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## ACKNOWLEDGEMENTS

This research was supported by the Government of Ontario through the Ontario Human Capital Research and Innovation Fund.


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## I. INTRODUCTION

In today's economic landscape, innovation has become the engine powering the growth and competitiveness of firms, sectors, and regions. However, the pursuit of innovation at all costs can widen inequalities and benefit some while leaving others behind.<sup>1</sup> Regions such as Silicon Valley, which are often held up as exemplars of innovation, are also some of the most unequal.

To fully capture its value while mitigating its risks, initiatives designed to support innovation should also take into account the distribution of economic gains. Distribution-sensitive innovation policies (DSIPs) recognize this need. They encourage economic growth and technological progress, while also aiming to spread their benefits broadly - to disadvantaged, displaced, or at-risk groups.

Within Ontario, policymakers, employers, and training providers face the challenge of balancing innovation-driven economic growth goals and inclusion considerations for workers, particularly for those who hold fewer educational credentials and economic advantages. Yet innovation and inclusion are often approached as separate issues.

This paper explores two DSIPs, which were designed to bridge these aims: North Carolina's BioWork course and Finland's Nokia Bridge program. Their purpose was to increase the resilience of mid-to-late career workers affected by technological innovation, while supporting regional economic growth. As such, these case studies hold relevant lessons for Ontario. They were shaped by strategic design and implementation that accounted for the economic realities of participants, target industries, and regions, to promote the development of inclusive innovation economies. In particular, they demonstrate that the existence of education and training supports, while important, is not sufficient to ensure inclusive outcomes.

Through stakeholder interviews, the study of existing literature, and data exploration, this report identifies some of the instrumental features of these programs, and the lessons that they offer. These highlight the importance of: resilient multi-sector networks, real knowledge of talent demand and supply, transparent and continuous information sharing, adaptability to changing needs, and recognition that workers from diverse educational and skill backgrounds can adapt and contribute to innovation-driven economic growth.

## II. OUR APPROACH

This report aims to better understand a sample of recent global approaches that support both technological innovation and the inclusion of at-risk or displaced workers in innovative and growing areas of the economy. The case studies in this report highlight the BioWork Program in North Carolina and the Nokia Bridge program in Finland. They yield lessons relevant to the Ontario context, with a view to supporting the development of policies and programs aimed at increasing the resilience of the province's labour force while fostering economic growth.

## METHODOLOGY

The approach is based on the conceptual framework of distribution-sensitive innovation policies (DSIPs) developed by Zehavi and Breznitz (2017).<sup>2</sup> DSIPs refer to science, technology, and innovation policies that aim to both encourage economic growth and address potential inequitable outcomes, specifically by supporting disadvantaged groups. Zehavi and Breznitz identify four types of DSIPs:

1. Policy that supports technological innovation while creating productivity gains for less skilled workers.
2. Policy that supports innovation in relatively disadvantaged regions, helping address interregional technological divides.
3. Policy that seeks to increase the share of participation of economically disadvantaged and underrepresented groups in technology-intensive industries as workers or entrepreneurs.
4. Policy intended to enhance the ability of disadvantaged groups to participate in the economy as consumers, through both monetary and utility effects (e.g. lower cost necessities, or higher-utility goods).

While these four categories are not mutually exclusive, this exploration focuses on programs fitting the first category. However, this paper will extend the first category by examining at-risk or displaced workers of varied skill profiles in its analysis of the labour market outcomes of the selected initiatives.

### Case study criteria

Case studies were selected based on the following criteria:

1. The policy or program is a promising model for supporting technological innovation while also upskilling or retraining workers who have been displaced from their jobs or are at risk of being displaced, including workers with lower levels of education. Specifically:
  - a. Policies and programs designed to train workers, improve signaling from employers to training programs, and/or incentivize employers to hire and/or train workers in jobs that are being reshaped by technology.
  - b. Models designed to help workers transition from jobs with a high potential of being impacted by automation, to jobs in the innovation economy with a low potential of being impacted by automation in the same or other industries.
2. The policy or program is established and has some evidence of success.
3. There is an economic and political environment comparable to that of Canada at the national and, if relevant, regional levels.
4. The policy or program was created within a prominent technology and innovation-driven sector.
5. There is a relatively supportive policy regime.

Each case study was informed by a triangulated approach involving (1) a literature review, (2) semi-structured interviews with [key stakeholders](#) representing vital actors and impacted groups, and (3) scanning of available data to understand the general economic context and trends.

## Case studies

Case Study	North Carolina and BioWork	Finland and Nokia's Bridge program
Program	A strong partnership of industry, education, and state-level government led to the creation of the BioWork certificate course, designed to both satisfy the specific production-line needs of the rapidly growing biotechnology industry and be accessible to at-risk or displaced workers from more traditional manufacturing subsectors.	In advance of significant layoffs caused by a shift in Nokia's corporate strategy, the company designed, funded, and implemented a program to help affected employees prepare to transition within or out of Nokia, yet "continue to utilize their capabilities to the fullest." <sup>3</sup>
Interesting Aspects	<ul style="list-style-type: none"> <li>+ Partnership-driven, partially government-funded</li> <li>+ State-wide reach</li> <li>+ Responsive to industry needs</li> <li>+ High-growth sector driven by scientific and technological innovation</li> <li>+ High-employment sector in the state</li> <li>+ Political landscape historically favouring lower levels of government involvement</li> <li>+ Less comprehensive and expansive social safety nets</li> <li>+ Ongoing program</li> <li>+ Thousands of participants from diverse backgrounds in the past 17 years</li> </ul>	<ul style="list-style-type: none"> <li>+ Primarily company-driven and funded, with some funding support from government</li> <li>+ Enacted in multiple sites</li> <li>+ Result of technological disruption, leading to a change in corporate strategy</li> <li>+ Important employer in the country, across different regions</li> <li>+ Interconnected and intentionally developed national innovation system</li> <li>+ Socially-oriented political landscape</li> <li>+ Strong social-safety nets</li> <li>+ Complex labour regulation environment</li> <li>+ Three-year, one-time program to deal with a shock</li> <li>+ Thousands of workers with different skill profiles impacted</li> </ul>

### III. CASE STUDIES

#### NORTH CAROLINA: BUILDING A WORKFORCE PIPELINE FOR BIOMANUFACTURING

##### Relevance to Ontario

Over the past two decades, much of the manufacturing sector in Ontario lost its competitive edge and experienced declines in revenue and employment.<sup>4</sup> Many displaced workers from the sector have been funnelled into more precarious service-oriented jobs.<sup>5</sup>

However, manufacturing in the province is far from a relic of the past. Manufacturers in key sub-sectors, such as those in Ontario's now thriving advanced manufacturing industry, are demonstrating not only their resilience, but their ability to carve out a niche and compete internationally.<sup>6</sup> Despite this potential, manufacturers across the province still face a number of hurdles, including challenges finding the right talent to work in highly technical environments.<sup>7 8</sup>

North Carolina is no stranger to these trends. The state, which was once home to prominent tobacco, furniture and textile manufacturing industries, transitioned into a global biotechnology hub as these traditional industries declined. The management of this transition provides a compelling case example of how one jurisdiction can promote the development of an emerging, innovation-driven manufacturing industry, while simultaneously providing opportunities for displaced workers. While no two jurisdictions are alike and there are many contextual factors at play, the lessons from this specific case could inform efforts in Ontario to lay the groundwork for a highly competitive, yet inclusive manufacturing sector.



## CASE SUMMARY

The biotechnology sector in North Carolina has, in recent decades, become a world-renowned hub of research and production, in large part due to strategies developed by the state government in partnership with the North Carolina Biotechnology Centre. It is an innovation-driven sector that continues to grow, demanding new skills and creating new jobs. In contrast, globalization, automation, and certain shocks have severely impacted the state's traditional tobacco, furniture, and textile manufacturing industries. These have experienced a marked decline, displacing many mid-to-late career workers with low levels of formal education, but significant experience with manufacturing processes.

In the late 1990s, the Biotechnology Centre found that the state's biotechnology firms were grappling with a significant shortage of qualified production-line process technicians, and sought to address it through the creation of the BioWork course. The course was designed in collaboration with industry, community colleges, and subject-matter experts, and delivered via community colleges. It aimed to meet the emerging needs of firms while being accessible to people with no more than a high school education, and with no previous experience in the sector. As a result, it attracted many of the workers displaced from traditional industries. Stakeholders credit the course with helping to build a talent pipeline that supported the continued growth of North Carolina's biotechnology sector, while creating pathways for displaced workers with relatively low levels of formal education to join an innovative sector.

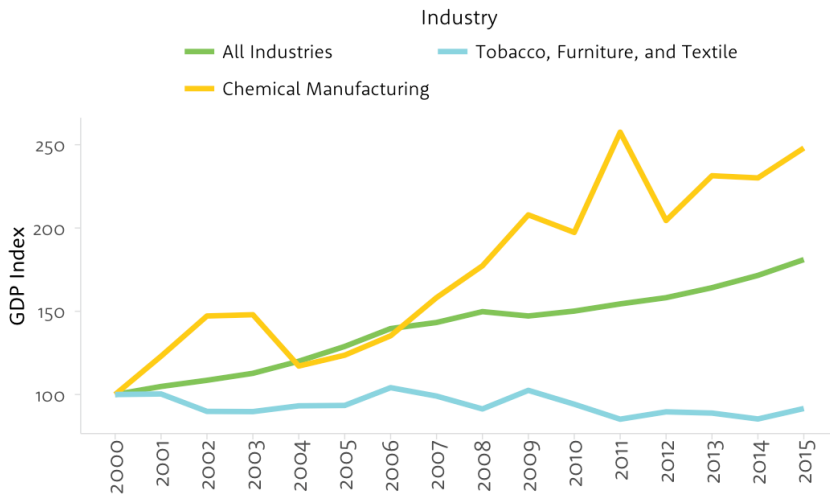
In the 17 years since its inception, BioWork providers and participants have encountered challenges including decreased political support as well as decreased funding for both community colleges and students. Yet, the biotechnology industry continues to value the course and community colleges maintain significant enrolment. This case study demonstrates the importance of the following in designing and implementing a training-focused DSIP:

- + A resilient network of partners
- + Accurate knowledge of skills demand
- + Allowing for change and evolution
- + Recognizing that workers of various education and skill backgrounds can play a part in innovation

## Context

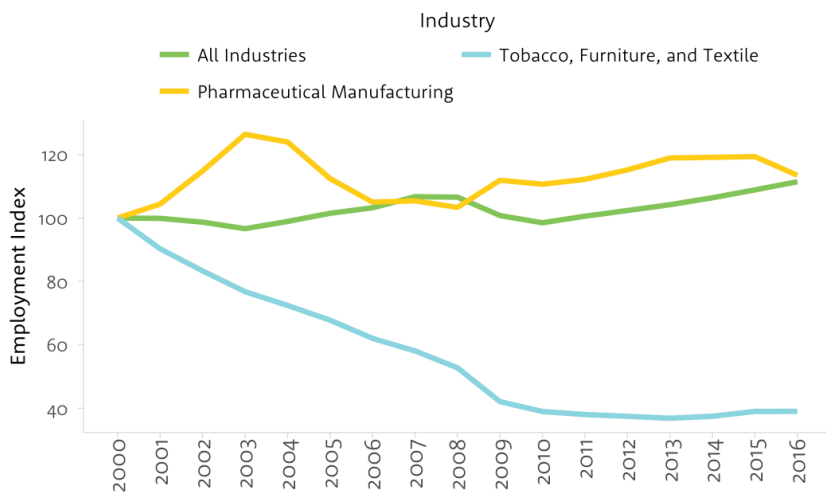
### Economic profile

Figure 1  
Index of Output, North Carolina, 2000-2015



Source: North Carolina Department of Commerce, BII+E Analysis  
 Note 1: Index Base Year = 2000  
 Note 2: Chemical Manufacturing Includes NAICS 32  
 Note 3: Tobacco, Furniture, and Textile Includes NAICS 23,26, and 27

Figure 2  
Index of Employment, North Carolina, 2000-2016



Source: North Carolina Department of Commerce, BII+E Analysis  
 Note 1: Index Base Year = 2000  
 Note 2: Pharmaceutical Manufacturing Includes NAICS 3254  
 Note 3: Tobacco, Furniture, and Textile Includes NAICS 3122, 3371, 3372, 3379, 3133, 3141, 3149

North Carolina is a state with a polarized economy. On one hand, it is world-renowned for its concentration of research and development (R&D) in biotechnology and the biomedical fields. On the other, it has a disproportionate concentration of workers in traditional manufacturing industries, most notably in textiles, furniture, and food processing (including tobacco), whose output and employment have experienced significant declines due to automation, offshoring, and increased competition.<sup>9</sup> Like many other manufacturing hubs in advanced economies, North Carolina has found it challenging to keep up with low-cost manufacturing centres in Asia and Latin America. As a result, many of the attributes that had attracted production sites to the state in previous decades (e.g., inexpensive labor, low taxes, minimal regulation, and low unionization rates) have made the region more vulnerable to international competition.<sup>10</sup>

In 1999, North Carolina's tobacco industry experienced a sharp decline in demand, employment, and output due to a successful class action suit addressing the negative effects of cigarettes.<sup>11</sup> At the time, the state was the largest producer of tobacco products in the country, and tobacco was one of the most important industries in the state. The industry's significant loss in revenue also caused the state and regional governments to lose significant tax income, affecting their ability to invest in economic development and employment programs.

