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SUPER CONNECTORS, SPECIALISTS, AND SCRAPPERS: HOW CITIES USE CIVIC CAPITAL TO COMPETE IN HIGH-TECHNOLOGY MARKETS

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Abstract

This paper uses three cities from the same Canadian province, Toronto, Ottawa, and Waterloo, to examine how regions compete in high-technology markets. We find that regions use civic capital to leverage new, technological windows of opportunity, but they do so in very different ways. Tracing Toronto's evolution from a marketing hub for foreign multinationals into a center for entrepreneurship, we illustrate how weak ties and cross-sectoral buzz created a "super connector," scaling high-technology firms in a wide variety of areas. In Ottawa, task-specific cooperation in R&D, education, and specialized infrastructure enabled the region to overcome the disadvantages of its small size as a "specialist" in a single, capital-intensive niche, telecommunications equipment. Finally, entrepreneurs in Waterloo eschewed task-specific cooperation for peer-to-peer mentoring. By diffusing generic knowledge about how to circumvent the liabilities of smallness, mentoring networks enabled this "scraper" city to support smaller startups in a broad range of niches.

The digital transformation is frequently depicted as a threat to latecomers and laggards. Firm-level economies of scale in the accumulation of intellectual property and data as well as regional agglomeration effects have created a winner-take-all economy, divided between superstar cities on the one hand and left-behind places on the other (Kemeny and Storper, 2020; Zukin, 2021). And yet, despite these formidable obstacles, several historically low- and medium-technology regions have successfully navigated these disruptive developments, repositioning themselves within new digital markets. Focusing on Canada as a least-likely case of high-technology competition, we apply the concept of “civic capital” (Nelles and Wolfe, 2022) to an examination of longitudinal and cross-regional variation among Toronto, Ottawa, and Waterloo to illustrate how communities can use these ties to respond to technological disruption and exploit new opportunities.

Significantly, we expand on previous applications of the concept of civic capital to argue that it can support high-technology entrepreneurship in three different ways, facilitating cross-sectoral cooperation, constructing specialized, strategic goods, or diffusing general knowledge within decentralized mentoring networks. In Toronto, civic capital connected high-technology entrepreneurs to a variety of deep, globally competitive sectors, particularly financial services, creating a “sector connector” with a diverse and growing community of successful start-ups and scale-ups. Without the advantages of a global city, Ottawa and Waterloo followed a niche-based path, but did so in very different ways. Ottawa relied on the construction of task-specific collective institutions and programs to support its position as a “specialist,” upgrading its position in telecommunications equipment and moving into adjacent software-related fields. Waterloo, a “scrapper,” used mentoring networks to support small- and medium-sized enterprises across a wide variety of industrial sectors. Collectively, the analysis suggests that

smaller, urban regions can enter high-technology markets in different ways, each with distinct tradeoffs.

Civic capital and high-technology competition

The shift to cloud computing, data analytics, mobile computing, and artificial intelligence in the 2000s created new opportunities for urban regions with robust capabilities in software development. Yet not all urban regions, even those with excellent universities, navigated these shifts successfully. The app revolution which powered the growth of Toronto's ICT sector (Denney et al., 2021) disrupted Waterloo and Ottawa, triggering the collapse of Waterloo's largest technology firm, Research in Motion (now Blackberry), and exposing Ottawa's vulnerabilities as a hardware-focused innovation center in a software-dominated world (Ornston and Camargo, 2022).

A growing literature attributes the varying capacity of urban regions to respond to these opportunities and challenges to the presence of civic capital (Nelles and Wolfe, 2022; Safford, 2009; Storper et al., 2015). Civic capital offers a more nuanced approach to some of the broader concepts found in the literature, particularly quality of government, institutions, and place leadership, usefully bridging gaps in both institution-centric and social capital approaches (Beer et al., 2019; Farole et al., 2011). Civic capital, as defined in the recent literature, is comprised of formal or informal networks among individuals and associations, grounded in a specific region or locality that sustains a common vision for the community. Civic capital is generated through a range of organizations, whose members collaborate to develop new relationships and establish common goals for the economic development of the urban region (Nelles and Wolfe, 2022: 8).

It is thus a constructive explanatory variable for analyzing collaboration at the urban scale — including the degree of political willingness to cooperate based on a shared identity, set of goals, or expectations. The concept provides a novel way to theorize collective action dilemmas and their resolution through collaborative processes. Civic capital is grounded in the analysis of “governance” arrangements at the urban level — but provides an actor-centric perspective that focuses on the role of agency by civic actors and associations in promoting new patterns of economic development at the regional and local level (Beer et al., 2019). This article builds on these recent contributions to the literature by arguing that civic capital can take different forms in different urban contexts and perform several different functions.

