When Flagships Falter: Comparing Finland and Waterloo

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In recent decades, Waterloo[1] and Finland have been hailed as high tech success stories, leapfrogging competitors to assume leadership in information and communication technology (ICT) markets. Flagship firms, BlackBerry[2] and Nokia, were central to this process. In addition to generating employment and tax revenue, the two firms popularized innovation-based competition, inspired local entrepreneurs, attracted international investment and diffused knowledge throughout the local economy (Dahlman et al. 2006; Gillmor 2012; Moen and Lilja 2005). In fact, the two regions could be viewed as a model of how to succeed in high-technology markets, as evidenced by the determination to create "new BlackBerries" or "new Nokias" (Ornston 2017; Yakabuski 2013).

But Finland and Waterloo also represent a cautionary tale, as their dependence on flagship firms increased their vulnerability to disruptive economic shocks. When BlackBerry and Nokia faltered between 2009 and 2013, they threatened to take their local, high-technology ecosystems down with them. In the end, their decline was not a death sentence. Both Finland and Waterloo have benefited from a proliferation of new, startups (Best 2014; Dingman 2015) and in time their high-technology industries may be stronger than ever. But the transition has been a rocky one, particularly for Finland, where startups have yet to approach Nokia in employment or revenue (Pajarinen and Rouvinen 2015). Robust startup scene notwithstanding, Nokia's decline transformed Finland into one of the worst-performing countries in the Eurozone after 2008 (Eurostat 2016). By contrast,

[1]In this paper, Waterloo refers to the Regional Municipality of Waterloo, a region of roughly 500,000 which encompasses the city of Waterloo, Kitchener, Cambridge and surrounding townships.

[2]Formerly Research in Motion. For simplicity, I use the name BlackBerry throughout the paper, even when referring to developments before the corporation's 2013 rebranding.

Waterloo's star has dimmed slightly in the wake of BlackBerry's decline, but the region's economy and ICT industry appear relatively resilient (CBRE 2016).

This paper seeks to explain why Waterloo and Finland diverged. While both communities embedded flagship firms within a broader ecosystem, Finland went further in connecting Nokia to public resources and private sector partners. As a nation-state (rather than a region), policymakers could use a wide range of tools to mobilize resources around Nokia, most notably ambitious innovation policies. As a coordinated market economy, private-public cooperation was complemented by dense, inter-firm ties. Collaboration yielded significant benefits, but I hypothesize that it also rendered Finland more vulnerable to Nokia's decline after 2009. Finnish ICT firms were more dependent on Nokia and more specialized in wireless communications, while public policy led firms to specialize technological development at the expense of other competencies.

The analysis, at this stage, is speculative, based on extensive fieldwork in Finland but only a brief visit to Waterloo and secondary literature on the region. If further research supports the hypothesis advanced in this paper, however, then this work has important policy implications. There are formidable benefits to embedding leading firms in local ecosystems, but communities can also go too far in mobilizing resources around large, flagship enterprises. In connecting large firms to small communities, policymakers should also consider strategies to diversify economic activity.

1. The Promise and Perils of Embedding Flagship Firms

Research on urban studies, economic development, regional innovation systems and related fields agrees that regions prosper by embedding firms within a broader network of

public and private sector actors (Evans 1995; Lundvall 1992; O'Riain 2004; Saxenian 1994). “Embedding” can take many forms. Public sector actors often rely on supportive policies to connect enterprises to host communities, subsidizing construction, funding research, protecting intellectual property or delivering other benefits (O'Riain 2004). Often, these public policies encourage enterprises to rely on public sector or non-governmental organizations for collective goods (Schienstock and Hämäläinen 2001). Skilled labor is particularly crucial, but these relationships can extend to knowledge, technical services or other specialized inputs (Walshok and Shragge 2014). Perhaps even more importantly, enterprises can embed themselves within local communities by developing long-term relationships with manufacturing sub-contractors, service providers or end users (Lundvall 1992).

These ties often benefit firms, lowering costs, reducing risk and resolving collective action programs. For example, high quality educational institutions and supportive labor market regulations might deliver a steady supply of affordable, high quality human capital (Barry 2004). Political stability and a robust property rights regime can encourage risk-taking by reducing the risk of appropriation (North 1990). A dense supplier network may enhance efficiency and enable enterprises to respond flexibly to shifting market conditions (Steinbock 2000). Finally, the creative interplay among these different actors can foster innovation, providing the enterprise with a competitive advantage over its rivals (Lundvall 1992).

More importantly for the purposes of this essay, however, embedding can also benefit the host community. First, communities can reduce the risk of capital flight by connecting enterprises to local resources. Reliance on regional educational institutions,

local research, specialized suppliers or supporting services increases the opportunity cost of relocation (Zheng and Warner 2010). These complex networks have the added benefit of fostering innovation, connecting actors with different resources (Storper and Venables 2004). By enabling firms to compete on the basis of novelty or quality rather than cost, communities can inoculate themselves from cost competition and the threat of capital flight that follows from it.

Second, embedding supports the construction of high-quality collective goods that anchor firms within host communities. To the extent that enterprises are less likely leave, communities can extract concessions in the form of higher taxes or wages. These concessions not only ensure that the benefits of growth are widely distributed, they also enable communities to upgrade investments in knowledge, human capital, infrastructure and supporting services (Weisskoff and Wolf 1977). Often, enterprises value these collective goods and "concessions" are entirely voluntary. As this paper describes, firms might independently raise wages, fund local universities or contribute to community development.

Finally, communities are more likely to learn from innovative firms when the latter are embedded within complex networks. Embedded enterprises are not only positioned to innovate, but they also share information, either deliberately or unwittingly, with employees, suppliers and end users (Lundvall 1992). As a result, the broader community can benefit from innovation. By contrast, self-sufficient firms with few ties to the host community are more likely to resemble "enclave economies" (Singer 1950), in which new knowledge is internalized within the firm or redirected outside of the community.