As a result of these trends and shocks, the previously prominent tobacco, furniture and textile industries shed over 200,000 jobs between 1996 and 2006.<sup>12</sup> Yet, despite the magnitude of job loss, the manufacturing sector as a whole continues to employ a sizeable portion of the state's workforce without a

college education.<sup>13</sup> While these traditional manufacturing industries faltered, biotechnology manufacturers were quickly entering North Carolina as a result of state recruitment efforts and research excellence in the field. The decline in traditional industries displaced many production-line workers, yet biotechnology firms faced serious shortages of process technician and entry-level manufacturing roles.

### North Carolina and the Biotech Centre

In the 1950s, the government of North Carolina began efforts to encourage growth in the biotechnology and pharmaceutical manufacturing sector. It focused on talent attraction and the establishment of North Carolina's Research Triangle Park in 1959 as a research and development (R&D) hub that encouraged academic and industry collaboration.<sup>14</sup> Building from these initiatives, the state established the North Carolina Biotechnology Centre (Biotech Centre) in 1984. This economic development agency was the first of its kind in the country and is dedicated to the growth of the biosciences sector. It is a not-for-profit organization funded through the state General Assembly as part of a wider strategy enacted by the North Carolina Board of Science and Technology.<sup>15</sup>

During the 1980s and 1990s, the Biotech Centre and North Carolina's Department of Commerce partnered in industrial recruitment efforts, and succeeded in attracting biotechnology firms to the state. They prioritized the creation of jobs for individuals with four-year academic or advanced degrees in order to retain scientific and engineering talent in North Carolina.<sup>16</sup> Over time, the Biotech Center began expanding its efforts to attract companies that would extend employment to a more diverse set of workers, including less educated job seekers, especially those displaced from other manufacturing industries.<sup>17</sup> In 1994, the North Carolina Biosciences Organization (NCBIO), an association for the state's life science industry, was formed with the aim to promote "the future growth and development of North Carolina's bioscience industry".<sup>18</sup>

Throughout the late-2000s, the Biotech Center prioritized the alignment of innovation and job-creation goals, in line with a broader state mandate.<sup>19</sup> Beginning in 2004, the GoldenLEAF Foundation provided significant funding for the development of the state's biotechnology workforce through various initiatives.<sup>20</sup> In 2009, the Biotech Centre and the Governor's office made biomanufacturing a strategic priority in their efforts to diversify the state's economy, and provide a significant number of accessible, high-paying jobs.<sup>21</sup> By the late 2000s, strong support for locally-led technological innovation and entrepreneurship coupled with activities aimed at building workforce potential, and attracting and preserving the presence of large biopharmaceutical corporations, culminated in the emergence of a complex and interconnected biotechnology cluster led by the Biotech Centre.<sup>22</sup> Some of these actors will be discussed in greater detail in later sections.

Within this network, the Biotech Centre enjoys a unique position, one which allows it to strategically prioritize workforce equity and inclusion.<sup>23</sup> It plays a key role in identifying skill needs, defining regional strategy, co-designing training curricula, maintaining stakeholder relationships, and ensuring employer buy-in.

As a convener, the Biotech Center ensures that key institutions such as training providers, local economic development representatives, and state officials communicate during the high-stakes and time-sensitive deal-making phase of industrial recruitment. In particular, the involvement of state universities and community colleges helps reinforce bioscience workforce talent as North Carolina’s top locational draw.<sup>24</sup>

Figure 3  
North Carolina’s Biotechnology Cluster



Source: Stakeholder interviews

“The North Carolina Biotechnology Center is not an industry trade association. We don’t have members, but we’re industry-friendly. We work to help industry be successful. And, as a separately chartered non-profit, we’re not part of any one government organization or any one university, and that’s an advantage in bringing people together to get things done.”

- Ken Tindall, Senior Vice President, Science and Business Development, NC Biotechnology Center

## The foundations of the BioWork course

In 1997, the Biotech Centre began systematic and comprehensive surveying of the state's biotechnology industry. The main products of these consultations were the Centre's *Window on the Workplace* reports, which aimed to identify and inform college educators of the industry's talent needs.<sup>25</sup> The 1997 and 2003 reports found that the state lacked the talent required to fill most biotechnology entry-level production positions. The Centre then developed a program to train individuals for the role of process technician, the industry's main production position, designed to teach the skills identified as most in-demand by industry and educators.

### THE BIOWORK COURSE: OVERVIEW

#### Delivery:

Offered by community colleges through open enrolment. In addition:

- + Stand-alone modules of the BioWork course are offered by some community colleges as the basis for customized biotechnology industry training.
- + The course can also be completed as part of an Associates Applied Science Degree at some community colleges.

#### Eligibility:

Limited spots are distributed to qualified applicants on a first-come, first-serve basis. Some colleges increase the number of course sessions in relation to student demand, with few capacity limits in practice. In general, participants are required to:

- + Be 18 years of age;
- + Have a high-school or General Equivalency Diploma (GED);
- + Pass initial reading and mathematics tests administered by the respective community college, demonstrating Grade 9/10 proficiency;
- + Complete an application form and attend an information session at the respective community college.

#### Design:

BioWork was initially designed as a 96-hour course. It has evolved into a 128-hour course comprised of 9 modules. Its modular approach enables students to take the full course, or individual modules.

#### Evaluation and requirements for completion:

Initially, students had to pass final cumulative exams with a grade above 80 percent, with the option to retake only one exam. Currently, community colleges have different approaches, including unit tests or online quizzes without a final exam. Some colleges also require a minimum level of attendance for course completion.

#### Cost:

The exact cost and availability of financial aid varies by college. Currently, the course tuition is, on average, US \$290 including textbook fees.

#### Certification:

State certification is optional, and administered by a third-party.

- + It incurs an additional \$55 USD cost to students.
- + A minimum grade of 60 percent is required to pass the certification exam.

*Sources: Regional Technology Strategies Inc. and Seymour, 2012; North Carolina Department of Public Instruction, 2006; Goldstein, Lowe, and Donegan, 2012; Biowork Process Technician For Pharmaceutical Manufacturing, Wilson Community College, 2016.*

## Intent

### Motivation and goals

The various actors involved in the creation of the BioWork course had different goals. The original driving force for the Biotech Centre was the aim to satisfy industry demand and create an efficient and sustainable workforce pipeline. The community colleges involved in implementing the course aimed to both meet the needs of employers in their region, and provide inclusive workforce training and student support. Individual community colleges in regions that lacked a local biomanufacturing presence saw the program as a way to attract firms to their area. In turn, companies had a clear incentive to participate in building a broad local talent base as a way to externalize employee training and reduce initial onboarding time and costs.

### Design process

The Biotech Centre's 1997 Window on the Workplace report provided a level of analysis and relationship-building that proved valuable in various ways:

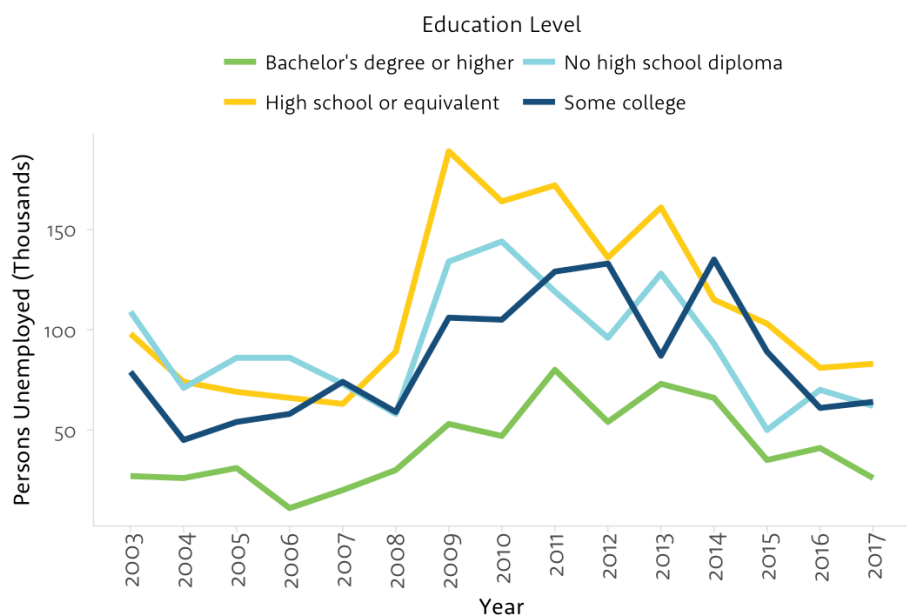
- + It accurately informed key stakeholders, including the Centre itself and college educators, about the industry, its skill needs, and local workforce deficiencies.<sup>26</sup>
- + It was an exercise in trust-building with industry and a demonstration of the capacity and value of the Centre and the sector to the state government and other potential funders, including the Golden Leaf Foundation, which has since provided the Centre with over US \$100 million for workforce development.<sup>27</sup>
- + Building on previous relationships developed through early industrial recruitment efforts, it facilitated contacts between colleges and biomanufacturers and provided a crucial vehicle for curriculum development.<sup>28</sup>

### The must-haves

Initial proponents of the Biotech Centre recognized that in order to meet industry needs, any training solution needed to satisfy two sets of requirements. First, its content had to be relevant and necessary for both traditional pharmaceutical manufacturers, who employ mostly chemical methods, and other biochemical manufacturers, including those employing increasingly biologically-centered processes. Second, the content had to be delivered at a level accessible to people

Figure 4

#### Unemployment by Educational Attainment in North Carolina



Source: US Census Bureau

with no more than a high school education, since this demographic has historically made up a majority of manufacturing workers in North Carolina, and has had a consistently high unemployment rate (although this has been dropping in recent years).<sup>29</sup> The course would therefore require neither post-secondary education nor prior work experience.