The relationship between civic capital and high-technology competition has received particular attention in larger metropolitan regions. With deep capital pools and labor markets as well as a large stable of complementary, supporting industries, their diversity facilitates innovation, whether through serendipitous street-level interactions or broader patterns of cross-sectoral “buzz” (Storper and Venables, 2004; Zukin, 2021). This diversity, however, can lead to fragmentation (Fritsch, 2003), as evidenced by the disappointing performance of cities with low levels of civic capital such as Los Angeles (Storper et al., 2015). And as Safford cogently argues, cities with certain kinds of networks may fail to generate the requisite levels of civic capital to support economic adjustment to external shocks (Safford, 2009). By contrast, high levels of civic capital enable certain big cities to exploit sectoral diversity. For example, civic capital enabled entrepreneurs in Silicon Valley to combine engineering, the arts, biology, and finance in ways that their counterparts in Los Angeles could not (Storper et al., 2015: p. 177)

Smaller cities cannot expect to leverage this type of cross-sectoral buzz, prompting many to associate high-technology markets with larger, metropolitan areas (Caragliu et al., 2016;

Duranton and Puga, 2000). Despite these disadvantages, a number of smaller cities such as Aalborg, Denmark and Salo, Finland have entered cutting-edge, high-technology markets. We argue that they have done so by using civic capital in a different way, relying on task-specific, inter-firm cooperation to develop and diffuse deep knowledge within regional supply chains and collaborate in the construction of specialized public goods, including R&D consortia, training programs, technological standards, and other infrastructure (Dalum et al., 2005; Farole et al., 2011; Sabel, 1993). More commonly associated with mature, industrial cities and regions (Todtling and Trippl, 2004), we argue that this “organizationally thick and specialized” model (Trippl et al., 2018: 69) can also facilitate entry into high-technology markets.

While this common distinction between large “diversified” cities and smaller “specialists” (Duranton and Puga, 2000) illustrates how civic capital can play different roles at different scales, it does not explain how smaller cities such as Cambridge in the United Kingdom (Garnsey and Heffernan, 2005) or Waterloo in Canada carved out competitive positions in high-technology markets without specializing in a particular industry. We argue that this reflects a different pattern of collective action, characterized neither by cross-sectoral buzz nor task-specific cooperation but rather the diffusion of generic knowledge within mentoring networks. While general, this form of civic capital can be useful for smaller regions, alerting entrepreneurs to unexpected opportunities in high-technology markets and helping them navigate the unique challenges associated with capital scarcity, thin labor markets, and the relative dearth of complementary industries (Ornston, 2021). Instead of specializing in a single sector, the most successful firms, whether guided by mentoring networks or trial and error, are more likely to settle into small, overlooked niches in a wide variety of different areas. The sheer volume of independent niches, connected only by mentoring networks, can render “scrapper” cities highly

resilient. In contrast to larger “sector connectors” and “specialists,” however, this diversified approach makes it harder to scale specific industries and firms (see Table 1).

Table 1: Super connectors, specialists, and scrappers compared

Type	Type of civic capital	Position in high-technology markets	Case study
Super connector	Cross-sectoral buzz: Weak ties among individual firms, complementary service providers, and customers	Characterized by scaleups in a wide variety of different technological niches	Toronto
Specialist	Task-specific cooperation: Collective investments in specialized skills, R&D, and infrastructure	Scaleups concentrated in specific industry verticals (e.g. telecommunications equipment). Limited support outside of this space	Ottawa
Scraper	Peer-to-peer mentoring: Exchange of generic information about how to run a startup	Few scaleups, firms instead gravitate toward smaller, highly technical, overlooked markets	Waterloo

To investigate these claims, the article compares three Canadian cities, Toronto, Ottawa, and Waterloo, all located in the same province, Ontario. The focus on Canada is deliberate as its laissez-faire national and provincial policies enable us to better disentangle the impact of civic capital relative to national- or provincial-level dynamics, while its status as a latecomer to high-technology markets (excepting Ottawa) increases longitudinal variation relative to long-established US tech clusters such as Boston or Silicon Valley.¹ High-technology entrepreneurship was a new development in Waterloo in the 1980s (Nelles et al., 2005), and the even more recent proliferation of startups in Toronto marked a break from its historic position as a sales and marketing site for multinational technology firms (Denney et al., 2021). In Ottawa,

¹ Although provincial and federal innovation policies changed during the period of study, these changes impacted all three regions simultaneously (Bramwell et al., 2019; Wolfe, 2002) and do not explain why high-technology entrepreneurship took off (and stagnated) at different times in Ottawa, Toronto, and Waterloo.

which historically benefited from being co-located with several critical federal laboratories, we use the breakdown of associational governance to illustrate what happens when civic capital declines. Table 2 provides some summary statistics on the technology sector in these three cities.