These efforts can prove particularly lucrative when they anchor large, "flagship" firms. In addition to their direct impact on employment, large enterprises are generally more productive than their smaller counterparts (Van Ark and Monnikhof 1996). Higher productivity often reflects economies of scale or some other competitive advantage that insulates the enterprise and the community from disruptive economic shocks. To the extent that flagship firms are embedded within local communities, productivity gains diffuse to local partners (Maliranta 2000: 69). Lead enterprises might actively upgrade the capacity of their local partners or knowledge can diffuse through spinoffs or labor market turnover (Paija 2000). Flagship firms also operate at a scale that enables them to invest in collective goods like infrastructure, human capital, knowledge creation or even community development. Finally, these global players create a regional reputation that creates opportunities for local firms and other organizations. Flagship firms put both Finland and Waterloo "on the map" as high-technology hubs, granting other, high-technology enterprises greater credibility with investors and clients (Gillmor 2012; Steinbock 2000). As a result, Finland and Waterloo emerged as a model for other regions seeking to promote rapid growth and innovation-based competition.

While flagship firms can yield significant benefits, they also generate significant risks. Drawing on Gernot Grabher's typology (Grabher 1993), flagship firms can create functional lock-in by integrating local firms into a single network, concentrating activity within a single industry, technology or even product. Flagship enterprises can also create political lock-in, using their clout to capture the policymaking process, reorienting public resources around their strategic goals. Finally, flagship firms can contribute to cognitive lock-in, influencing the behavior of unrelated organizations and enterprises by redefining

what success looks like. By mobilizing resource around a single, competitive strategy, flagship enterprises can increase a region's vulnerability to disruptive economic shocks.

This is an issue with any large enterprise, but the risks are magnified when flagship firms are integrated into local policymaking, connected to local enterprises and collaborating with local institutions. As a result, the politics of embedding, which represents best practice under normal circumstances (Lundvall 1992; Weisskoff and Wolf 1977), may prove unhelpful or even dangerous with large, leading firms. In short, this paper hypothesizes that communities may enjoy greater benefits when they embed large enterprises, but they are also more vulnerable when those firms get into trouble. By contrast, communities that fail to embed their flagships should exhibit greater resilience. While the decline of a flagship firm poses a challenge to any industry, the fallout is less likely to destabilize other enterprises.

2. When Flagships Falter: Characterizing Adjustment in Finland and Waterloo

To test these claims, this paper compares developments in Waterloo and Finland. The two regions are characterized by significant differences, most notably the fact that Finland is a nation-state rather than a municipality and it is roughly ten time larger. That said, the similarities are even more striking. While Waterloo benefits from an insurance industry with roughly 10,000 employees and Finland is more dependent on natural resources, both economies were historically defined by their reliance on medium-technology engineering (Munro and Bathelt 2014: 221). During the 1990s, both communities engineered big leaps into mobile communications, propelled by flagship firms, BlackBerry and Nokia, with similar strengths in mobile handsets. Nokia was the

larger of the two firms, employing 125,829 in 2008 when it controlled 40.8% of the global market for smart phones. BlackBerry approached a 20% market share at the same time and employment peaked a few years later at 19,000 (Gartner 2009; Pajarinen and Rouvinen 2013; Sher 2013).

While differing in size, the two firms played a similar role within their respective communities. BlackBerry was by far the largest ICT employer in the region of Waterloo with approximately 11,000 employees in 2011 (Pender 2015). While estimates vary, this would represents half (CBRE 2016) to a third (Lu 2013) of total ICT employment in the Waterloo region. If anything, Nokia was slightly less dominant in Finland, employing only 23,320, or roughly a fifth of the Finnish ICT sector, at its peak in 2008 (Pajarinen and Rouvinen 2015). The structural composition of employment was also similar. By the mid-2000s, both firms had retained some manufacturing capacity, but local activity was dominated by professional services, most notably research and development (Ali-Yrkkö 2010: 32; Yakabuski 2009).

During the early 2010s, both firms were devastated by the rise of the iPhone and a series of corporate miscues. Neither failed completely. Nokia would fall back on its strengths in network equipment, particularly following its 2006 merger with Siemens, whereas BlackBerry redefined itself as a software firm, specializing in security. But each reduced employment by more than two-thirds, to roughly 6,000 in Finland and 2,700 in Waterloo (Pender 2015; YLE 2016). As of 2016, both firms continue to reduce employment, albeit more modestly than in previous years. On the other hand, their decline unleashed a vibrant startup scene, which mitigated the decline in employment. In Finland, mobile gaming has demonstrated particular promise (Cutler 2013), whereas Waterloo is

characterized by a more heterogeneous mix of enterprises, in digital content, wearable devices, robotics and other fields (Dingman 2015; Lu 2013).

The transition, however, has proven particularly jarring in Finland. Finnish ICT employment fell by over 10% between 2008 and 2012 (Pajarinen and Rouvinen 2015: 96). If we go back to the height of the dot com bubble, the contraction has been even more pronounced. Anecdotal evidence suggests that a significant portion of new ICT employment reflects relatively low-productivity, part-time, one-person consulting operations (Interviews with economists, 7 June 2012 and 17 June 2016, Finland). The statistics provide some evidence to support this view, as R&D expenditure, ICT value-added and ICT exports have all plummeted since Nokia's decline in 2008 (Ali-Yrkkö et al. 2015). The crisis transformed Finland from a model pupil into one of the worst-performing countries in the Eurozone (Eurostat 2016). Nokia, which had contributed heavily to GDP growth during the late 1990s and early 2000s, was singlehandedly responsible for approximately a third of the decline (Pajarinen and Rouvinen 2013: 3).

By contrast, the regional economy in Waterloo appears relatively immune to BlackBerry's decline. Although BlackBerry ran into trouble later and the region has had less time to adjust, unemployment had *fallen* by 2016 and real estate prices had increased (CBRE 2014; Roose 2015). One could argue that this reflects the movement of labor into other industries, like financial services or advanced manufacturing, but anecdotal evidence suggests that high-technology employment has proven relatively resilient. Whereas Finnish interviewees described the ICT industry in cautious terms, expressing uncertainty about the long-term strength of a booming startup scene (Interview with former policymaker, 7 June 2016, Tekes director 9 June 2016 and economist 17 June 2016), interviewees in

Waterloo were more likely to argue that high-technology industry was as strong as ever (Interviews with journalist and industry representative, 15 March 2016). With 1,845 new technology firms established in the last five years (Dingman 2015), the number of tech startups alone has begun to approach job losses at BlackBerry. Studies reveal that Waterloo has fully recovered from initial losses to boast the fastest-growing tech industry in Canada by 2016 (CBRE 2016). The local industry association, Communitech, cites different figures, but draws similar conclusions (Lu 2013).