In addition, stakeholders involved in the course's initial design identified the need for the course to go beyond superficial process training. As a result, the curriculum provides a basic science background and theoretical explanations of typical manufacturing processes used by companies. According to industry, education, and Biotech Centre stakeholders, BioWork's approach allows participants to be better problem solvers on the manufacturing floor.<sup>30</sup> Stakeholders also maintain that underlying scientific knowledge also enables future workers to be more aware of potential hazards and their consequences, reducing the number of manufacturing errors and increasing worker safety. The course focuses on core competencies (e.g. measures and weights, good manufacturing practices, gowning practices, etc.) that are otherwise often acquired through a mix of formal education and experience. While process technicians perform different tasks at different plants, strong training in these competencies increases the flexibility of workers and shortens the in-house training needed for entry-level positions.

### *The process*

The biomanufacturing sector and state actors became aware of the widespread need for process technicians, and early movers started to look for a practical way of addressing the problem. Prior to the development of the BioWork course, one company, Novozymes (previously a part of NovoNordisk), partnered with Vance-Granville Community College (VGCC) to prepare their process technicians.<sup>31</sup> Through VGCC's industrial training arm, entry-level production workers were trained in the basic math, chemistry, and biology specific to the processes of the firm.<sup>32</sup>

Inspired by the success of this collaboration, the Biotech Centre identified a potentially scalable training scheme that could be implemented throughout North Carolina's community college system. In 2000, vocational training specialists from the Centre began to work closely with Novozymes to design the original BioWork course. As part of the pilot design process, the company agreed to pre-test an initial version of BioWork with its employees, and reviewed job applications from trainees who completed the first semester of the program at VGCC in 2001.<sup>33</sup> While Novozymes was an integral part of the initial design process, there were many contributors throughout the state who engaged in content feedback and revision, including human resource managers, educators and other subject-matter experts.

We did a lot of interviews. In terms of developing text, [we] visited every bio manufacturing facility in North Carolina and interviewed employees. Not only to learn their technology and how the processes work, but also their views from a human resource angle.”

- Biotech Centre stakeholder

The Biotech Centre drew further on its relationship with Novozymes, and with other important regional and sectoral players such as Biogen, established through involvement in earlier industrial recruitment and workforce surveys, to obtain expert review and feedback on every unit of the BioWork course.<sup>34</sup> This active participation of industry stakeholders encouraged several other pharmaceutical-related companies interested in similar training supports to provide curriculum feedback.<sup>35</sup> The process culminated with



revisions to the pilot curriculum, including the addition of job search training such as resume writing and interview preparation.<sup>36</sup> Overall, integrating firms in the design process had two important outcomes. First, it ensured the course would develop the skills needed by industry. Second, it led to the relaxation of human resources standards and recognition of a new credential so that matches between local talent and employers could happen more readily.

### Target, eligibility, main beneficiaries

Interviews with stakeholders involved in the design of the BioWork course suggested that the program was designed without a specific demographic target, but rather with broad eligibility in order to satisfy wide industry demand. As such, it was intended to include people with a high school education who were interested in working in the local biomanufacturing industry.<sup>37</sup>

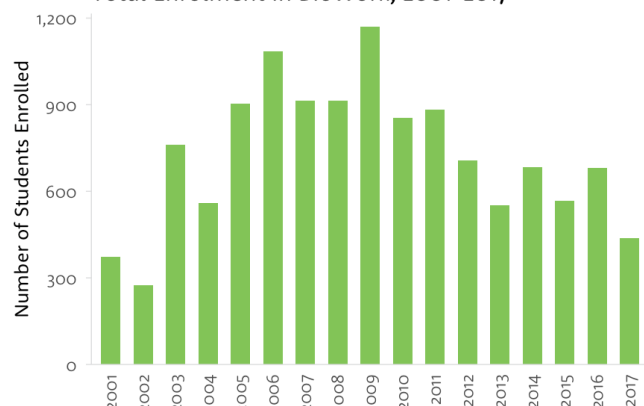
However, Biotech Centre leaders, along with government and educational actors, recognized workers displaced from traditional manufacturing industries as the main potential beneficiaries of the BioWork course, alongside industry. This potential incentivized the GoldenLeaf Foundation, a non-profit organization dedicated to supporting workers and regions affected by the decline in the tobacco industry, to collaborate with the Biotech Centre and provide financial support for an array of workforce training programs, starting with BioWork.<sup>38</sup>

## Implementation

### Rollout

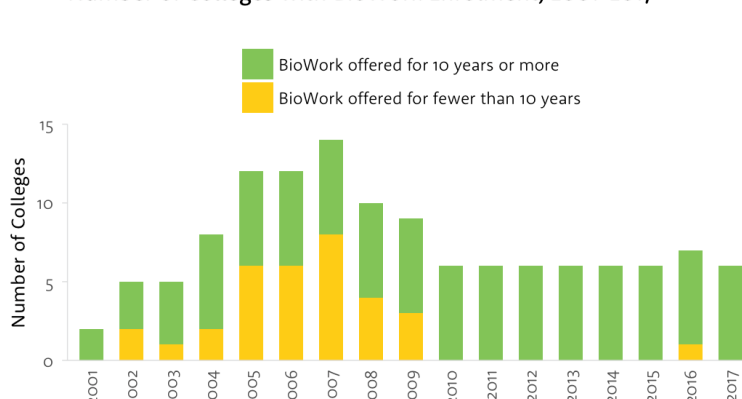
When piloted in 2001, the curriculum consisted of a 96-hour modular course, and concluded with a final exam requiring a passing grade of 80 percent in a maximum of two tries.<sup>39</sup> In 2002, after extensive collaboration, five community colleges were offering the standardized BioWork course to 274 students.<sup>40</sup> In 2003, the Biotech Centre again partnered with companies and community colleges to produce a version of the course with minor updates.<sup>41</sup> By 2008, it had evolved into a 128-hour, nine-unit course, and in 2009 enrolment grew to 1,169. In 2012, the second edition of the BioWork textbook was released. However, stakeholders indicated that these updates, while necessary, were insufficient in reflecting the variety and depth of changes in both technology and skill needs within the biomanufacturing industry. As of 2017, the course had 510 enrollees in six colleges.<sup>42</sup>

Figure 5  
Total Enrolment in BioWork, 2001-2017



Source: North Carolina Community College System  
Note: 2017-2018 data is preliminary

Figure 6  
Number of Colleges with BioWork Enrolment, 2001-2017

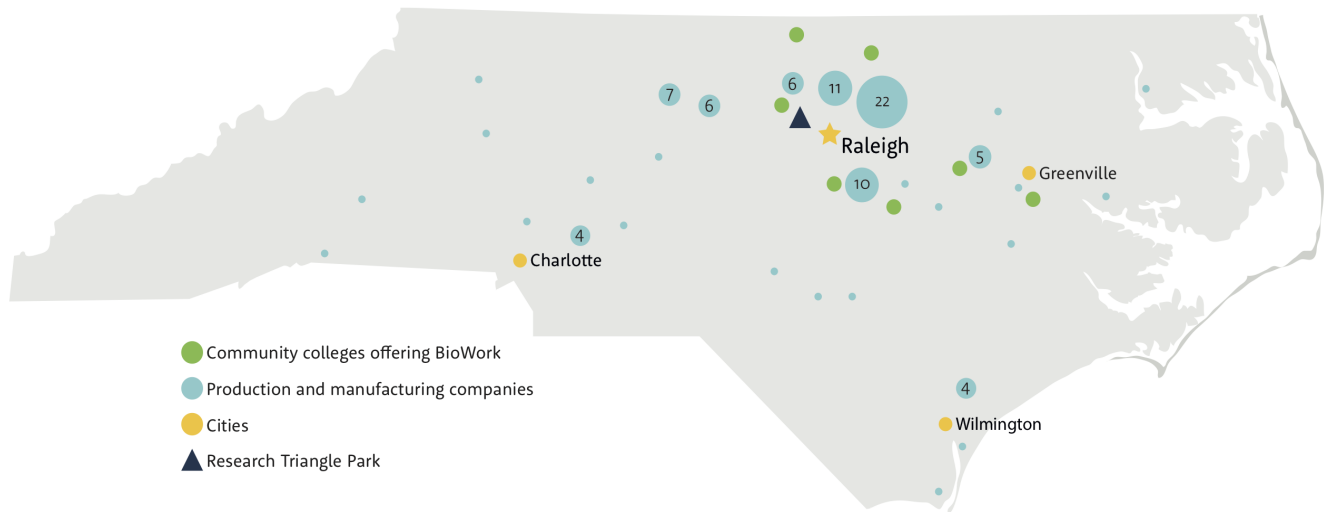


Source: North Carolina Community College System  
Note: 2017-2018 data is preliminary



Figure 7

Map of North Carolina's Biopharmaceutical Ecosystem, 2018



Source: North Carolina Bionetwork BioWork community college website, North Carolina Biotechnology Centre 2018 Company Directory, and stakeholder interviews.

Note: Pitt Community College added by advice of stakeholder interview. Not listed in main Bionetwork website, but stakeholder advised that the college continued to offer BioWork.

Through interviews with representatives from the community college system, it became clear that each community college offers a differentiated version of BioWork and has slightly different requirements for admission. In response to changing needs of local employers, instructors and program directors added and revised course content. Colleges also use different placement tests to assess math and language ability, and apply various levels of flexibility regarding eligibility requirements. In fact, interviews with stakeholders revealed that some colleges have relaxed the formal GED requirement and accepted individuals as long as they had passed the college's proficiency test or qualified for dual enrolment as a high school student. Most colleges also have remedial language and math support programs available to those unable to meet the proficiency requirements, with some providing this free of charge. Others, however, view the attainment of a high school diploma, or its equivalent, as a strict requirement in addition to passing the proficiency test.

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**WakeTech Community College Targeted Workforce: Those with at least a high school diploma or GED who are unemployed; transitioning, especially from other manufacturing sectors; or starting a new career.<sup>43</sup>**

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In 2017, the course began undergoing the most significant restructuring since its inception.<sup>44</sup> Today, the standard BioWork course remains sufficient training for traditional pharmaceutical firms, but less so for firms that have transitioned towards a more technologically-advanced workplace. Stakeholders have indicated that current restructuring efforts are focused on addressing the increase in the automation of processes, a shift towards technologically-enabled learning and working environments, a move toward more holistic learning outcomes (i.e. "teaching the *why*, and not just the *how*"), and changes in skill demand.<sup>45</sup> Inclusivity and connections to regional industry players also remain prominent features of course design and implementation.

## The role of community colleges

Within the United States, community colleges are encouraged to position themselves as regional workforce intermediaries due to their comprehensive educational offerings, access to diverse and marginalized populations, and solid reputation within the business community.<sup>46</sup> North Carolina's state-wide community college system comprises 58 institutions, which serve the state's 100 counties. Community colleges typically offer two-year associate degrees equivalent to the first two years of a university-level bachelor's degree, as well as specialized programs, often in business or technology, geared toward regional industry needs. In addition to these open enrolment streams, each community college has a customized industrial workforce training arm which provides local companies with an open channel to approach their county's college and develop internal training courses focusing on the skills and competencies they need.<sup>47</sup> It is this feature that has historically allowed colleges to cement relationships with employers, building both trust in their training capabilities and a knowledge base of local needs, as demonstrated by the partnership between Novozymes and VGCC.

Each community college has a dual mission: to serve the students and the employers in their region.<sup>48</sup> This is evidenced by the modifications made by individual community colleges to the BioWork course during its implementation. Most individual community colleges have modified the standard BioWork curriculum to take into account the needs of particular employers within the immediate county, providing them with the opportunity to secure commitments from certain employers and improve participants' employment prospects.<sup>49</sup> This fuels an interdependent relationship, as regional firms turn to their local community college as a source of graduates with in-demand skills. For example, Wilson Tech Community College added content to the BioWork course to better reflect the specific processes of local biomanufacturers, who in turn committed to interview the college's graduates for job openings.<sup>50</sup>

Interviews with stakeholders also illuminated the efforts of individual community colleges to incorporate additional content within the BioWork course to better address the concerns of employers and educators regarding technological innovations and broad industry trends. By filling these regional industry gaps, community colleges have extended the shelf-life and relevance of BioWork.