Table 2: The technology² industry in Toronto, Ottawa, and Waterloo

City	Population (2016) ³	Tech employment (2016) ²	Share of total employment (2016) ²	Change in tech employment (2001-2016) ^{2,4}	Number of tech establishments (2016) ²	Percentage of total establishments (2016) ²	Venture capital deals (2015-2017) ⁵	Venture capital investment (millions, 2015-2017) ⁴
Toronto	5,928,040	264,630	8.5%	11.2%	8,073	3.5%	482	2,986
Ottawa	1,323,783	56,335	7.9%	-22.6%	1,369	3.8%	73	605
Waterloo	523,894	23,810	8.3%	54%	558	3.7%	73	492

To assess the role of civic capital, the article draws on 211 semi-structured interviews with policymakers (n = 24), industry observers (n = 15), and industry representatives (n = 172) in Toronto (T, n = 104), Ottawa (O, n = 56), and Waterloo (W, n = 51) from 2016 and 2022, the majority of which were conducted before 2020. Interview subjects, which extend from former founders from the 1970s to contemporary entrepreneurs to maximize longitudinal variation, were selected using secondary literature, newspaper reports, and websites as well as subsequent snowball sampling.⁶ We used responses to a sequence of open-ended and non-leading questions about regional strengths and weaknesses to investigate the level and type of civic capital. Specifically, we employed a qualitative analysis of the 211 interviews above to identify the history and activities of the key collaborative organizations in each city, as well as a thematic

² Definition from the Brookfield Institute (Vu, Lamb, and Zafar, 2019, 63).

³ Statistics Canada, 2016

⁴ Statistics Canada, 2001

⁵ Florida and Hathaway, 2018

⁶ Due to the sensitive material discussed, we do not disclose any identifying information about our interview subjects.

analysis to probe the degree to which the presence (or absence) of cross-sectoral interactions, specialized infrastructure, and peer-to-peer mentoring supported or inhibited high-technology competition.⁷ To address selection bias, all of the interview data presented in this paper were triangulated with peer-reviewed academic literature, journalistic publications and organizational websites.

Toronto: Using civic capital to create cross-sectoral buzz

Toronto's economy is the largest in Canada and it used civic capital to build the most diverse technology sector considered here. One analysis observed that "the Toronto region has become the country's preeminent metropolis, its dominant economic engine as well as innovation milieu, as well as its principal gateway to the rest of the world" (Bourne et al., 2011: p. 236). The leading sectors in Toronto's economy are concentrated in the knowledge and design-intensive sectors around business and financial services, some core manufacturing sectors, including automotive and computers, the biopharmaceutical and biotechnology sectors, as well as the cultural, creative, and design-intensive sectors. Since the mid-2000s Toronto has ranked as one of the largest technology clusters in North America, after the San Francisco Bay Area and New York (Bramwell and Wolfe, 2016).

Toronto's status as a global hub for high-technology entrepreneurship is predicated on a dense pool of talented and highly skilled labor (Denney et al., 2021), including the city's status as a magnet for inward migration, absorbing almost 40 per cent of all immigrants to Canada and with foreign-born residents accounting for more than 50 per cent of the region's population

⁷ While we do not have space to draw on all 211 interviews below, this paper draws on single case studies of Ottawa, Toronto, and Waterloo which make more extensive use of our interview data and provide a more detailed picture of each region (Denney et al., 2021; Haley et al., 2017; Ornston 2021; Ornston and Camargo, 2022).

(Statistics Canada, 2016). Our interviewees consistently pointed to the depth of talent in the region as one of its strongest assets (for example, interview T1, T2, T3, and T4, see also Denney et al., 2021). For decades, however, the high-technology enterprises best positioned to capitalize on these assets were multinational subsidiaries in information and telecommunications hardware rather than domestic start-ups (Britton, 2004; Creutzberg, 2006). These investments transformed Toronto into one of the three major geographic concentrations of ICT firms in the province of Ontario (Wolfe, 2002). The bulk of employment in Toronto's ICT firms prior to 2000 was thus based in the subsidiaries of foreign, primarily US, MNEs (Denney et al., 2021).

There were important exceptions, such as locally-owned Delrina and Workbrain, that paved the way for the next generation of successful entrepreneurs (Yunusov, 2017), but pre-2000 Toronto provides an excellent example of how the greatest barrier to high-technology entrepreneurship in large, urban agglomerations is “fragmentation” (Fritsch, 2003). A Waterloo-based interviewee, after commenting approvingly about the depth of talent in Toronto, noted, “In Toronto you see segregated communities. You don't see mixtures. For us to say we're in Kitchener, not Waterloo, we don't do that. But they make those geographic distinctions in Toronto.” (interview W1). A few short-lived attempts to create Toronto technology cluster organizations prior to 2000 either failed or were absorbed into larger national organizations and lost their capacity to represent the local cluster (interview T5). For older entrepreneurs, the well-documented absence of an entrepreneurial startup culture (Lucas et al., 2009) did not preclude development, but certainly constituted a challenge (interview T6), “When I was starting my company, there was nothing. I was on my own. There was nobody to turn to. I knew no other entrepreneurs; I was making all the mistakes on my own” (interview T3).