How do we account for these differences? Why has the decline of Nokia transformed Finland into the "sick man" of Europe (Khan 2015), whereas Waterloo appears to be thriving? As noted above, it's difficult to attribute these differences to the direct impact of Nokia. Measured as a share of ICT and aggregate employment, Waterloo was *more* dependent on BlackBerry than Finland ever was on Nokia. Waterloo should have been *more* affected by its decline, particularly since BlackBerry's employment peaked later, in 2011, and the region has had less time to adjust.

One could attribute the differences in economic performance to patterns of regional specialization. As noted above, Finland is more dependent on natural resources, most notably forestry, while Waterloo benefits from advanced services, like insurance. The two communities are quite similar, however, in their dependence on medium-technology manufacturing (Munro and Bathelt 2014; Paija and Palmberg 2006). Moreover, if Waterloo's resilience was based on the growth of other industries, one would expect high-technology employment and new firm creation to plummet rather than increase.

Alternatively, one could focus on institutional differences, most notably the fact that Finland is a nation-state whereas Waterloo is a municipal region. But Waterloo has did not

solved its problems by offloading labor to other regions. The tech community was characterized by net brain *gain* after 2010 (CBRE 2016). Of course, Waterloo could also benefit from countercyclical spending by provincial and federal authorities. But it is difficult to attribute Waterloo's success to automatic stabilizers. With relatively robust growth and *falling* unemployment, Waterloo has not benefited from larger transfer payments. Macroeconomic conditions have certainly been more favorable in Waterloo than Finland, but this only represents a partial answer. After all, one would expect research-intensive, high-technology firms to be less vulnerable to exchange rate movements than resource-based enterprises or low-technology manufacturers. Interest rates, which could have a more direct impact by influencing capital availability, have been low in both regions.

At first glance, microeconomic conditions appear roughly comparable at first glance, at least as it relates to high-technology enterprises. Both regions produce an abundant supply of high-quality human capital, specializing in science and technology (Bramwell and Wolfe 2008; Koski et al. 2006). Enterprises in both countries can also draw on world class public research and, in recent years, a modest but rapidly expanding pool of risk capital (FVCA 2016; Pender 2014). Taxes and labor market regulations pose a greater burden in Finland, but this has not prevented entrepreneurs from launching new enterprises in the past or in recent years (Ornston 2012, 2017). Higher costs are also partially offset by one of the most ambitious and highly regarded innovation policies in the world (Dahlman 2006).

To the extent that the two communities do differ, I would propose that the variation is endogenous, reflecting the different ways in which they embedded their flagship enterprises. In the following section, I argue that Nokia was more tightly embedded within the Finnish high-technology ecosystem and Finnish society more generally. Following the

typology laid out above, this reflects the degree to which Nokia was *politically* embedded (reshaping public policies around its corporate goals), *functionally* or economically embedded (mobilizing private sector firms around its strategic objectives) and *cognitively* embedded (defining what it means for a company or a region to be successful). As a result, Finland was exceptional in the degree to which it mobilized public and private sector resources around a single competitive strategy. Finland was remarkably specialized in technological development and mobile communications R&D in particular (Paija and Rouvinen 2004; Sabel and Saxenian 2008). When the industry changed, however, the impact on the Finnish economy was devastating (Helsingin Sanomat 2011).

While BlackBerry was also embedded in Waterloo, it never achieved the same level of political, economic or social influence. Unlike Finland, inter-firm cooperation was not particularly common in the region (Munro and Bathelt 2014). It also reflects Waterloo's status as a region rather than a nation-state. Policymakers could not mobilize public resources around BlackBerry even if they wanted to and this reduced the degree to which local enterprises reoriented themselves around BlackBerry's strategic vision. Meanwhile, BlackBerry's local influence, however formidable, was always muted by competing national-level voices and never as hegemonic as Nokia's position within the Finnish news media. Consequently, Waterloo's high-technology ecosystem was *always* more diverse than its Finnish counterpart and more resilient when BlackBerry faltered. The following section develops this point, comparing the initial growth of BlackBerry and Nokia and the degree to which the two enterprises were embedded within the local community.

3. The Politics of High Tech Growth: Using Flagship Firms to Build High Tech Clusters

While BlackBerry was less embedded in its local community than Nokia, it would be misleading to characterize the firm as an "enclave" enterprise. BlackBerry enjoyed a particularly strong relationship with local educational institutes. The University of Waterloo's apprenticeship-based "coop" program enabled BlackBerry to adapt the local educational system to its needs, while the management deliberately designed their offices to face the university (McQueen 2010: 197-98). Co-founder Mike Lazaridis, likening university graduates to a natural resource, suggested that it anchored the firm within the region (Sweeny 2009: 35). It also benefited the broader community, facilitating the diffusion of new ideas as students moved from the classroom to the workplace and back again (Munro and Bathelt 2014).

University cooperation extended to research as well. While BlackBerry was not known for licensing academic research , the firm often poached professors and CEOs Mike Lazaridis and Jim Balsillie donated generously to local educational institutions (see below). Research collaboration appears less pronounced than Finland, however, as BlackBerry management emphasized the importance of human capital, and students in particular, rather than joint research (Sweeny 2009: 35). Certainly relations appear less structured in Waterloo than in Finland, which boasted the highest levels of industry-university cooperation in the OECD (Koski et al. 2006: 50). This is partly a consequence of public policy, where Finland and Waterloo clearly differ.

To be clear, local policymakers enthusiastically supported BlackBerry. Municipal and regional governments, however, possessed few tools to influence industrial development. Informal discussions with former policymakers suggest that local

governments worked closely with BlackBerry in promoting the region and coordinated public relations in response to crises. They also used their control over land use and local infrastructure to accommodate BlackBerry's rapid expansion during the 2000s (Interview with journalist, 15 March 2016). But the local politicians who most enthusiastically championed BlackBerry had no direct control over labor market policy, innovation policy or other high-level issues. For example, BlackBerry did not exercise Nokia-like influence over higher education, which granted institutions like the University of Waterloo a measure of independence.