## Impact

### Effects

The BioWork course created an institutionalized path to jobs in the biotechnology sector. Previously, most bioprocessing employers required a minimum of one year of experience in the sector for an entry-level process technician role, and were struggling to fill these vacancies. Now, many employers in the sector accept and value the successful completion of the BioWork course and are using this channel to fill critical talent needs.<sup>51</sup>

### Participants

The BioWork course has provided mid-career and displaced workers from a variety of educational and skills backgrounds with an accessible pathway to retrain for a second career in the bio-pharmaceutical sector. While the participant makeup has fluctuated, and some studies indicate that workers with manufacturing backgrounds or with more formal education experienced greater employment success, the modularity and relative accessibility of the course has provided a wide range of participants with an opportunity to participate in an innovative sector of North Carolina's economy.

In particular, mid-career workers displaced from North Carolina's traditional manufacturing industries proved to be ideal candidates for BioWork, and eventual positions as process technicians, due to their familiarity with production processes and routine shift work. However, workers from more modern declining manufacturing industries, such as microelectronics, were seen as more promising candidates given their immediately transferable skills, including knowledge of clean room processes and standards.<sup>52</sup> Interviews with training experts in the bio-processing manufacturing industry revealed that while general experience is desirable, they expected graduates with previous microelectronics employment to outperform those with experience in traditional manufacturing.<sup>53</sup>

Moreover, a 2012 study focusing on the labour outcomes of BioWork participants found a strong negative correlation between having been recently laid off and receiving a job offer, when controlling for other factors.<sup>54</sup> This result suggests that displaced workers looking for second careers, a group that was a main target for the course, were on average less successful than their peers in reinclusion through BioWork.<sup>55</sup> Various factors could be responsible for this result, including negative signals to potential employers, lower levels of human capital, or higher wage expectations of participants.<sup>56</sup>

However, studies have found that North Carolina's biopharmaceutical workforce is more educationally diverse than those in other important pharma-cluster states such as California, Massachusetts, New Jersey, New York and Pennsylvania.<sup>57</sup> In 2012, 30 percent of North Carolina's biopharmaceutical workers had college or graduate degrees, 35 percent had high school equivalencies or less, and 30 percent had associates degrees or some college education. This composition has been consistent since 2000.<sup>58</sup> In comparison, Pennsylvania's workforce is comprised of 40 percent college graduates or higher, and only 25 percent workers with high-school equivalencies.

Over the last two decades BioWork has also begun to attract participants from more diverse occupational backgrounds, including accounting, teaching, healthcare, and the social sciences. According to stakeholders, while the majority of participants are still mid-career workers seeking to change occupations, there is also a significant portion of participants who go through the course post-retirement to acquire a position that would supplement their income and enable them to continue to participate in the economy. In addition, the proportion of younger participants is increasing. This trend is likely driven by coordinated efforts from the Biotech Centre and its partners to boost the presence of the industry in both primary and secondary schools, and the sustained growth and perceived resilience of the state's biotechnology sector even through the 2009 recession. Due to the diversity of participants in terms of age and experience, BioWork presents all potential workers with the expectations of biopharma production positions, including shift work, discipline, regulations, and responsibilities on the manufacturing floor.

The recession and its accompanying rise in unemployment prompted a significant increase in BioWork enrolment, particularly among students with higher formal education, from associates degrees to PhDs, despite the course's introductory level.<sup>59</sup> However, it is unclear whether, and how permanently, this will change the participant composition. While credential accumulation is common in periods of economic downturn, this trend can create participation and hiring barriers for those with lower levels of education through increased competition for both enrolment and jobs. There is no clear consensus among stakeholders regarding whether and how this shift may have altered employer expectations of educational attainment. Some believe that the higher supply of more-qualified participants allowed companies to require higher levels of education. Others, however, maintain that employers still prefer workers familiar with production roles, and hesitate to place candidates with bachelor degrees or higher in these positions due to poor retention rates.

Community college representatives indicated that although most applicants pass the proficiency test, approximately 20 to 30 percent of students drop out every session due to a lack of interest, the inability to keep up with course demands, or an alternative job offer, despite the institution's efforts to forewarn them about the demanding course requirements. Most colleges offer a comprehensive session about the BioWork course, open to prospective students, detailing application requirements, course structure, expectations, and job pathways. Commenting on this dropout rate, however, an interviewed instructor noted that, for some participants, success may not mean completion but rather getting a job they want with the skills they have.

It is important to note that different regions in the state experience contrasting rates of program uptake and success. Regional studies reveal that a majority of manufacturers within the Triangle Park and Eastern North Carolina areas require BioWork even when individuals possess higher qualifications, but it is rarely asked for in the Charlotte and Triad areas where hiring standards appear to be less rigorous.<sup>60</sup> This disparity may be a factor of both the supply of labour and the type of industry present in each region. Triangle Park is an important urban biomanufacturing hub, while the Eastern area is a centre for traditional pharmaceutical production, and in the Charlotte area medical device manufacturing is more prominent.<sup>61</sup>

In general, stakeholders agree that BioWork has helped to “pull down the bioscience career ladder so that it now includes rungs for those with fewer educational credentials, and provides viable pathways to inclusion.<sup>62</sup> Notably, companies view participation as a sign of willingness to complete additional rounds of firm or topic-specific training.<sup>63</sup> Interviewed stakeholders also reported that BioWork can provide a foundation for university-level education.

#### *Economic impact: workers, communities, and firms*

The BioWork course established a healthy regional talent pipeline tailored to local industry labour needs, which further attracted firms to set up business in North Carolina. Previous to BioWork, poaching employees from other companies was a frequent practice, creating a need to continuously fill entry-level production jobs. This was primarily driven by the lack of trained process technicians. In the years since 2003, BioWork, along with additional biotechnology courses delivered through community colleges and industry-targeted university programs, has improved the general job candidate pool.<sup>64</sup>

There is little question that pharmaceutical manufacturers were initially attracted to the state by affordable property, low-cost labour, and low taxes, but quality labor, strong research supports, and established industry networks have become important draws.<sup>65</sup> These same factors also aid in anchoring existing firms to the region.<sup>66</sup> By externalizing training on basic protocol and processes, BioWork allowed industry to develop better internal training programs that focus more on firm-specific knowledge.<sup>67</sup> The current situation in North Carolina's biomanufacturing industry presents a stark contrast to the situation for other manufacturing industries in the state.<sup>68</sup>

## BIOWORK'S RIPPLE EFFECTS

The extent of collaboration involved in BioWork helped to deepen the public-private exchange and opened channels for the expansion of training initiatives. The Biotech Centre, the state's educational system and legislature, and Golden LEAF funding enabled the creation of several other sector partnerships and programs, including:

- + The Biotechnology Manufacturers Forum, which provides a space for industry to share best practices, provide updates on expansions, showcase changing products, compare skill demand, and pool resources for training and recruitment.
- + NCBioImpact, an industry-academic partnership funded by Golden LEAF and the state's General Assembly to proactively respond to biomanufacturing workforce needs. NCBioImpact's assets include:
  - BioNetwork, an expansion of educational offerings in biotechnology led by the community college system, informed by industry, government, and Biotech Centre representatives.
  - The Biotechnology Research Institute and Technology Enterprise (BRITE) and the Golden LEAF Biomanufacturing Training and Education Center (BTEC), state of the art training facilities offering associate's degree programs, semester-long continuing education courses, and day and week-long specialty training sessions.

*Sources: Lowe, 2007; NCBioImpact, 2018; Stakeholder interviews.*

### *Social impact: regional imbalances*

Efforts have disproportionately benefited urban residents within the state due to the spatial clustering of the BioWork courses and the bulk of the employers.<sup>69</sup> Geographical divides between higher tech biopharma and traditional pharmaceutical firms have also driven spatial clustering in labour demand, generating a concentration of colleges offering BioWork. Higher-tech biopharma firms coalesced around the Research Triangle region, Greensboro, and Charlotte, while traditional pharmaceutical firms are situated in smaller towns and rural areas. In general, labour market conditions in these clusters present less demographic and economic heterogeneity than North Carolina as a whole.<sup>70</sup> Some studies highlight that this concentration may give rise to a spatial mismatch that disadvantages job-seekers who identify as visible minorities, as areas of employment growth may not correspond to where these individuals live.<sup>71</sup>

### Success factors

**Knowledge of industry demand** was key in developing a curriculum that would encourage employers to relax hiring requirements. It was vital to the early success and adoption of the program, and will remain so. In an industry where it can take 10-15 years to move biological or chemical breakthroughs to production, it is both possible and important to be accurately informed of the labour needs of projects in the pipeline and to design training programs to match these needs. Detailed knowledge of demand at various time horizons can only be achieved through continuous communication and trust-building with industry.

**The Biotechnology Centre's role as a convener** of key actors was crucial in opening communication channels and fora that enabled cooperation between entities that may otherwise have been reticent or in conflict. This included competing firms, state officials, community college and university representatives, regional economic development organizations, and subject matter experts. Alongside establishing an understanding of in-demand skills, this network was valuable in minimizing the duplication of roles and

establishing a shared purpose. These factors contributed to an increase in political capital, which has helped to sustain the longevity of the BioWork course.

**Community colleges were essential in filling workforce intermediation roles** that served both their community's workforce and local industry needs. This position allows them to demonstrate the value of nontraditional credentials and transferable qualifications, as they did with BioWork.<sup>72</sup> Stakeholders stressed that the early participation of both individual colleges and the North Carolina Community College System in the design of the course was necessary for success. As the main providers of the course, their early involvement in curriculum design was crucial in helping partners understand implementation options and potential participants.

**The significant and growing presence of biopharma manufacturing and its above average wage levels** provided an opportunity to focus on this sector for transitioning less educated workers from declining manufacturing industries to relatively high-paying jobs in the 'new economy'.<sup>73</sup> BioWork has been successful in tailoring training to the biopharma manufacturing industry, which in turn has contributed to the industry's continuous growth within North Carolina.

## Barriers

### *Participants*

**Participants incur a cost yet have limited financial support.** While the cost of the program relative to other educational options is rather low, community college stakeholders often cite financial access as a barrier for some students, particularly first-generation students, who are often people of colour. This is exacerbated by BioWork's ineligibility for certain government subsidies.<sup>74</sup> Community colleges often receive less funding for non-degree continuing education courses, and cannot run a course at a loss. These two factors sometimes result in the cancellation of BioWork sessions.

**Completion requirements are fairly rigorous and demanding for those with a lower level of formal education and external responsibilities.** A common evaluation framework consists of eight unit tests, each of which a student must pass with a grade over 80 percent, with only one re-take opportunity. In addition, some colleges require a 90 percent attendance rate, which is difficult for some participants due to differing learning styles, inflexible occupational work hours, or family obligations.<sup>75</sup> However, flexibility is increasing in the form of hybrid distance classes, evening classes, and single-module classes.<sup>76</sup>

Surveys of human resource managers indicate a **growing preference for two-year associate degrees across all levels of manufacturing.** According to industry experts, workers with an associate degree are more easily moved from one job category to another, enabling firms to respond quickly to unanticipated shifts in demand or production-related regulatory decisions.<sup>77</sup> Process technicians with associate degrees have additional education, which sometimes includes a BioWork certification, without displaying the relatively poor retention rates seen in employees with bachelor degrees. One college stakeholder reported that 30 percent of BioWork graduates who did not hold higher degrees found jobs within a year, 60 percent if they had some complementary specific-topic courses, and 90-95 percent if they had an associates degree.<sup>78</sup>

**Participants face the challenge of obtaining a position in a competitive industry with low labour intensity.** Although it employs a significant number of people in the state, the biomanufacturing industry is not always easy to navigate. All stakeholders maintained that BioWork graduates need to know how to market themselves effectively in order to increase their chances of employment. However, many



stakeholders also indicated that while graduates may outnumber the process technician vacancies and may not get jobs in production (or the area of their choice), the training they receive through the BioWork course is widely applicable to important auxiliary roles, such as shipping, administration, and support positions which can comprise up to two-thirds of a plant's staff.