Consistent with the development of other high-technology clusters (Feldman et al., 2005), the emergence of a local high-technology industry was associated with the entrepreneur-led development of social connections through both formal and informal collaborative networks and organizations (interview T7; Denney et al., 2021). In addition to a profusion of incubators, accelerators, and other intermediaries, Toronto has benefited from boundary-spanning organizations beginning with BarCamp meetups organized by entrepreneur David Crow as a catalyst in the self-organization of Toronto's technology community between 2005 and 2015. These efforts resulted in the creation of a "positive feedback loop and reward cycle for people that would come out of the basements and the small offices, share what they were working on, and get to know each other. . . it was revolutionary" (Yunusov, 2017). In 2014, local entrepreneurs Alex Norman and Jason Goldlist founded TechToronto, a networking organization which runs monthly meetups of over 500 people (during which its twitter hashtag #TechTO trends nationally) (interview T7). It has grown to 8,500 members and has drawn sponsorship from larger private sector firms and local government (RBC, 2016). Interviewees cited TechToronto as emblematic of a larger "tech community in Toronto [that] has flourished over the last six or seven years" (interview T8). In the words of the former entrepreneur above,

What's changed in the last 15 years, is this incredible support network has popped up There is so much more here than there was even 10 years ago. It's changed the trajectory of entrepreneurship just based on the supports that exists [and] the community that exists around that, I think if I were doing it now, I would not be the only entrepreneur that I knew. I would have another CEO to reach out to and talk to So that's the biggest [change] (interview T3).

TechToronto does not support or even broker the kinds of specialized infrastructure which characterize its Ottawa equivalents, Invest Ottawa or the Kanata North Business Investment Area. Nor does it support the extensive and structured mentoring that underpin

Waterloo, although its meetups certainly foster individual-level interactions. Rather, TechToronto is distinctive in its ability to link technology firms to complementary services, most notably investment, as well as local, advanced demand through the development of industry-specific meetings corresponding to existing local verticals such as FinTechTO, HealthTechTO, and SalesTO.⁸ This emphasis on cross-sectoral bridge building extends to local “regional innovation centers” (interview W1, W2, T9, T10, T11, and T12; Bramwell et al., 2019). For example, the MaRS (Medical and Related Sciences) Discovery District excelled at connecting entrepreneurs to investors and advanced users in verticals such as financial services or medicine, but it struggled to develop a strong culture of peer-to-peer mentoring (Cicci et al., 2023).

Collectively, this cross-sectoral buzz has transformed the local landscape, fostering the emergence of new, high-technology clusters such as fintech (Denney et al., 2021). The number of technology exits increased from fewer than 25 per year from 1995-2006 to over 125 per year in 2016-2018 (Denney et al., 2021: 203). While tech valuations continue to lag US technology clusters, the biggest challenge relative to Ottawa and Waterloo appears to be one of fragmentation, with some entrepreneurs finding the ecosystem hard to navigate (interview W2, T13, T14, T15, and T16).⁹ For those who can access the support networks above, however, the opportunities are substantial, offering an unparalleled depth of expertise in an exceptionally wide array of industries. This is not only evident in interviews with long-time Torontonians, but also transplants, who were drawn to the region either to escape the narrow sectoral focus of Ottawa (interview O1 and O2) or to leverage Toronto’s deep talent pool (interview T2 and T4). The development of strong associational linkages that support civic capital has reinforced Toronto’s

⁸ More information about TechTO and its sector-based spinoffs can be found at: <https://www.techtoronto.org>.

⁹ While some founders outside of the telecommunications industry complained about accessibility during the aughts (see below), no entrepreneurs from Ottawa or Waterloo characterized their local ecosystem as overwhelming or difficult to navigate.

enviable position of combining scale and scope. Ottawa and Waterloo, as smaller communities, did not enjoy these benefits, but this did not preclude them from entering high-technology markets.

Ottawa: Using task-specific cooperation to achieve high-technology specialization

During the second half of the 20th century, Ottawa was the exception to Canadian underperformance in high-technology markets that proves the rule, using civic capital to achieve scale in specific fields, most notably telecommunications equipment. During this period, the federal research laboratories in the region worked closely with local firms, most notably defense contractors, by funding private research, allowing lab access, and spinning out firms. This collaborative environment, with strengths in telecommunications, attracted Northern Electric (Nortel) to move its research arm, subsequently Bell-Northern Research (BNR) after a merger with Bell Canada's research facilities, to the Ottawa suburb of Kanata in 1962. By the 1970s, this laboratory had supplanted federal research labs as the key regional anchor. In addition to attracting thousands of researchers to Ottawa (Harrison et al., 2004: p. 1062), BNR served as a hub for dense, task-specific, inter-firm cooperation with few parallels in Toronto or Waterloo.