Local policymakers did work with BlackBerry to mobilize external resources, but provincial and federal support was inconsistent. BlackBerry received $4.7 million from the Ontario Technology Fund in the 1990s and $39.7 million from Technology Partnerships Canada at the turn of the millennium, as well as tax credits for research and development. But a significant share of this support was directed at other regions, like new R&D facilities in Kanata, Ontario, and BlackBerry did not receive any public funding after 2004 (McQueen 2010: 198; Sweeny 2009: 77). More importantly, public funding was directed at BlackBerry rather than a broader consortium. This may have anchored BlackBerry within Waterloo and Canada more generally, but did not encourage the firm to develop deeper relationships with local firms and educational institutions.

In fact, BlackBerry was remarkably self-contained. When asked to identify firms that worked with BlackBerry, interviewees (Interviews with journalist and industry representative, 15 March 2016) and secondary sources (Gillmor 2012) were more likely to identify caterers or restaurants rather than sub-contractors. The firm's most important partners were located elsewhere in Canada (e.g. Celestica) or outside of the country (e.g.

Elcoteq, a Finnish firm) (Yakabuski 2009). This is typical of the Waterloo region, where inter-firm linkages are relatively weak (Munro and Bathelt 2014). Nor was BlackBerry connected to the region through a large number of new enterprises. Spinoffs from BlackBerry, and labor market circulation more generally, was rare (Interview with journalist, 15 March 2016). Meanwhile, BlackBerry's relations with other enterprises, like Kik, were just as likely to be characterized by conflict as cooperation (Hardy 2013).

This is not to imply that BlackBerry ignored its community. In addition to the firm's close relationship with local educational institutions (see above) and countless informal ties, corporate leadership contributed generously to the local community (Roose 2015). For example, Mike Lazaridis donated $70 million to establish the Perimeter Institute for Theoretical Physics, while his counterpart, Jim Balsillie, used $50 million to found the Balsillie School of International Affairs at the University of Waterloo (Gillmor 2012). While demonstrating close ties to the Waterloo region, it is also important to recognize that these were individual donations rather than corporate decisions. While BlackBerry benefits indirectly from a stronger academic community, these long-term investments were weakly connected to its corporate strategy.

As a result of its status as a large employer and its outsized influence in the Waterloo region, BlackBerry monopolized local headlines and dominated local politics (Interview with journalist, 15 March 2016). Informal conversations suggest that policymakers were in close contact with BlackBerry and faced continuous pressure to support the firm. But BlackBerry's influence did not extend to the national media, which was divided between competing developmental models. Here, enthusiasm for rapid, innovation-based competition was tempered by the collapse of Nortel and the growth of

natural resource exports, most notably oil. As result, BlackBerry was never as hegemonic as Nokia.

Overall, BlackBerry played an important role in Waterloo as a large employer and it delivered significant reputational benefits. In redefining the region as a high-technology cluster, BlackBerry helped attract public funding and private sector investment (Gillmor 2012; Nelles et al. 2005). But its influence did not extend much further than this. In contrast to Nokia, BlackBerry did not maintain a large network of sub-contractors and labor market mobility appears to have been limited. These weak ties inhibited the diffusion of new ideas (at least until BlackBerry declined) and reduced the firm's influence over the rest of the industrial ecosystem.

Nokia, by contrast, was deeply embedded within Finland. Like BlackBerry, Nokia vacuumed up human capital, to the point where locals quipped that the firm's motto should be, "Nokia: Collecting People" (Interviews with venture capitalist 8 June 2016 and software industry representative 10 June 2016, Finland). Unlike BlackBerry, however, Nokia could directly influence university and polytechnic output through its influence on national innovation and educational policies. Nokia played an outsized role in national policy discussions since the 1980s when charismatic CEO Kari Kairamo used his position as chairman of the Confederation of Finnish Employers to lobby for new technology policies (Moen and Lilja 2005: 372). By the 1990s, Nokia was represented on the Science and Technology Policy Council, which established the broad, overarching priorities for Finnish innovation policy, as well as other influential boards. As a result, the firm exercises a pervasive influence over public policy (Ornston 2017: 129-32). In the words of one former employee,

> When I was working at Nokia was that the industry associations, the federation of technology industries and even the Finnish government would approach us and ask "What is the next thing that we need to do?" And I thought, "Why are you asking me? Shouldn't you have a plan of your own?" (Interview with former employee, Nokia, 14 June 2016, Finland)

In education, the results were clear. Whereas BlackBerry subtly enticed students by reoriented its offices toward the University of Waterloo or accepting coop students, Nokia spearheaded the decision to double university intake and triple polytechnic intake during the 1990s (Dahlman 2006: 102). Not coincidentally, this massive expansion of human capital focused on engineering and ICT in particular. By the turn of the millennium, Finland ranked second only to South Korea in the share of engineers (OECD 2003). In short, Nokia restructured Finnish education in ways that BlackBerry could only dream of.

Nokia's influence over public policy extended to other areas as well. Through its representation in the Science and Technology Policy Council and the board of Tekes (the Finnish Funding Agency for Innovation), Nokia shaped Finnish innovation policies. The 175 million Euro in R&D grants that Nokia received from Tekes between 1995 and 2008 dwarfed Canadian support for BlackBerry, but the crucial development was the way those innovation policies were constructed. Finnish public policy emphasized technological innovation, a strategic priority for Nokia. It also focused on developing private-public and inter-firm networks, which Nokia could exploit to monitor technological developments. Between 1995 and 2008, Nokia participated in no fewer than 375 separate Tekes projects (Ali-Yrkkö 2010: 26-27), often situating itself at the center of these consortia (Paija and Palmberg 2006: 78). Former employees make it clear that by the mid-1990s the goal was not public funding, which was heavily regulated by the EU and paled in comparison to Nokia's corporate R&D budget. Rather, Nokia used Finnish innovation policies to mobilize

public and private sector actors around its strategic vision, like the shift from hardware to services at the turn of the millennium (Ornston 2012: 83).