### *Program*

**Public funding is insufficient to effectively support the basic hands-on science courses needed** to respond to the talent needs of life science industries due to the cost of lab and technical equipment, software, and other material needs. As a result, BioWork courses have sometimes run at a loss, but according to representatives from one community college, this is no longer possible.<sup>79</sup> It has also become increasingly difficult to find instructors with industry experience, as most remain in industry, where compensation is higher.

Within its first few years, BioWork was offered at 30 of the state's 58 community colleges. However, the course was short-lived at most community colleges outside of the Research Triangle Park regions due to a misperception that the program would entice biomanufacturing companies to relocate. **Certain communities and colleges offered the course without the appropriate local biotechnology base** to absorb BioWork graduates, with the goal of attracting industry, but this hope proved unrealistic. A plant needs more than process technicians to operate, and a company's location decisions depend on important factors in addition to talent supply. BioWork is now offered at seven institutions.<sup>80</sup>

**Wavering political support, leadership and ideological changes in the state legislature, and resulting budget cuts** have significantly affected the administration, dissemination, and delivery of BioWork. Responsibility for course design and curriculum administration were transferred from the Biotech Centre to the BioNetwork arm of the community college system due to lack of sufficient funding. While this allowed for the survival of BioWork, it created some additional challenges in continuity of vision and strategic planning. The lost financial support has not been re-established.

While BioWork is widely cited as a success, **limited monitoring of participant results, industry satisfaction, and wider social and economic effects** pose a challenge in definitively reaching this conclusion. There was uncertainty among interviewed stakeholders regarding who held comprehensive data. Alongside the current revamp of the BioWork course, stakeholders indicated a desire to institute a monitoring process to better track its effects.

## Lessons

The development and implementation process of BioWork illustrated the importance of strong relationships, timely knowledge of regional skill demand, and flexibility in providing an accessible workforce training program that prepares individuals for work in a fast-evolving innovation economy. The North Carolina experience offers the following lessons for policy-makers and other key actors in Ontario:

### 1. Importance of a network

An effective network with diverse actors and efficient and continuous information flows was vital in the design and effective implementation of BioWork. If the Biotech Centre and its partners had not worked to maintain consultation channels, the initial industry acceptance of the certificate and subsequent training schemes may have failed. These resilient relationships had important effects beyond the implementation of BioWork. North Carolina's biotechnology network allowed sector actors to align their objectives in terms of workforce training, industrial recruitment and retention, and sector development priorities. In addition, it helped the Biotech Centre, its partners, and its workforce training programs weather drastic changes in the economic and political landscape, including funding challenges. This network has proved vital in contributing to the growth of the biotech workforce, encouraging firm attraction and expansion, and worker retention.

### 2. Importance of demand

All stakeholders cite the Biotech Centre's accurate, and current knowledge of the skills demanded by firms for existing unfilled positions, as well as potential future ones, as the main factor responsible for the early impact of the program. Stakeholders from different organizations recognize that skill and job demand forecasts are often based on assumptions, or informed by too few industry representatives, making labour market information incomplete. This was not the case with the Biotech Centre's various *Window on the Workplace* studies, which relied on extensive and direct industry engagement. The lack of success of the BioWork course in regions without a biotechnology industry base supports this lesson.

### 3. Importance of allowing for change

Despite initial industry engagement and a strong network, the BioWork course lost some of its momentum and relevance since its inception in 2001. This is partly due to the lack of regular curriculum updates informed by industry needs and trends. Only now, almost two decades after its inauguration and after significant stakeholder pressure, is it undergoing a substantial rewrite. As many stakeholders indicated, this will involve consultations with industry to ensure relevance in an automation-ready innovation environment. Some stakeholders also pointed to a need for greater emphasis on transferable skills. To date, programs have been largely locally-focused, tailored to regional firms. While this continues to be important, there is a growing recognition that the skills obtained by participants should be more transferable across firms and geographic bounds to increase worker resilience.

### 4. Everyone can play a part in innovation

The firm and industry-level benefits of workforce training schemes that prepare workers for entry-level roles in the biotechnology sector are two-fold. Firms need skilled people in process technician and other roles in order to bring new products to market and remain competitive in an innovation economy. In addition, production jobs are increasingly touted as drivers of innovation in their own right, and production workers are increasingly portrayed as 'knowledge workers'.<sup>81</sup> Highly trained production workers contribute



to process innovations from the manufacturing floor, enabling firms to “upgrade their production processes and keep their production workforce in step”.<sup>82</sup> BioWork’s inclusion of underlying scientific knowledge in the curriculum alongside process manufacturing practices helped prepare workers for these more active innovation roles.

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It is necessary that actors outside of workforce training also recognize the potential role of workers with varying skill and educational backgrounds in innovation-driven industries. North Carolina state government policymakers, alongside the Biotech Centre, formulated an industrial recruitment strategy for biopharmaceuticals that prioritized both manufacturing and R&D. This intentional co-location of production and research activities helped to improve the workforce outcomes of previously at-risk workers.<sup>83</sup> Accessible workforce training that focuses on advanced manufacturing practices and prepares participants for continuous innovation, such as BioWork, can expand access to jobs in an innovation economy to at-risk and displaced workers with lower levels of education.

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## FINLAND: ALL ABOUT NETWORKS

### Relevance to Ontario

Ontario's tech sector has grown into a major engine of economic growth, employing 6.2 percent of Ontario's labour force in 2015.<sup>84</sup> However, Ontario's tech firms also face fierce global competition in a sector that is characterized by increasing product market consolidation and growing superstar firms.<sup>85</sup> Ontario has already witnessed the ramifications of these trends. In the mid-2000's the Waterloo-based tech giant Blackberry was a major player in the global smartphone market. However, its failure to compete with major emerging players, such as Samsung and Apple, resulted in a rapid loss of market share and significant layoffs.<sup>86</sup> While this event helped to spark a new generation of tech firms across the province, it was a blow to the local economy.

Similar to Blackberry, Nokia, headquartered in Finland, was also hit hard in the global race for smartphone supremacy. However, despite its decline, Nokia offers a compelling case for how a private sector firm can support vulnerable workers in the transition period, while also promoting regional economic development and innovation.

This is not to say that action was not taken to reintegrate employees following Blackberry's decline. For example, in 2012 the Ontario government partnered with Waterloo-based incubator Communitech, which worked closely with Blackberry to deliver a \$1.2 million-dollar program to help former Blackberry employees adjust.<sup>87</sup> However, the Nokia Bridge program offers a number of lessons that could be valuable for Ontario in future.

## CASE SUMMARY

Global competition and technological advancements in the mobile phone industry, including Apple's launch of the iPhone, forced Nokia to reevaluate its strategy and restructure its operations in 2011. This decision had a particularly large impact in Finland, where the company is headquartered, resulting in approximately 5,900 layoffs of workers with varying skill and education profiles. In order to support the communities where Nokia had a presence, and most importantly its workers, the company created the Bridge Program. The Bridge Program offered workers funding, training, advice, and other resources to help them find another job, retrain, or start their own company. This initiative was unprecedented in both scale and design, and provided its soon-to-be-displaced workers with different paths to reinclusion in their local economies.

In addition to supporting workers, the Bridge program encouraged innovation. Nokia enabled its entrepreneurial employees to establish startups that harnessed technological innovations developed at the firm, or of their own invention, and to take them to market through expedited channels, providing them with financial support. Additionally, the program allowed the company to make strategic business decisions to keep up with a highly innovative sector while mitigating reputational consequences. The Bridge program supported the majority of newly-displaced workers (most of whom were mid-to-late-career) and their communities, while also promoting innovation and economic diversification, making it an exemplary DSIP.

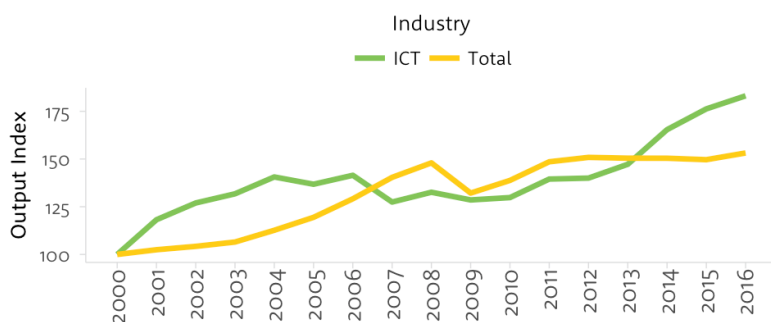
The program and its participants encountered various obstacles including employee and community skepticism, regulatory challenges, and worker inexperience outside of Nokia. However, company commitment and robust collaboration networks, among other factors, helped the initiative succeed. In particular, this case study highlights the importance of the following:

- + A multi-sector network of partners
- + Information sharing and gathering
- + Flexibility in design and implementation
- + Fostering entrepreneurship

## Context

Figure 8

Index of Output, Finland, 2000-2016



Source: Statistics Finland, BII+E Analysis

Note 1: Index Base Year = 2000

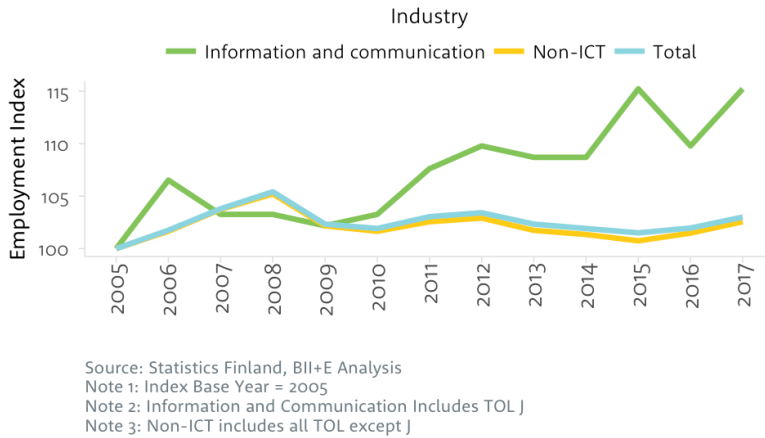
Note 2: ICT includes TOL 61,62, and 63

Note 3: Non-ICT includes all TOL except 61,62, and 63

## Economic profile

The decline of the Union of Soviet Socialist Republics (USSR), once a major trading partner, in the late 1980s and early 1990s, forced Finland to undertake significant economic restructuring, shifting away from the production of capital, energy, and raw materials towards a knowledge-based economy.<sup>88</sup> This shift facilitated the rise of a thriving Information and Communications Technology (ICT) sector which, by the late

Figure 9  
Index of Employment, Finland, 2005-2017



1990s, became undeniably important for Finland’s overall economic growth and stability.

In this context, Nokia emerged as a preeminent actor and employer. During the company’s prime, from 1998 to 2007, Nokia contributed to nearly 25 percent of Finnish economic growth, and employed a significant portion of Finland’s national and regional workforces through their mobile phone R&D and manufacturing sites.<sup>89</sup> However, the global recession following the 2009 financial crisis caused many sectors in Finland to face employment and profitability challenges, and Nokia and the ICT sector

were not exempt.