For example, BNR partnered with local subcontractors, beginning with the establishment of a semiconductor manufacturing subsidiary, Microsystems International Ltd (MIL), in 1969. MIL would prove short-lived, but its employees would go on to launch more than twenty startups including Calian, Mitel, and MOSAID Technologies (Harrison et al., 2004). Nortel and Mitel were the two largest private sector founders of the Canadian Microelectronics Corporation (CMC) in 1984, which conducted research on integrated chip design, trained engineering students in semiconductor design, and diffused knowledge to the broader industry (Niosi and

Bergeron, 1995: pp. 54–55). The deep reservoir of civic capital in the region was institutionalized in the Ottawa-Carleton Research Institute (OCRI) in 1983.¹⁰ Unlike the Atlas Group and Communitech in Waterloo, mentoring was not an area of focus (Spigel, 2017), perhaps in part due to the frictionless flow of information within the tight-knit telecommunications industry. OCRI’s initial title and subsequent rebranding as the Ottawa Center for Research and Innovation reflect the organization’s laser-like focus on task-specific cooperation in research and human capital. OCRI, which boasted over 600 members by 2000, developed physical infrastructure such as a focused ion beam facility and also secured provincial support to expand specialized university engineering programs and research (Julie, 2016; Niosi and Bergeron, 1995: p. 55).

Sector-specific cooperation in research, training, and regional supply chains enabled Ottawa to do what few other Canadian cities could in the 20th century – carve out a competitive position in high-technology markets at a time when they were dominated by capital-intensive, hardware industries with high barriers to entry. By the turn of the millennium, high-technology employment had surpassed federal employment for the first time in the city’s history (Harrison et al., 2004: 1048), the region ranked first in Canada in measures of technology employment, and it led the country in venture capital investment (Florida and King, 2015). Ottawa, however, was very much a “telecom town” (interview O3). Five of the region’s largest six firms by employment and six of the top ten by revenue were in the telecommunications sector (PricewaterhouseCoopers, 1998). A software entrepreneur who left the city for Toronto commented, “Celtic House, like the big Ottawa guys, all they did was infrastructure.... I wasted

¹⁰ Unlike TechTO and Communitech, the municipal government was one of the fourteen founding members of OCRI alongside large private sector firms and regional universities. It did not, however, play a leading role in the organization until 2000.

so much time talking to those guys. But all our founders did. And the angel groups were the same” (interview O1).

As a result, the region proved vulnerable to the downturn in telecommunications markets at the turn of the millennium. Nortel reduced its headcount by two thirds between 2001 and 2009 before declaring bankruptcy, while suppliers and spinouts were even harder hit (Spigel, 2011: p. 15). In contrast to Waterloo (Ornston and Camargo, 2022), anchor decline caused high-technology employment to shrink by 20.3% between 2001 and 2006 before hitting a new low in 2011 (Statistics Canada, 2001, 2006, 2011). Sectoral specialization was exacerbated by the absence of Waterloo-style peer-to-peer mentoring (interview O4, O5, and O6). Aspiring entrepreneurs in the aughts were either forced to rely on industry veterans in telecommunications equipment or were directed to a centralized question and answer service at OCRI which covered restaurants alongside software firms (Spigel, 2017: 301). As a result, and in contrast to Waterloo, several non-telecommunication-based entrepreneurs described how OCRI’s inaccessibility led them to either bootstrap their own development (interview O5, O7, and O8) or leave the city (interview O1 and O2).

Any effort to reallocate resources from Nortel was undermined by a crisis of associational governance (Ornston and Camargo, 2022). OCRI’s mandate became muddled when it merged with a local economic development agency in 2000. Increasing political interference resulted in the organization “trying to be everything to everyone” (interview O7), with the result that mayoral candidate Jim Watson actively campaigned against the organization with comments like, “How many of you know what OCRI stands for, let alone what it does?” (Kovessy, 2010). Nonetheless, it is unclear whether private leadership could have fared better, as the organization

hemorrhaged event and fee revenue and lost the “800-pound gorilla” which gave OCRI its clout and focus (Julie, 2016: 17).

The eventual revitalization of the Ottawa technology sector coincided with the reconstruction of its civic capital. Here, we observe two parallel, but distinct processes of path creation. First, the Kanata North Business Investment Area recaptured OCRI’s tighter, sectoral focus (Julie, 2016). This new form of civic capital, supported by a restructured and rebranded Invest Ottawa, has supported several new initiatives. Competing MNEs, Cisco, Juniper Networks, and Nokia, have collaborated on the Center of Excellence for Next Generation Networks (CENGN), while ENCQOR, a 5G wireless testbed anchored by CGI, Ciena, Ericsson, IBM, and Thales, followed shortly thereafter. In addition to tethering foreign firms in Ottawa, these projects created openings for smaller Canadian-owned firms to enter the telecommunications equipment value chain by contributing to software-defined networks or layering new applications on top of them (Haley et al., 2017).