In this respect, Nokia was quite successful. Coordinated efforts to connect academic research with industrial needs enabled Nokia for forge research partnerships with major Finnish universities, separate from the recruitment of recent graduates. Finland ranked highest in the OECD in measures of industry-university cooperation (Koski et al. 2006: 50) and Nokia was no exception. Whereas BlackBerry's management emphasized the role of universities as a source of people rather than technology, Nokia employees and academics alike were quick to describe their collaboration in various projects, from the development of the software protocol for the GSM mobile standard to research on user-friendly design (Interviews with professor, 27 September 2005, former executive, 17 October 2005, and professor, 8 November 2005, Finland). My own, early research was funded by Nokia (among other sources).

This dense networked structure extended to the private sector, where Nokia had constructed a sprawling cluster of three hundred first-tier, Finnish suppliers (Ali-Yrkkö and Hermans 2004: 113). In the late 1990s, this network employed almost as many Finns (14,000) as Nokia itself (21,000) (Paija 2000: 4). While most manufacturing sub-contractors moved abroad after the dot com crash, Nokia continued to rely heavily on Finnish sub-contractors in software development (Interview with former executive, 24 November 2006, Finland). The connections between these firms are so strong that foreign enterprises aspiring to penetrate Nokia's supplier network acquired Finnish sub-contractors, not for their technology or skills, but specifically because of their close

personal relationships with Nokia employees (Interview with policymaker, 11 November 2005, Finland).

Finally, Nokia shaped firms outside of its supplier network, through its outsized influence in the Finnish media. Consistently lionized in the Finnish media (the Helsingin Sanomat reviewed editorial content with Nokia before publication), Nokia defined successful corporate strategy for traditional firms and aspiring entrepreneurs alike (Ornston 2017: 130). Former sewing machine and toothpaste cap producers like Elcoteq and Perlos used Nokia contracts to redefine themselves as high-technology equipment producers. Startups that were not drawn into Nokia's orbit often targeted mobile communications, inspired by the firm's success.[3] Even traditional, low-technology enterprises replicated Nokia in their own way, prioritizing R&D and technological innovation (Ornston 2012: 59).

This coordinated approach to industrial development was great for Nokia and great for Finland during the 1990s and early 2000s. Nokia not only benefited from skilled labor, but supportive public policies, advanced research and a flexible network of high-quality subcontractors (Steinbock 2000). As a result, Nokia not only remained in Finland, but upgraded the technical capacity of its manufacturing firms, raising productivity throughout the economy (Paija and Rouvinen 2004). But the vulnerabilities are equally evident. Unlike Waterloo, Finland was exceptionally dependent on a single firm, a single industry and a single corporate strategy (Ornston 2017; Sabel and Saxenian 2008). When Nokia faltered in 2008, the adjustment in Finland was far more disruptive.

[3]Until 2010, Finland's most famous technology startup, IObox, was also a mobile communications play. Thegaming industry, Finland's biggest ICT success story since 2010, delivered games to Nokia in its formative years and is heavily oriented toward mobile devices.

4. Managing Decline: Where Waterloo Succeeded and Finland Stumbled

To be clear, the decline of Nokia and BlackBerry challenged both Finland and Waterloo. In both communities, the rapid growth of large, flagship enterprises had sucked up human capital, making more difficult to launch new enterprises and diversify the economy. *Neither* Finland nor Waterloo were especially entrepreneurial before 2008, instead staking their reputation on leading firms that represented at least a fifth of employment and even greater share of turnover. When these flagships stumbled, high-technology employment in both regions contracted, before a wave of entrepreneurial startups picked up the slack.

As described above, however, the situation was far more dire in Finland. In addition to absorbing the best talent across the country, Nokia's deep pockets attracted a huge cadre of subcontractors. There was little reason to go against the grain by launching a startup in an unrelated field when one could work for Nokia as an employee or subcontractor. When Nokia stumbled, however, this meant that other high-technology enterprises were affected as well. The impact was most severe for manufacturing subcontractors, who responded to relentless price competition by scaling down Finnish operations a few years after the dot com crash (Seppälä 2010). Finnish strengths in automation, hybrid circuits, printed circuit board production, precision moulding, rf-filters and silicon wafers all depended on Nokia and all vanished in the 2000s (Paija and Rouvinen 2004).

Software subcontractors benefited from lower fixed costs and rapidly increasing demand for software by traditional Finnish enterprises. Even these firms struggled, however, when Nokia abandoned its work on Symbian, MeeGo and other software

platforms. A massive, diversified consultancy operation, Tieto was ideally positioned to withstand the decline of Nokia, but even it was forced to contain losses by laying off workers. Other, more specialized operations were not so fortunate (Interview with economist, 17 June 2016, Finland). As a result, ICT employment declined after 2008, despite the long-term secular *increase* in demand for software services (Pajarinen and Rouvinen 2015).

Meanwhile, efforts to diversify the Finnish economy by developing new enterprises were hamstrung by ineffective policies. First and second generation initiatives to stimulate entrepreneurship mobilized early stage risk capital, but provided little in the way of mentoring or supporting services. Finnish innovation policies more generally were heavily oriented toward technological development rather than commercialization (Leiponen 2004: 102). New firms, for example, were evaluated on the technical quality of their producers rather than their commercial viability (Interview with director, Tekes, 16 June 2016). This may have worked for Nokia, a century-old conglomerate with sophisticated logistical capabilities and marketing skills (Häikiö 2002), but it did not help inexperienced startups. As a result, Finland did not possess a particularly robust ecosystem of high-technology firms beyond Nokia and its suppliers, and those firms that did succeed did not always feel well-supported (Ornston 2017: 133).

Of course, the Finnish ICT industry has not collapsed entirely. While Nokia's decline caused ICT employment to fall by over 10% between 2008 and 2012 (Pajarinen and Rouvinen 2015: 96), these losses have been partially offset by a wave of entrepreneurial startups. These new enterprises have been bolstered by a very different set of public policies, focused on commercialization and the delivery of supporting services, often by

private sector partners . New public policies have been complemented by grassroots developments, most notably the organizational efforts of Finnish university students, which launched one of Europe's largest technology conferences, Slush, and a business accelerator (Best 2014; Toivonen 2014). It is too early to tell whether the new generation of startups will ever rival Nokia in employment and turnover, but industry observers suggest that this new generation of enterprises is stronger and more diverse than its predecessors. While Finland exhibits particular strength in mobile gaming, it is possible to identify promising enterprises in a wide range of industries (Interviews with venture capitalist, 8 June 2016, and director, Tekes, 16 June 2016, Finland).