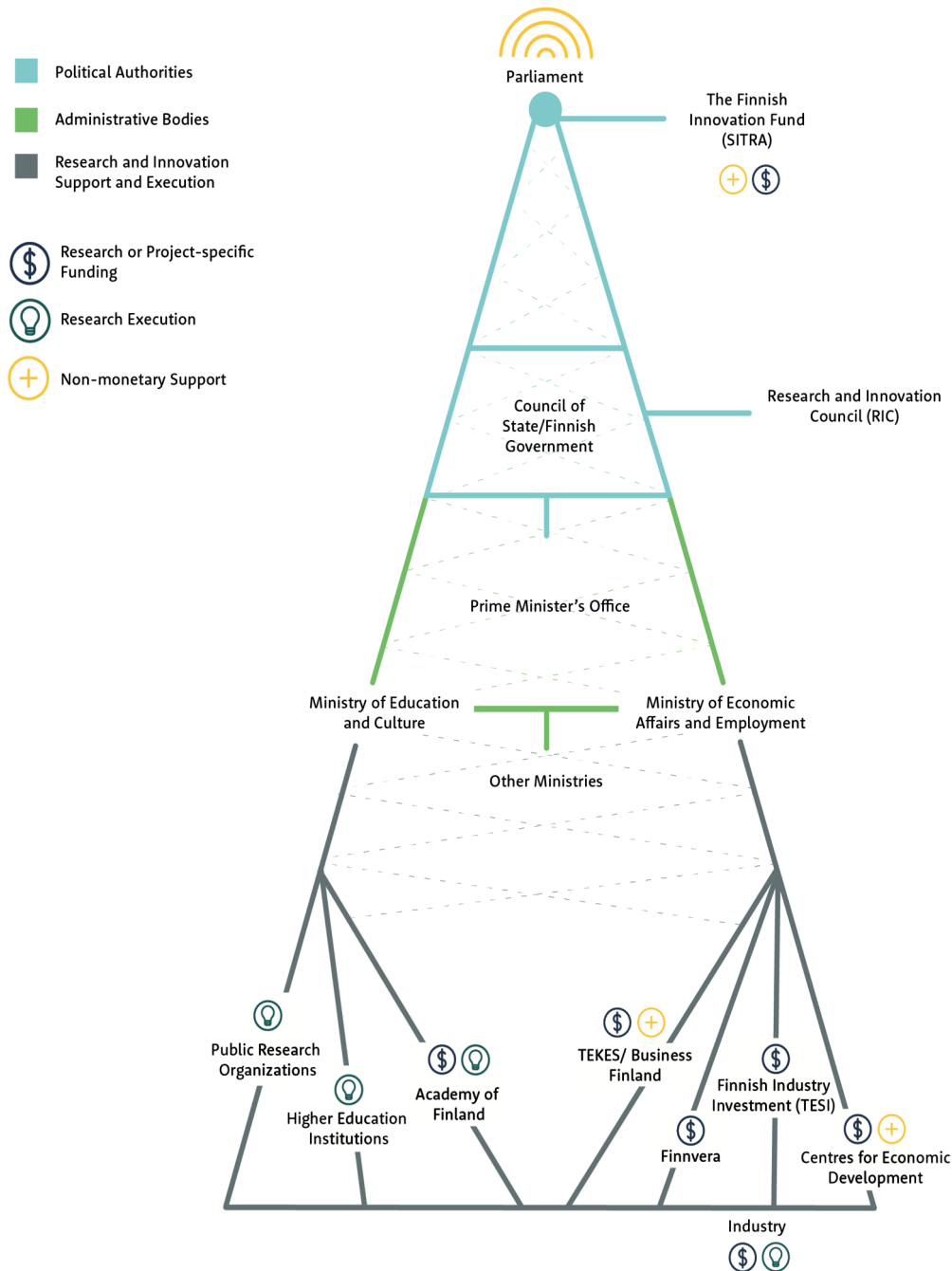
### Finland and innovation: the national innovation environment

Since the early 1960s, Finland engaged in the intentional development of science and technology capacity and governance. In 1961, the Finnish government established the Academy of Finland, an organisation focused on funding scientific research, providing science policy expertise, and strengthening “the position of science and research.”<sup>90</sup> In 1963, it instituted the Science Policy Council of Finland, a ministerial committee meant to serve as a coordination body for national R&D.<sup>91</sup> Both organizations gradually increased the nation’s focus on and involvement in science and technology-focused higher education and R&D, by coordinating projects and distributing funding across traditional administrative bounds.<sup>92</sup> In 1967, the Finnish Parliament also created SITRA, the Finnish Innovation Fund, which operates both as a policy research agency and an investment institution.<sup>93</sup>

Government efforts to encourage and strengthen scientific R&D became particularly important in response to the decline of the USSR and economic restructuring beginning in the 1980s. In 1983, the government established the Finnish Funding Agency for Technology and Innovation (TEKES), an organisation that aimed to boost “the development of Finnish industry and the service sector” through technology and innovation.<sup>94</sup> Four years later, the Science and Technology Policy Council (STPC) was established to convene political, economic, educational, scientific, and industry actors to discuss the state of Finland’s science, technology and innovation policy as well as inform and propose future direction. In 2009, the Research and Innovation Council (RIC) replaced the STPC. The RIC, chaired by the Prime Minister, is also legally mandated to have a membership that is representative of these stakeholder group. The council informs innovation policy, though has lacked decision-making power since its inception.<sup>95</sup> By the 2000s, the country’s innovation system had developed into a complex network connecting policy makers, public and private actors and funders, as well as researchers and higher-education institutions.

This interconnectedness of the Finnish innovation system has enabled individuals from various sector to move between public and private institutions, creating trust and personal connections that strengthen the system as a whole. Many of the regional development workers interviewed were previously employed in the private sector, including Nokia, and some industry representatives also had experience in the public sector. These exchanges deepen formal and informal relationships between actors.

Figure 10  
**Finland's Innovation System**



Sources: Institutional Mapping of Finland's National System of Innovation, OECD, n.d., and Private Sector Interaction in the Decision Making Processes of Public Research Policies, Meissner, n.d.; RIO Country Report 2015, Halme, Saarnivaara and Mitchell, 2016.

## The origins of the Bridge Program

In 2011, Nokia faced lower growth and fiercer competition from global smartphone developers. In response, it redirected its corporate strategy away from the development and manufacturing of its own mobile phones, and partnered with Microsoft to provide devices that would operate as Windows phones. This shift involved consolidating research centres, winding down operating systems development, and restructuring manufacturing processes and locations. In 2013, Nokia announced that it would sell its remaining mobile phone division to Microsoft. Over the next four years, Microsoft closed the sites where this division had operated. While this decision impacted Nokia's operations in 13 countries, this report focuses on the effects felt within Finland.

In 2000, at its peak, Nokia accounted for four percent of Finland's GDP, one percent of national employment, and 40 percent of corporate R&D investment.<sup>96</sup> While this influence had significantly diminished following the 2008-2009 recession, the announced reductions in 2013 were expected to have a substantial effect on both the local and national economies.<sup>97</sup> Nokia's decision to scale back operations impacted approximately 5,900 Finnish workers, of varying skill and education profiles, including people in the company's headquarters in Espoo and its three other major research and manufacturing sites throughout Finland: Oulu, Salo, and Tampere.<sup>98</sup>

## Intent

### Motivations and goals

Recognizing the impact that its reductions would have on its employees and on the Finnish economy, Nokia developed the Nokia Bridge program. The program's main goal was to place the company's affected employees in a career-development path, ensuring their inclusion in the economy through further education, finding a new position, or creating a new company. They aimed for full reemployment.<sup>99</sup> Early in the design process, Nokia leaders identified three priorities of the Bridge program that would guide both content and implementation decisions, listed in order of importance:

1. Assist individuals and teams to utilize their capabilities to the fullest;
2. Continue to build the local economies where Nokia plays a driver role; and
3. Support Nokia's renewed strategy and ecosystem.<sup>100</sup>

According to stakeholders, corporate social responsibility and - to a lesser extent - legal obligations under Finnish labour law, featured in the discussions surrounding the decision to develop the Finnish version of the Bridge program. Corporate reputation considerations also heavily influenced the company's executive decision to provide support to affected workers. Nokia wanted to avoid the repercussions it had faced after closing its plant in Bochum, Germany in 2008, which tarnished its brand and negatively impacted its country-wide sales.<sup>101</sup> Additionally, Nokia faced the prospect of employees leaving the company before site closures, jeopardizing its ability to deliver products, a situation that could have cost Nokia up to 40 percent of its annual revenue. The confluence of these factors ensured strong initial backing for a more inclusive and comprehensive support package for laid-off workers than what was mandated by legislation.

Government support for the program was motivated by concern about the potential impacts of layoffs on workers and local economies. It centered around reskilling and reemployment, and aimed to help all affected employees. Some stakeholders suggest that there was particular political focus on supporting those with relatively low levels of education who were more likely to face prolonged periods of

unemployment, yet the funding was granted to the Bridge program to subsidize the reinclusion of participants from all skill profiles.

### Design process

In the early stages of the design phase, a small team of Nokia executives commissioned a review of the best practices of companies facing structural change and widespread layoffs. According to stakeholders, this inquiry did not uncover a model that was suited to Nokia's situation or goals, but did highlight gaps or shortcomings that Nokia could avoid. Informed by this analysis, company leaders drafted the Bridge program, which was quickly approved by the Board of Directors for global implementation.

Both internationally and within Finland, the skill profiles and needs of employees differed at each site. Aware of these regional variations, Nokia executives designed the Bridge program with sufficient flexibility in implementation to meet the needs of all types of employees at each site, and to adapt to varying regulations and economic circumstances.

### Target, eligibility, main beneficiaries

The Bridge program was intended to serve all impacted employees, accommodating differences in careers and skill levels. As a result, eligibility was automatic for workers that would be laid-off due to the restructuring. Most eligible employees took part and stakeholders interviewed for this case study noted that non-participation was usually due to retirement or prompt reemployment. Eligibility for the funding portion of the entrepreneurship path, however, was more restrictive. Interviewed stakeholders indicated that the process of grant distribution was more rigorous and discriminating than the other routes.

Supporting communities that were highly dependent on Nokia sites was a key priority for the firm. Nokia's awareness of its systemic importance in Finland meant that it devoted substantial resources to the Finnish version of the program.

## Implementation

### The Finnish experience

Following the initial workforce reduction announcement, Nokia engaged in an extensive effort to educate its employees on the Bridge program, its features, and the benefits for which they were eligible. Internal communications, information sessions, and widely-publicized commitments were key to involving those affected.