These new applications reflect the region’s ability to apply its deep expertise at the interface of communications hardware and software to adjacent areas such as cybersecurity, the Internet of Things, and autonomous vehicles (Haley et al., 2017). For example, when Waterloo’s flagship firm, RIM (renamed BlackBerry), pivoted to automotive software, it built its center of gravity on its subsidiary in Ottawa, QNX. This reorientation was supported by dedicated infrastructure reminiscent of the specialized, private-public, and inter-firm investments which characterized the Ottawa region in the past. For example, BlackBerry, alongside Ericsson, Nokia, and Invest Ottawa, have contributed to the construction of Area XO, a test track for autonomous vehicles (Gorachinova and Wolfe, 2023).

The most dramatic move toward diversification, however, revolved not around the reconstruction of civic networks and incremental diversification in suburban Kanata, but rather the independent, collaborative efforts of a new generation of software firms situated in downtown Ottawa (Spigel, 2017: p. 118). These downtown software entrepreneurs responded to OCRI's deficiencies in the aughts by establishing their own organization, Fresh Founders (Ornston and Camargo, 2022). E-commerce giant Shopify's role as an anchor within this community is less direct than was Nortel's and the diverse network associated with Fresh Founders resembles Waterloo's looser web of peer-to-peer mentoring relationships (see below). But Shopify executives have been more engaged than their counterparts at RIM in mentoring, launching incubators, and making angel investments. This has created favorable conditions for entrepreneurs in and adjacent to e-commerce, but it may narrow the community's focus. One entrepreneur, who found a more receptive audience in Toronto, remarked,

[Ottawa] is very sector limited. We're talking software, e-commerce, these things. So, there are people there [but] it depends on your company, right? I think for some companies, this is a fantastic place. [Names companies] had a great time, they were working with Shopify. They have an e-commerce security service that was perfect for them. That was amazing [Names advisor, a Shopify employee] got bored very quickly of what we were doing, which was unfortunate (interview O2).

Ottawa's ability to specialize and compete at scale in more than one high-technology sector indicates the region's capabilities are not limited to telecommunications equipment manufacturing and that specialists can outgrow dependence on a single industry. But Ottawa's new, bipolar structure still stands in contrast to Waterloo, which, despite its smaller size, has assumed a more diversified position in high-technology markets.

Waterloo: Peer-to-peer mentoring and scrappy startups

Unlike Toronto, the Waterloo region has long boasted a high level of civic capital, both at the industrial level and across the community (Leibovitz, 2003). The region's inhabitants have been linked by a dense patchwork of churches, clubs, musical societies, and other organizations since the late 19th century (Nelles et al. 2005: p. 233) and a culture of collaboration, most commonly expressed through references to Mennonite "barn raising" (Bathelt and Spigel, 2019; Ornston, 2021). Historically, this deep reservoir of civic capital was applied to traditional industries (Munro and Bathelt, 2014: p. 221). This remained true even following the establishment of the University of Waterloo, as tech-oriented graduates migrated to US multinationals such as Microsoft (Ornston, 2021). One interviewee characterized 1990s Waterloo as,

Essentially a Mennonite farming community. [We] had a wonderfully vibrant farming community and somewhat long in the tooth textile and automotive assembly areas, as well as a fledging mathematics and actuarial area because of the insurance companies. And that was Waterloo (interview W3).

The entrepreneurial ecosystem which exists in Waterloo today can be traced back to the University of Waterloo professor Wes Graham, whose entrepreneurial activities inspired dozens of faculty spinoffs within a tight-knit academic community (Wolfe, 2009: p. 205). These informal interactions were organized into regularly scheduled meetings during the 1990s. At a standard event, a rotating host would present a five- to ten-minute story followed by discussion and collective problem solving (interview W4). In 1998, this "Atlas Group" was institutionalized as Communitech, an official industry association with a president, permanent staff, and 120 members (Pender, 2017). Although initially inspired by a visit to Ottawa and OCRI (interview W3), Communitech never pursued pre-competitive research consortia or sector-specific

investments in human capital (Leibovitz, 2003). In the words of a Communitech veteran and long-time industry observer, “Just about the best thing we did at Communitech was move the focus away from [commercialization] toward expertise, EIRs [entrepreneurs in residence], mentors, and things like that” (Will, 2017).¹¹ This absence of specialized public goods was mirrored by limited collaboration in innovation. In contrast to Ottawa’s dense, local supply chains, Waterloo tech enterprises have looked abroad for partners (Bramwell et al., 2008: pp. 106–107; Munro and Bathelt, 2014: p. 230). For example, local anchor RIM worked almost exclusively with external sub-contractors and frequently feuded with local actors (Howitt, 2019; Ornston and Camargo, 2022).