In the Finnish case, it appears that diversification was only possible when Nokia declined. This shift started shortly after the dot com crash, when Nokia started to unilaterally disengage from the Finnish ecosystem by offshoring production and squeezing its suppliers. By 2005, venture capitalists expressed a reluctance to invest in Nokia suppliers, preferring alternative business models (Interview with venture capitalist, 20 November 2006, Finland). Aspiring entrepreneurs also considered alternatives, as exemplified by Rovio's decision to target Apple's iOS in 2009.

It was only around this point, as Nokia's troubles clearly mounted, that the institutional environment for startups truly changed. 2009 marks the establishment of the Aalto Entrepreneurship Society, the driving force behind Slush and several other startup-related initiatives. Tekes' Vigo accelerator program, focused on mentorship and commercialization rather than technological development, was launched in the same year. Between 2005 and 2012, funding for entrepreneurship tripled from 40 million to 130 million Euro (Interview with director, Tekes, 9 June 2016). In this radically new

environment, startup activity has flourished. But it happened too late and too small of a scale to fully offset Nokia's rapid decline.

Because BlackBerry was never as tightly embedded within the local community as Nokia, Waterloo was less affected by its decline. Of course, BlackBerry's troubles resulted in significant layoffs, eroded the tax base and impacted local firms, but it did not devastate the regional ICT industry. In contrast to Finland, there were no hardware or software subcontractors that went down with BlackBerry. Instead, the region was marked by a heterogeneous collection of local firms, occupying very different niches and only tenuously connected to BlackBerry, even at the height of its influence (Dingman 2015). Search pioneer OpenText, for example, employed over 4,000 and is in a position to capitalize on BlackBerry's decline by expanding its labor force. This also applies to D2L, in educational technology, which is approaching 1,000 employees. Foreign firms like Electronic Arts, SAP, SAP, Intel and Google have also sought to capture talent exiting BlackBerry (Dingman 2015).

These stalwarts have been joined by an unprecedented wave of startups, with the number of new tech entrants increasing from 155 in 2010 to over 500 by 2014 (Dingman 2015). While Waterloo, like Finland, was not exceptionally entrepreneurial before 2010, the institutional environment was far more conducive to new enterprises. For example, the University of Waterloo has encouraged its faculty and students to launch new enterprises since the 1980s (Bramwell and Wolfe 2008), while Communitech has been delivering a wide range of supporting services to startups since its establishment in 1998 (Bramwell et al. 2008). The University of Waterloo Velocity accelerator, which has worked with over one hundred startups, was launched in 2008 (Dingman 2015). Perhaps just as importantly,

college graduates that did not want to work within BlackBerry were forced to forge their own path as there were few opportunities for subcontractors.

As a result, Waterloo was already in a stronger position even before BlackBerry declined. Whereas ICT employment in Finland contracted following Nokia's decline and struggles to recover, Waterloo appears to have recovered more swiftly from BlackBerry's collapse (CBRE 2016; Lu 2013). Existing enterprises were well-positioned to utilize the human capital that exited BlackBerry, while new startups could draw on experienced entrepreneurs and robust institutional supports. By contrast, former Nokia employees and Finnish university graduates were faced with the more daunting task of constructing a new high-technology industry from scratch, without the support of the flagship firm that had defined the sector for so long.

5. Conclusion: The Strength of a Weak Innovation Policy?

Both Finland and Waterloo benefited immensely from their flagship firms. In addition to their direct contribution to employment and productivity growth, Nokia and BlackBerry redefined their local communities as high-technology hubs, creating lucrative opportunities for other enterprises. Both communities have also survived the decline of these anchor firms, despite their exceptional position within the local, high-technology ecosystem. While rapid downsizing was disruptive, any employment losses have been muted by an unprecedented wave of high-technology startups. Clearly, communities can survive the demise of a flagship firm.

At the same time, Waterloo and Finland exhibit significant differences. Although BlackBerry was a proportionately larger employer within Waterloo, Finland had a more

difficult time adapting to the decline of its flagship firm. When Nokia faltered, it took down a large number of subcontractors with it and Finnish public policies were not particularly well-adapted to support entrepreneurial startups. Conditions have improved dramatically since 2012, but the transition has been a rocky one and the newest generation of Finnish startups remains untested.

This paper argues that Finland's difficult transition reflects the degree to which it embedded Nokia with the policymaking process and the local economy. In the short run, policy coordination and inter-firm cooperation tied Nokia to Finland and diffused expertise from Nokia throughout the Finnish economy. Nokia not only contributed directly to employment and productivity growth during the 1990s and 2000s, but lifted many other firms alongside it.

By contrast, BlackBerry was never as tightly embedded within Waterloo. While the firm contributed actively to the community and enjoyed close ties to the University of Waterloo and other educational institutions, it never refashioned public policy in the way Nokia did and it maintained an arms-length relationship with local firms. This may have limited the diffusion of knowledge and productivity spillovers, but it also led to a more diverse and resilient high-technology ecosystem. In addition to nurturing a collection of indigenous and foreign enterprises that had little to do with BlackBerry, local entrepreneurs enjoyed more institutional support before 2012 and were in a stronger position to expand when BlackBerry faltered.

These divergent developments have important implications for policymakers. While the demise of a flagship firm was not fatal to either region, policymakers should exercise caution in embedding large firms within their local community. The decision to anchor

large firms within local institutions is a sensible one, but very high levels of coordination can hinder diversification, heightening vulnerability to disruptive economic shocks. Since large enterprises are often powerful enough to independent influence local educational institutions, attract business partners and shape community institutions, policymakers might be better served by targeting entrepreneurial new enterprises and doing so separately from their effort to retain large flagships.