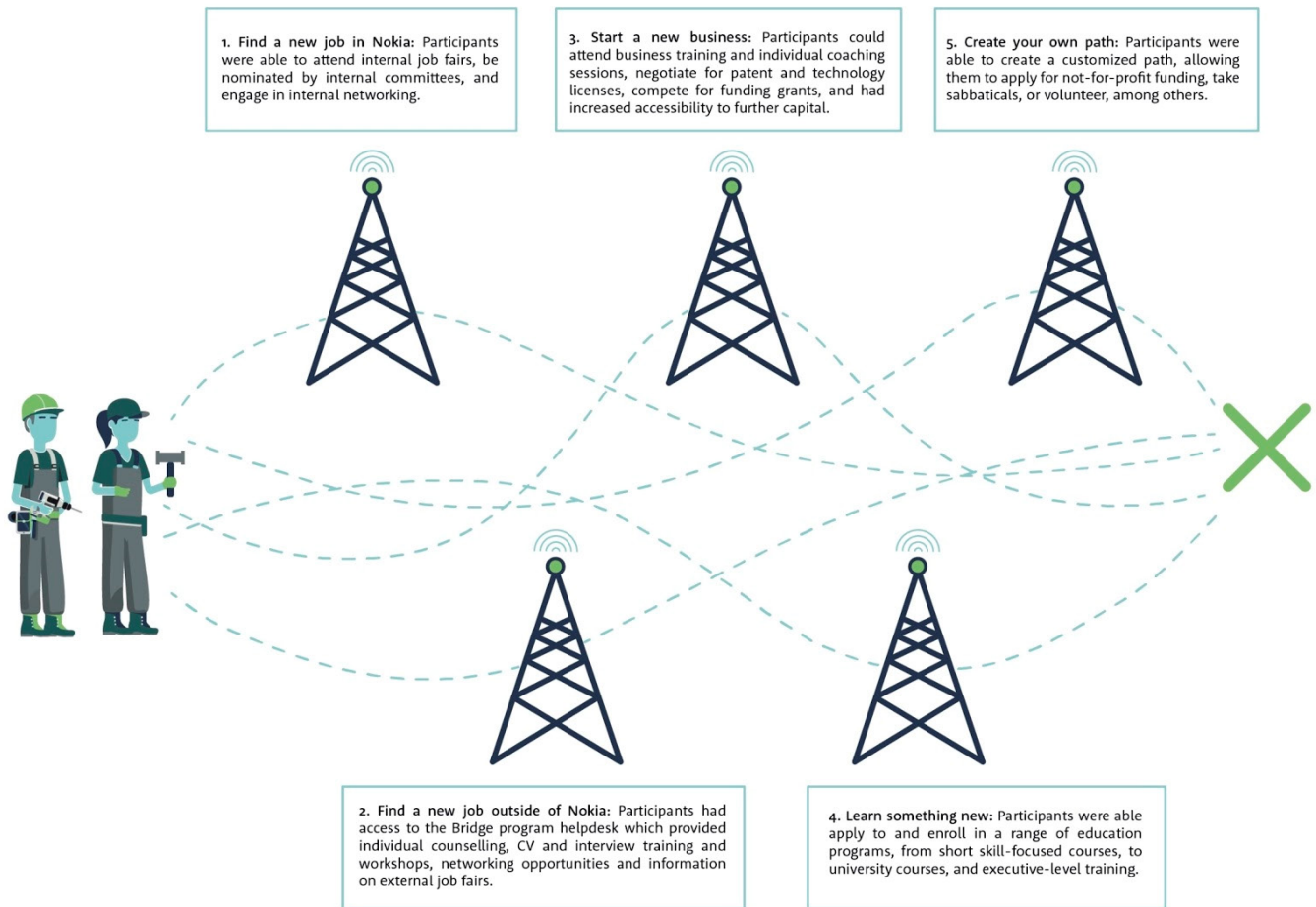
To support a smoother transition for workers, the national government allocated funding to some aspects of the Bridge program through various channels, including its "Sudden Structural Change" initiative.<sup>102</sup> Since some paths received government funding, a public procurement process took place, and resulted in the involvement of various external training partners. One stakeholder involved in Finland's Bridge program estimated that the average cost of the supports offered to each employee was €6000. Most of this amount was financed through funds from the European Union and the Finnish government, with Nokia responsible for 20 percent.



## THE BRIDGE PROGRAM IN FINLAND

Figure 11

### The Bridge Program's Five Paths



Sources: The Bridge Program - Participant Perspectives, Aalto University, 2015

Bridge Program Values	Bridge Program Priorities
<ul style="list-style-type: none"> <li>+ Accept responsibility as the driver of local economies.</li> <li>+ Take an activist role and lead the program with brand, expertise, and resources in the key areas affected.</li> <li>+ Involve relevant parties in program design and operations.</li> <li>+ Communicate openly with all stakeholders including employees, unions, government, and local actors.</li> </ul>	<ol style="list-style-type: none"> <li>1. Assist individuals and teams to use their capabilities to the fullest.</li> <li>2. Continue to build the local economies where Nokia plays a driving role.</li> <li>3. Support Nokia's renewed strategy and ecosystem</li> </ol> <p style="text-align: right; font-size: small;"><i>Source: Sucher and Winterberg, 2015a, p.8</i></p>

### Main implementation sites

1. Salo: The centre of Nokia's mobile phone manufacturing in Finland, also host to R&D.
2. Oulu: Site focused on R&D.
3. Tampere: Site fully focused on R&D.
4. Espoo: Headquarters, focused on business administration and management operations, with some R&D presence.

**Duration:** 2011-2014



External partners were involved in the external job placement, education, and entrepreneurship paths. HRM Partners, a company specializing in career training and coaching, was in charge of supporting employees in finding a new job, as well as for the provision of some entrepreneurship training.<sup>103</sup> Job placement offerings included a dedicated Bridge Program Career Help Desk, networking support, CV writing sessions, and interview training. Universities and local educational entities were the main partners in reeducation and made courses available for workers at different skill levels - from technical courses to executive training. Participants could use the resources offered under various paths at the same time, and could access options at other sites, so that, for example, a participant from the Oulu site had the opportunity to enrol in training at Aalto University in the capital region.

Employees who opted for the entrepreneurship track could participate in additional individual coaching and apply for Nokia's startup funding. A grant committee awarded up to a maximum personal amount of €25,000 and a team maximum amount of €100,000 to startups based on the merit of their concept and business plan. Some stakeholders maintain that Nokia offered the grants quite liberally to people with a reasonable proposal and did not restrict new companies to ICT products and services. According to other stakeholders, including participants, acquiring funding through this pathway was at times difficult given employees' lack of business experience and the competitive process. Grant decisions were managed by a central committee at Nokia's headquarters. With the help of Bridge mentors, contacts, and networking resources, a significant number of new companies also sought and received funding from other actors in the innovation system, such as TEKES's Innovation Mill, private venture firms, and regional incubators.

### Site implementation

It was important to Nokia executives that impacted employees were in charge of program administration, site leadership, coaching, relationship-building, and implementation. They designed a 'Bridge leader' selection process that required applicants to be employees affected by the layoffs, senior enough to represent their colleagues and carry authority, and have meaningful connections with relevant actors in their wider community.

In order to provide Bridge site teams with the resources appropriate to carry out their role, Nokia's human resources department conducted and shared site-specific research on the needs and demands of employees. These needs informed the training and relationship-building activities of site leaders, and were often communicated to external partners. Since each site had a different skill profile, and a differing level of dependence on Nokia as a local employer, the implementation plan and recovery path varied for each municipality.

Site teams received significant support from their respective municipalities. In anticipation of the closures, the communities of Tampere, Salo, and Oulu convened local industry, public sector, and university representatives in order to coordinate efforts. Additionally, the national government partnered with Nokia to coordinate and help fund regional strategies for the four sites. This support included the provision of additional resources exclusive to Bridge participants.

## Impact

### Effects

#### *Participants*

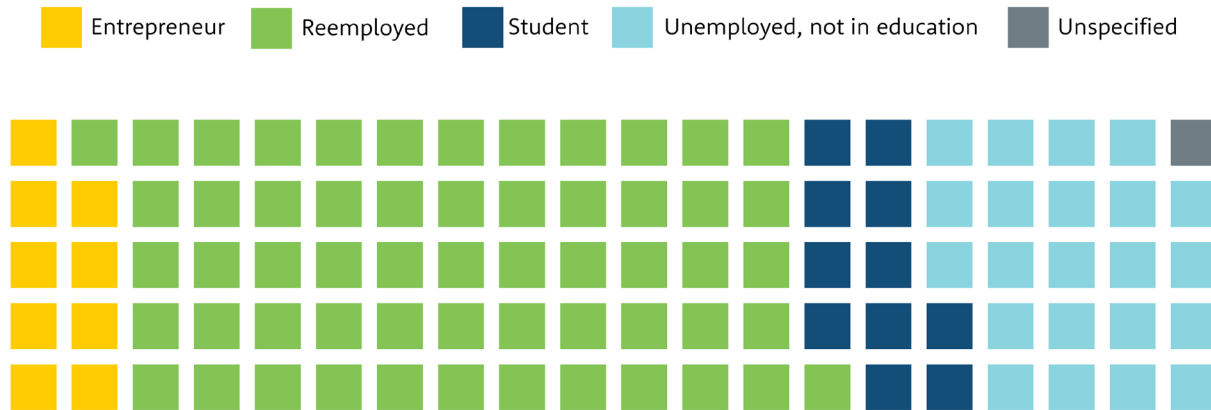
The Nokia Bridge program proved to be relatively successful for Nokia's employees, with roughly 85 percent of those affected participating. By 2014, three years after the program was first implemented and a year and a half after the last layoffs were announced, most participants were in employment or pursuing education in a variety of sectors, with about half remaining in ICT.<sup>104</sup>

In general, employees were highly incentivized to join the program. Out of 5,900 impacted Nokia employees in Finland, close to 5,000 participated.<sup>105</sup> A survey conducted by the primary outplacement training provider found that by February of 2014, 57 percent of respondents were reemployed, 11 percent were studying, and nine percent were working as entrepreneurs.<sup>106</sup> The remaining 22 percent had not yet found a promising path to employment.<sup>107</sup> By the end of the program, one third of survey respondents were at least somewhat unsatisfied by their current situation, yet 90 percent rated the Bridge program as rather or highly valuable.<sup>108</sup>

According to the same survey, 52 percent of respondents who identified as being re-employed indicated that ICT was their current employment field, while 48 percent selected other sectors.<sup>109</sup> A number of interviewees mentioned that many sectors, such as manufacturing, were expanding their digital and ICT capabilities at the time of Nokia's layoffs, and therefore took advantage of the spike in available talent exiting Nokia. Strikingly however, 57 percent of those who found a position after leaving Nokia earned less at their new position. Stakeholder interviews indicated that highly educated employees who specialized in software technologies transitioned more easily to both employment and entrepreneurship than those whose main expertise was in hardware. The former were considered to have more transferable knowledge for other companies and for other industries.

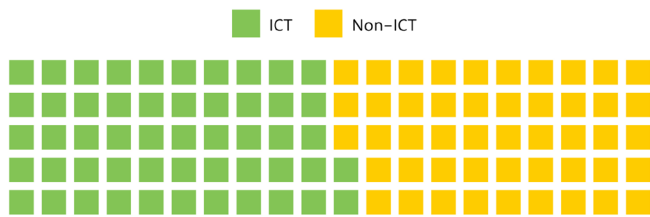
Of the survey respondents who identified as re-employed, 74 percent were working with established enterprises, eight percent were employed by the public sector, nine percent by a start-up, six percent by a university, and the remaining three percent had other employers.<sup>110</sup> While 69 percent of respondents under 40 years of age re-entered employment, this proportion dropped to 58 percent for those aged 40 to 49, and to 37 percent for those over 50.<sup>111</sup>