Unlike Toronto, cross-sectoral collaboration is also limited (Bathelt et al., 2011: 474–475). Although Communitech attempted to build bridges by constructing innovation labs around large firms in traditional industries, collaboration was rare, even among tech startups which were directly adjacent to local industries (interview W1, W4, W5, and W6). The initiative has since been shuttered. A Toronto-based investor may have been particularly harsh in characterizing Waterloo as “a wasteland for scale-up talent” (interview T18), but many locals expressed similar concerns (interview W5, W7, W8, and W9). For example, one tech employee said, “If you want venture capital, you’re going to Boston, Toronto, or Silicon Valley. There isn’t this venture capital presence in Waterloo” (interview W10). This deficiency prompted Communitech and other business leaders to promote the Toronto-Waterloo Innovation Corridor brand to link its tech economy more tightly to that of its larger neighbour (Wachsmuth and Kilfoil, 2021).

¹¹ Although Communitech’s programming would expand, these initiatives were rarely sector specific (Cicci et al., 2023), and studies find that they played a marginal role in shaping local innovation (Bathelt et al., 2011: 479–480; Ornston, 2021).

Why then do locals consistently speak of “barn raising” (Bathelt and Spigel, 2019; Ornston, 2021) in the absence of task-specific cooperation or cross-sectoral buzz? In contrast to Ottawa and Toronto (Spigel, 2013), where this was identified as a weakness, industry representatives consistently point to mentoring networks as a regional asset and one of Communitech’s key strengths (see Ornston 2021). Mentoring can be found in other regions, most notably through individual entrepreneurs-in-residence. Their individual, often sector-delimited experience, however, does not approximate the decentralized body of knowledge embodied in the dense, decentralized peer-to-peer relationships which underpin Communitech and the Waterloo community more generally (Spigel, 2017). As one interviewee explained,

[Waterloo is] not quite as fragmented as it is in Toronto. It’s easy to get lost in the noise with all the big things happening in the big city ... The support and assistance that exists for entrepreneurship isn’t just found locally with an incubator, it’s found throughout the community (interview W11).

These mentoring networks were especially valuable for a smaller region such as Waterloo for two reasons. First, senior-junior and peer-to-peer mentoring networks increased the supply of entrepreneurs by redefining what was possible in the context of a historically low- to medium-technology region (Ornston, 2021). For example, mentors assisted through the “validation of the ideas” (interview W12) and by providing “role models” (interview W7). Second, mentoring networks delivered general advice about how to operate a firm. As a former executive described it,

One of the first things I did [when I moved here] was to join a peer-to-peer group at Communitech ... The thing that struck me was the way the community was open and willing to share with each other. ... How do I do SRED tax credits? Who is the best person to go to? What should my option plan look like? (interview W13).

This generic advice, drawn from a decentralized network of peers, rather than a single veteran entrepreneur, was particularly important for firms who could not draw on the resources of a large metropolitan area like Toronto or use well-established verticals as a shortcut to specialized knowledge and global markets like their counterparts in Ottawa. Mentoring networks taught Waterloo founders how to deviate from the big city, Silicon Valley-style playbook by connecting proteges to international service providers (Bathelt et al., 2011: p. 482) as well as instructing them how to secure risk capital from Toronto and other cities (interview W3 and W11), import human capital from outside the city (interview W1), co-locate closer to international customers (interview W4), construct dual office structures (interview W1), and manage remote workers (interview W9).

Among other strategies, mentors encouraged their peers and proteges to capitalize on the region's engineering knowledge base by targeting technically demanding niches with lower capital and marketing requirements (interview W9). An advisor remarked, "I'm always telling students if you can find a business-to-business niche, you're far better off than trying the big consumer plays because they take incredible resources," (interview W11). As a result, and unlike Ottawa and Toronto, the most successful Waterloo-based scale-ups have thrived in obscure, technical, less capital-intensive, often slower growing business-to-business or business-to-government niches overlooked by larger players (Howitt, 2019: p. 240). This "scrappy," niche-based strategy results in a diverse sectoral profile, spanning from hardware to med tech as well as myriad, industry-specific software applications, connected by mentoring networks rather than well-developed industry linkages or specialized infrastructure.

There is an opportunity cost to a scrapper-based strategy. While Waterloo-based interviewees generally painted a positive picture of the region (Ornston, 2021), several locals

acknowledged external critiques (interview T18 and T19) that the region has struggled to scale new enterprises since a spate of initial public offerings in the 1990s (interview W4, W7, W10, and W17). The emphasis on peer-to-peer networking and the diffusion of generic, non-specialized knowledge exacerbated these weaknesses. A scale-up employee remarked,

When you're starting some of those early, high-level tips [are useful]. But we're in the business of [identifies niche] right now ... That's pretty specific. So, then you start looking and saying, "Do I start relating more to someone because they're in proximity to me? Is proximity a valuable asset?" (interview W17).

That being said, "scrapping" has resulted in a surprisingly resilient pathway into high-technology markets, resulting in sustained employment gains and insulating the region from disruptive shocks (Ornston and Camargo, 2022). In one study, it ranked second to Silicon Valley in per adjusted startup activity (Compass, 2015). As one industry representative concluded, however, it has followed a distinctly less glamorous pathway to high-technology markets, "Waterloo solves hard, boring problems. Valuable problems, obviously. Business-to-business is pretty good But let's face it, it's not sexy" (interview W18).