Whether or not this is politically feasible is a separate question. In the case of Waterloo, historically arms-length, competitive inter-firm relations prevented the formation of close-knit inter-firm relationships. Meanwhile, limited fiscal resources and regulatory authority prevented local policymakers from mobilizing public resources around BlackBerry to the same degree as their Finnish counterparts. Provincial and federal authorities, paralyzed by regional cleavages and competing developmental models, were hardly in a position to compensate. This fragmented and inconsistent approach to innovation is frequently depicted as a liability (Nicholson 2016). When confronted with the decline of a flagship firm, however, this weakness was actually an asset.

References

Ali-Yrkkö, Jyrki (2010), 'The Role of Nokia in the Finnish Economy', in Jyrki Ali-Yrkkö (ed.), *Nokia and Finland in a Sea of Change* (Helsinki: Taloustieto Oy), 9-36.

Ali-Yrkkö, Jyrki and Hermans, Raine (2004), 'Nokia: A Giant in the Finnish Innovation System', in Gerd Schienstock (ed.), *Embracing the Knowledge Economy: The Dynamic Transformation of the Finnish Innovation System* (Cheltenham, UK: Edward Elgar), 106-27.

Ali-Yrkkö, Jyrki, et al. (2015), 'A Comparison of the Finnish and the Swedish ICT Sector', in Eric Giertz, Annika Rickne, and Petri Rouvinen (eds.), *Small and Beautiful: The ICT Success of Finland and Sweden* (Stockholm: Vinnova), 38-50.

Barry, Frank (2004), 'Export-Platform Foreign Direct Investment: The Irish Experience', *EIB Papers,* 9 (2), 8-37.

Best, Jo (2014), 'From Angry Birds to Nokia Castaways, Finland's Startup Scene Has High Expectations', *Tech Republic,* January 9.
Bramwell, Allison and Wolfe, David A. (2008), 'Universities and Regional Economic Development: The Entrepreneurial University of Waterloo', *Research Policy,* 37, 1175-87.
Bramwell, Allison, Nelles, Jen, and Wolfe, David A. (2008), 'Knowledge, Innovation and Institutions: Global and Local Dimensions of the ICT Cluster in Waterloo, Canada', *Regional Studies,* 42 (1), 100-16.
CBRE (2014), 'Tech Sector Buoys Waterloo Office Market Amidst Increased Scrutiny', (Toronto: CBRE).
--- (2016), '2016 Scoring Tech Talent Report', (Toronto: CBRE).
Cutler, Kim-Mai (2013), 'In Rovio and Supercell's Wake: Finland's Gaming Scene Sees a Renaissance', *Tech Crunch,* December 3.
Dahlman, Carl J. (2006), 'Conclusions and Lessons from Finland's Knowledge Economy for Other Economies', in Carl J. Dahlman, Jorma Routti, and Pekka Ylä-Anttila (eds.), *Finland as a Knowledge Economy: Elements of Success and Lessons Learned* (Washington DC: World Bank Institute), 99-110.
Dahlman, Carl J., Routti, Jorma, and Ylä-Anttila, Pekka (eds.) (2006), *Finland as a Knowledge Economy: Elements of Success and Lessons Learned* (Washington DC: World Bank Institute).
Dingman, Shane (2015), 'Startup City: The High-tech Fever Reshaping Kitchener-Waterloo', *The Globe and Mail,* July 17.
Eurostat (2016), 'Data Explorer', <http://epp.eurostat.cec.eu.int/>, accessed 1 June.
Evans, Peter (1995), *Embedded Autonomy: States and Industrial Transformation* (Princeton: Princeton University Press).
FVCA (2016), 'Yearbook 2015', (Helsinki: Finnish Venture Capital Association).
Gartner (2009), 'Market Share: Smartphones, Worldwide, 4Q08 and 2008', (Stamford, CT: Gartner, Inc.).
Gillmor, Don (2012), 'The Invention of Waterloo', *The Walrus,* September 12.
Grabher, Gernot (1993), 'The Weakness of Strong Ties: The Lock-in of Regional Development in the Ruhr Area', in Gernot Grabher (ed.), *The Embedded Firm* (London: Routledge), 255-77.
Häikiö, Martti (2002), *Nokia: The Inside Story* (London: Prentice Hall).
Hardy, Ian (2013), 'BlackBerry and Kik Settle 2010 Patent Infringement Lawsuit', *Mobile Syrup,* October 8.
Helsingin Sanomat (2011), 'More Than 1,000 Nokia Employees Walk Out in Tampere in Protest at Symbian Phase Out', *Helsingin Sanomat,* February 11.
Khan, Mehreen (2015), 'Finland Emerges as the 'New Sick Man of Europe' as Euro's Worst Performing Economy', *The Telegraph,* November 13.
Koski, Heli, et al. (2006), 'Innovation and Education Strategies and Policies in Finland', in Carl J. Dahlman, Jorma Routti, and Pekka Ylä-Anttila (eds.), *Finland as a Knowledge Economy: Elements of Success and Lessons Learned* (Washington DC: World Bank Institute), 39-62.
Leiponen, Aija (2004), 'Knowledge Services in the Finnish Innovation System', in Gerd Schienstock (ed.), *Embracing the Knowledge Economy: The Dynamic Transformation of the Finnish Innovation System* (Cheltenham, UK: Edward Elgar), 85-105.

