product has been downloaded more than five million times since 2009 and has been translated into 22 different languages.
- Has five staff.

Sound Selecta*Currently Incubating*

Founded in April 2010, Sound Selecta makes ArtJam, a mobile platform that blends music, art, and technology to bring users new interactive media experiences.

- Apple named ArtJam's Nursery Jam as one of its Top 10 apps for toddlers.
- Has five staff.

Phosphorus Media*Currently Incubating*

Founded in April 2010, Phosphorus Media specializes in high impact media systems and interactive displays.

- Select clients include: Sony, Ikea, Club Med, The Gap, Starbucks, Red Bull, L'Oreal, Adidas, and Pampers.
- Has five staff.

Teamsave*DMZ Graduate*

Founded in April 2010, Teamsave is a social buying website and platform.

- Partnered with Kijiji; both the Kijiji deal site and Daily Deals run on the TeamSave platform.
- TeamSave operates in 20 cities in North America and has over 50 staff.

Viafoura*Currently Incubating*

Founded in May 2011, Viafoura is a cloud-based plug-and-play commenting platform targeted to premium digital publishers.

- Currently partnered with 12 of the world's largest digital publishers.
 - Expanded from two employees to 17 in only six months.
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