Conclusion: Civic capital and economic change

This comparative analysis of Ottawa, Toronto, and Waterloo makes three theoretical contributions to the literature on regional development. First, we use longitudinal variation to illustrate how the institutionalization of civic capital facilitates the transformation of high-technology clusters (Nelles and Wolfe, 2022; Safford, 2009; Storper et al., 2015). Civic capital, in the form of the Atlas Group and Communittech, turned Waterloo from a feeder of engineering talent to US technology firms into an entrepreneurial hub, while its collapse in Ottawa impeded the region's response to disruptive economic shocks. Even Toronto, despite its formidable

advantages, failed to capitalize on cross-sectoral buzz until the establishment of bridging organizations such as TechTO.

At the same time, cross-regional analysis qualifies broad, universalizing accounts (Denney et al., 2021; Nelles and Wolfe, 2022; Storper et al., 2015) by suggesting that cities, and intermediaries which inhabit them (Cicci et al., 2023; Madaleno et al., 2021), use civic capital in very different ways. Toronto, a large city, cultivated loose ties among entrepreneurs, human capital, complementary service providers, and advanced users, underscoring the importance of “cross-sectoral buzz” in large, diversified cities, which can scale startups in a wide variety of different sectors (Storper and Venables, 2004; Zukin, 2021). This distinctive pattern of cooperation and specialization does not generalize to our smaller cases.

The literature on smaller urban areas argues that smaller regions use stronger ties to generate Marshallian externalities and specialize (Caragliu et al., 2016; Todtling and Trippl, 2004; Trippl et al., 2018). Our case studies, however, challenge this literature on two fronts. First, and in contrast to the literature on social capital more generally (Gargiulo and Benassi, 1999; Grabher, 1993), we find that strong ties do not have to relegate (smaller) regions to mature, slow-moving industries. Ottawa relied on institutionally demanding, task-specific cooperation to enter new, high-technology markets, constructing specialized infrastructure, first in telecommunications and optics, and then next generation software-defined networks and the Internet of Things. While this pattern of task-specific cooperation and specialization can be crisis-prone, we should not overlook its potential dynamism.

Second, we question the popular dichotomy between diversified cities and specialized, smaller regions (Caragliu et al., 2016; Duranton and Puga, 2000; Todtling and Trippl, 2004) by suggesting that the latter can support a wider array of innovative strategies (Herstad, 2018).

Waterloo relied on a looser pattern of cooperation to compete in a wide variety of high-technology niches, albeit in a way that did not reflect big city “Jacobian externalities” or “cross-sectoral buzz” (Storper and Venables, 2004). Instead, the diffusion of generic knowledge within dense, peer-to-peer mentoring networks helped firms to assume a foothold within a wide variety of small, highly technical niches. We believe this novel and understudied archetype, the “scrapper,” could shed light on smaller cities such as Cambridge (Garnsey and Heffernan, 2005) which succeed without a clear pattern of industrial specialization. This alternative form of “niching” (Kristensen and Levinsen, 1983), based not on sectoral specialization but rather diversification into small, unrelated markets, deserves more research, especially in light of the fragmentation of traditional, Marshallian, industrial districts (De Marchi and Grandinetti, 2014).

Going forward, future research could focus on the causes and consequences of these different forms of civic capital. A detailed exploration of their origins is beyond the scope of this article, but has been explored in other studies (Creutzberg, 2006; Nelles et al., 2005). Toronto’s status as a large, highly diverse metropole clearly militated against denser ties, but size does not explain why larger Ottawa specialized, whereas smaller Waterloo was characterized by looser connections and a more diversified profile. The fact that task-specific cooperation in Ottawa outlasted shifts in government intervention and a pivot from telecommunications equipment (Nortel) to e-commerce (Shopify) makes it hard to attribute differences in civic capital to the local government or sectoral specialization. Nor is the role of a local anchor decisive. RIM, which employed a larger share of the local labor force in Waterloo, never sought to support task-specific cooperation (Ornston and Camargo, 2022) suggesting space for change agency in shaping civic capital (Beer et al., 2019).

The longer-term evolution of specialists and scrappers also deserves our attention, as Ottawa and Waterloo appear to be outgrowing their initial constraints, even as they rely on traditional patterns of cooperation. Ottawa is using task-specific cooperation to layer new specializations on top of previous ones, creating a more diverse, multi-pillar economy, whereas peer-to-peer networking in Waterloo has eased barriers to scale by connecting the region to progressively larger pools of extra-regional capital, talent, and customers. These developments are encouraging, suggesting that both specialization and scrapping are viable, long-term strategies. Unlike their larger counterparts, however, there are no shortcuts to scale for smaller regions. In the short to medium run, second-tier cities face important trade-offs in their efforts to promote local, high-technology entrepreneurship.

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