Lu, Vanessa (2013), 'Waterloo's Tech Hub Thrives Despite BlackBerry's Woes', *The Star,* September 27.
Lundvall, Bengt-Åke (ed.), (1992), *National Systems of Innovation: Towards a Theory of Innovation and Interactive Learning* (London: Pinter Publishers).
Maliranta, Mika (2000), 'Privately and Publicly Funded R&D as Determinants of Productivity: Evidence from Finnish Enterprises', in Rita Asplund (ed.), *Public R&D Funding, Technological Competitiveness, Productivity and Job Creation* (Helsinki: Taloustieto), 47-86.
McQueen, Rod (2010), *Blackberry: The Inside Story of Research in Motion* (Toronto: Key Porter Books).
Moen, Eli and Lilja, Kari (2005), 'Change in Coordinated Market Economies: The Case of Nokia and Finland', in Glenn Morgan, Richard Whitley, and Eli Moen (eds.), *Changing Capitalisms: Internationalization, Institutional Change and Systems of Economic Organization* (Oxford: Oxford University Press), 352-79.
Munro, Andrew and Bathelt, Harald (2014), 'Innovation Linkages in New- and Old-Economy Sectors in Cambridge-Guelph-Kitchener-Waterloo (Ontario)', in David A. Wolfe (ed.), *Innovating in Urban Economies: Economic Transformation in Canadian City-Regions* (Toronto: University of Toronto Press), 219-44.
Nelles, Jen, Bramwell, Allison, and Wolfe, David A. (2005), 'History, Culture and Path Dependency: Origins of the Waterloo ICT Cluster', in David A. Wolfe and Matthew Lucas (eds.), *Global Networks and Local Linkages: The Paradox of Cluster Development in an Open Economy* (Montreal: McGill-Queen's University Press), 227-52.
Nicholson, Peter (2016), 'Canada's Low-Innovation Equilibrium: Why It Has Been Sustained and How It Will Be Disrupted', *Canadian Public Policy,* 42 (1), 39-45.
North, Douglass (1990), *Institutions, Institutional Change and Economic Performance* (Cambridge, UK: Cambridge University Press).
O'Riain, Sean (2004), *The Politics of High Tech Growth: Developmental Network States in the Global Economy* (Cambridge, UK: Cambridge University Press).
OECD (2003), *Science, Technology and Industry Scoreboard* (Paris: OECD).
Ornston, Darius (2012), *When Small States Make Big Leaps: Institutional Innovation and High-Tech Competition in Western Europe* (Ithaca: Cornell University Press).
--- (2017), *Good Governance Gone Bad: When Adapability Leads to Excess* (Unpublished book manuscript).
Paija, Laura (2000), 'ICT Cluster: The Engine of Knowledge-Driven Growth in Finland', in The Research Institute of the Finnish Economy (ed.), (733; Helsinki: The Research Institute of the Finnish Economy).
Paija, Laura and Rouvinen, Petri (2004), 'The Evolution of the ICT Cluster', in Gerd Schienstock (ed.), *Embracing the Knowledge Economy: The Dynamic Transformation of the Finnish Innovation System* (Cheltenham, UK: Edward Elgar), 47-64.
Paija, Laura and Palmberg, Christopher (2006), 'Sectoral Perspectives on the Finnish Knowledge Economy: From Forest-Related Industries to ICT ', in Carl J. Dahlman, Jorma Routti, and Pekka Ylä-Anttila (eds.), *Finland as a Knowledge Economy: Elements of Success and Lessons Learned* (Washington DC: World Bank), 63-86.

Pajarinen, Mika and Rouvinen, Petri (2013), 'Nokia's Labor Inflows and Outflows in Finland: Observations from 1989 to 2010', in ETLA (ed.), *ETLA Reports* (10; Helsinki: The Research Institute of the Finnish Economy).
--- (2015), 'The Finnish ICT Sector Today', in Eric Giertz, Annika Rickne, and Petri Rouvinen (eds.), *Small and Beautiful: The ICT Success of Finland and Sweden* (Stockholm: Vinnova), 96-105.
Pender, Terry (2014), 'Waterloo Getting $200-million Venture Capital Fund', *Waterloo Region Record,* April 17.
--- (2015), 'BlackBerry Cuts More Jobs', *The Record,* July 20.
Roose, Kevin (2015), 'The Life, Death and Rebirth of BlackBerry's Hometown', *Fusion,* February 8.
Sabel, Charles and Saxenian, Annalee (2008), *A Fugitive Success: Finland's Economic Future* (Helsinki: Finnish National Fund for Research and Development).
Saxenian, Annalee (1994), *Regional Advantage: Culture and Competition in Silicon Valley and Route 128* (Cambridge, MA: Harvard University Press).
Schienstock, Gerd and Hämäläinen, Timo (2001), *Transformation of the Finnish Innovation System: A Network Approach* (Helsinki: Finnish National Fund for Research and Development).
Seppälä, Timo (2010), 'Transformations of Nokia's Finnish Supplier Network from 2000 to 2008', in Jyrki Ali-Yrkkö (ed.), *Nokia and Finland in a Sea of Change* (Helsinki: Taloustieto Oy), 37-68.
Sher, Jonathan (2013), 'Former Employees of Waterloo-based BlackBerry Search for Success in Life After Research in Motion', *London Free Press,* October 11.
Singer, Hans (1950), 'The Distribution of Gains between Investing and Borrowing Countries', *American Economic Review,* 15, 473-85.
Steinbock, Dan (2000), *The Nokia Revolution: The Story of an Extraordinary Company that Transformed an Industry* (New York: Amacom).
Storper, Michael and Venables, Anthony J. (2004), 'Buzz: Face-to-Face Contact and the Urban Economy', *Journal of Economic Geography,* 4 (4), 351-70.
Sweeny, Alastair (2009), *BlackBerry Planet: The Story of Research in Motion and the Little Device that Took the World by Storm* (Mississauga: John Wiley & Sons Canada, Ltd).
Toivonen, Tuukka (2014), 'Success of Angry Birds Reflects Growth of Young Entrepreneurship in Finland', *The Guardian,* September 8.
Van Ark, Bart and Monnikhof, Erik (1996), 'Size Distribution of Output and Employment: A Data Set For Manufacturing Industries in Five OECD Countries, 1960s-1990', *OECD Working Paper No. 166* (Paris: OECD).
Walshok, Mary Lindenstein and Shragge, Abraham J. (2014), *Invention and Reinvention: The Evolution of San Diego's Innovation Economy* (Palo Alto: Stanford University Press).
Weisskoff, Richard and Wolf, Edward (1977), 'Linkages and Leakages: Industrial Tracking in an Enclave Economy', *Economic Development and Cultural Change,* 25, 607-28.
Yakabuski, Konrad (2009), 'Manufacturing: Make or Break? ', *The Globe and Mail,* September 7.
--- (2013), 'If BlackBerry Is Sold, Canada Faces an Innovation Vacuum', *The Globe and Mail,* August 17.
YLE (2016), 'Nokia to Cut 1032 Jobs in Finland', *YLE,* May 21.

Zheng, Lingwen and Warner, Mildred (2010), 'Business Incentive Use Among U.S. Local Governments: A Story of Accountability and Policy Learning', *Economic Development Quarterly,* 24 (4), 325-36.