**Figure 12**  
**Status of Laid off Nokia Employees in 2014**



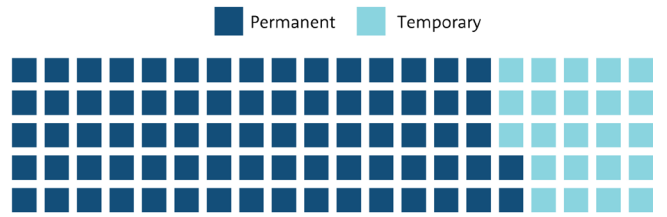
Source: HRM Partners Survey

**Figure 13**  
**Sector of Reemployment in 2014**



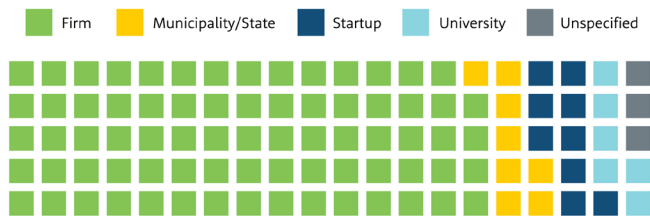
Source: HRM Partners Survey

**Figure 14**  
**Type of Reemployment Contract in 2014**



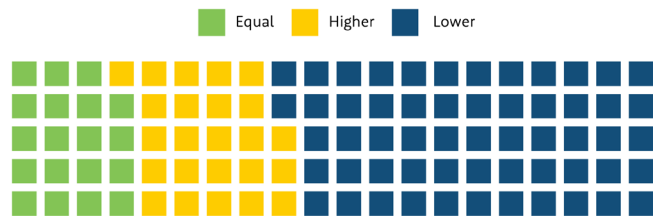
Source: HRM Partners Survey

**Figure 15**  
**Institution of Reemployment in 2014**



Source: HRM Partners Survey

**Figure 16**  
**Earnings Compared to Earnings at Nokia**

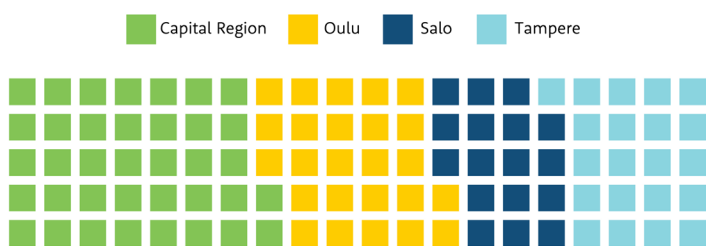


Source: HRM Partners Survey

Approximately 3,000 Bridge participants were ‘white-collar’ workers, distributed between the four Finnish sites. The other 2,000 workers had ‘blue-collar’ roles, and were mostly affected by the factory closure in Salo.<sup>112</sup> Some stakeholders consider the program to have been less beneficial for blue-collar workers, compared to some of the advantages it afforded employees with higher educational credentials. One regional representative remarked that the different levels of government had “taken unprecedented steps in trying to ensure the employment of experts that were going to find a job anyway”. The counterfactual is not clear, however, particularly given Finland’s economic situation, and the realities of the communities affected. All stakeholders interviewed said the Bridge program played an important role in maximizing the reintegration of participants into the local economy. Interviewees also stated that despite uneven outcomes, the Bridge Program provided all workers with substantial benefits. They were unaware of alternatives that would have better served production workers with lower levels of education, other than keeping the original positions intact.<sup>113</sup>

In the entrepreneurship stream, approximately 500 Bridge participants founded over 400 startups in Finland from 2011 to 2013.<sup>114</sup> Approximately one in ten laid off Nokia employees opted for this path, a much higher number than expected by the program’s designers.<sup>115</sup>

Figure 17  
Site Provenance of Nokia Entrepreneurs



Source: HRM Partners Survey

Another survey of Bridge participants conducted by Aalto University indicates that the number of entrepreneurs at each site varied considerably: 37 percent of them were from the Helsinki Metropolitan area, 25 percent from Oulu, 21 percent from Tampere, and the remaining 17 percent from the Salo region.<sup>116</sup> Stakeholder interviews made it evident that the opportunities and resources available to entrepreneurs in their home sites differed and may have impacted the participation rates of workers. Helsinki, for example, had a much more developed

entrepreneurship environment, as well as a more diversified economy, while sites like Salo or Oulu were historically more dependent on Nokia as both a traditional employer and a driver of technological innovation. Despite this, all sites produced a significant number of entrepreneurs and surpassed the expectations of Bridge planners.

As of 2014, about 90 percent of companies launched through this stream continued to operate, indicating that they were quite successful in the early stages.<sup>117</sup> Many of the new companies were geared towards consulting which, while reasonably effective in providing founder(s) with employment and a relatively stable income, did not forecast much job creation or longevity past their creator’s working life. One regional stakeholder noted that very few, if any, one-person consulting startups survived in their region. Yet, about one in five of these entrepreneurs were able to negotiate licensing or an idea release agreement with Nokia, indicating that employees were able to mobilize the firm’s innovative technologies.<sup>118</sup>

## Economic impact: workers, communities, and firms

The Bridge program led to many positive economic impacts at the local level, including talent retention, fostering regional entrepreneurial ecosystems, and diversifying local economies. The main priority for municipalities following the Nokia shock was the retention of regional talent. Various levels of government became involved in the Bridge program as a way to ensure local experts would find employment within the region, and they provided significant assistance and support to this end. The Bridge program helped communities retain talent, and reduced the severity of the consequences of a displaced workforce. Stakeholders consider the program crucial in mitigating local shocks, such as a decline in real estate markets or decreased consumer spending. They cited Nokia as an important partner in regional recovery thanks to both the resources offered by the Bridge program and the firm's role in helping municipalities with industrial recruitment.

Some regional development stakeholders outside the capital region characterized their regional entrepreneurial ecosystems as muted before being fueled by the startup influx created by the Bridge program, and the increased regional funding and attention. They considered the companies created through the entrepreneurship track to have higher growth potential and more direction than was usual for these localities, due to teams with unique abilities and products, who knew their customers and markets well. Stakeholders maintain that Nokia's entrepreneurship offerings permanently transformed startup culture in Tampere and Oulu, and demonstrated the value of an active innovation and entrepreneurship ecosystem.

The experience of recovering from the Nokia shock also drove the impacted regions to increase diversification efforts, invest in talent retention, and connect talent to companies interested in locating in these regions - such as Intel, which opened an R&D site in Tampere in 2012.<sup>119</sup>

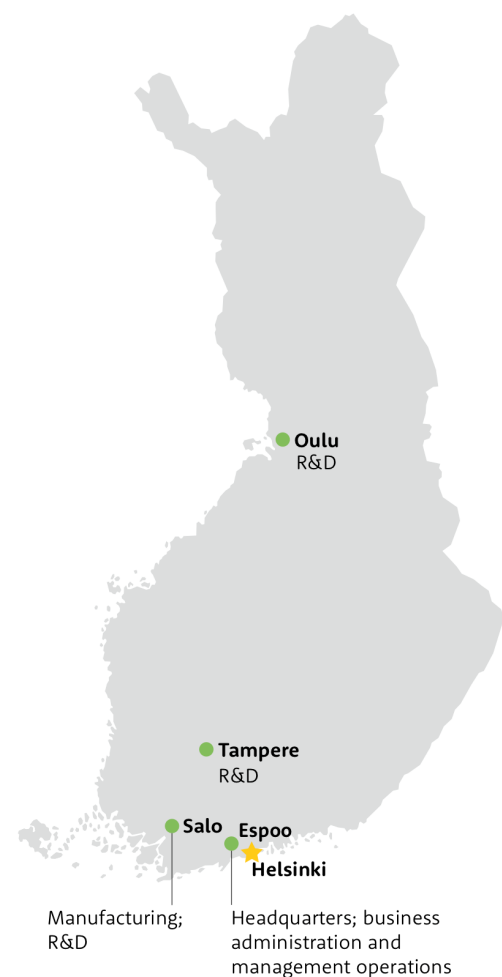
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**“The fall of Nokia was the best thing that happened [to the city] in the past 20 years” - Regional development stakeholders about Oulu and Tampere areas**

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However, some stakeholders believed Nokia could have done better at promoting innovation by providing more assistance to entrepreneurs and leveraging equity to create wholly owned spin-off companies, based off existing Nokia projects. One stakeholder specifically mentioned that even though the entrepreneurship path enabled the formation of promising companies and products, stronger managerial and business support would have better enabled new firms to compete and survive in the Finnish economy.

Figure 18  
Nokia Mobile Phone Sites, 2011



## REGIONAL EFFECTS

Impacts varied by region. While Espoo, as part of the capital region, was better able to absorb the shock of the Nokia layoffs due to its size, the diversity of the economy, and its significant entrepreneurship ecosystem, employees at other sites found reinclusion more challenging. In Tampere, a city in the south of Finland with a population just below 200,000, Nokia employed approximately 2,000 employees, 500 of whom worked on mobile phones at the time of the restructuring. Most were above the age of 30, had families, and held at least one university degree. At Nokia's height, Tampere hosted 4,000 of its R&D jobs. The concentration of unemployed R&D talent caused by layoffs within the region made it both attractive and lucrative for other companies to move into Tampere, and the Bridge program helped workers find and upskill for jobs at these companies. A number of former Nokia employees who opted into the entrepreneurship path were housed in incubators and accelerators that had existed in the region since the 1990s. Overall, according to stakeholders, Tampere's ICT employment did not experience any significant losses due to Nokia's withdrawal.

In Oulu, a city in Finland's midwest with a population of approximately 200,000 people, Nokia employed 5,000 people at its peak, a significant portion of the city's young and skilled workforce. Unlike Tampere, where Nokia layoffs took place incrementally, all of Nokia's Oulu employees were discharged at once. In the first nine months, 15 R&D firms moved into the region, seizing upon the large amount of displaced talent. However, stakeholders from Oulu indicated that those with technical skills were hired more easily than managers or supervisors, primarily due to the less hierarchical and more project-centric nature of modern technology companies. Following Nokia's announcement of its withdrawal from the region, the city's economic development arm, BusinessOulu, created an incubator program that became one of the Bridge program's regional partners. These developments sparked what has become a prominent entrepreneurship culture, with 500 startups established over the past seven years.

Salo, a small city in the southwest of Finland with 55,000 inhabitants, was home to Nokia's only Finnish production site. Within the city, Nokia employed nearly 7,000 people: 4,000 in production, and 3,000 in R&D. During its peak, Nokia hired employees with fewer credentials and provided direct training for its production roles, resulting in a less educated workforce overall. As a result, employees encountered more difficulty finding reemployment in comparison to Oulu and Tampere. Similar to Tampere, the layoffs of R&D experts took place gradually, making it harder for city actors to attract firms to the region based on available talent. One stakeholder indicated that Nokia was not transparent about the skills profiles of laid-off employees, which hindered the city's recovery efforts. Salo faces the additional challenge of lacking a local university to sustainably feed the sector's workforce pipeline, while Oulu and Tampere are home to technology-oriented institutions. As part of the plans to revitalize its economy, the city purchased the former Nokia site and built a collaborative innovation campus centered around the Internet of Things (IoT). Overall, the city and its employers faced the challenge of rethinking their identity as a Nokia-centric economy.

*Sources: Stakeholder interviews; Sucher and Winterberg, 2015b; Crouch, 2015.*

For Nokia, the Bridge program was vital in ensuring business continuity, and was an important part of its wider strategy to sustain product development and delivery. One third of the firm's revenue from mobile phones between April 2011 and May 2012 came from new products developed at impacted sites. Despite the closures and downsizing, Nokia employees continued to generate the same level of product development and production as under normal circumstances.<sup>120</sup> According to interviewed stakeholders, the Bridge program was a key part of this success as it helped retain workers by providing them with a transitional safety net, allowing them to continue focusing on completing present tasks.

Nokia garnered a reputation for corporate responsibility, and its Bridge program is often cited as a best practice. It was highlighted as a successful model by the Finnish Prime Minister's working group on corporate social responsibility in the face of structural change.<sup>121</sup> Nokia representatives cited the company's investment in its employees as a significant draw for talent, and as a point of pride and security for its current workforce. Some stakeholders suggested that commitments to support employees in case of layoffs are fairly common in innovation sectors, and lessen the uncertainty of working for a riskier company.

### MICROSOFT'S POLKU PROGRAM

Following Nokia's restructuring, Microsoft acquired the remaining sites of Nokia's mobile phones division in 2014. However, by 2016, they had announced the closing of all mobile operations in Finland. They laid off over 3,200 employees which, although significant, was substantially less painful to the local and national economies than the Nokia shock. The number of jobs lost was lower, the local economies had become more diversified in terms of companies and sectors, and the national economy was in a period of growth and recovery. In addition, Microsoft employees were highly skilled, and were much more focused on software.

To mitigate the impacts of its decision, Microsoft enacted the Polku ("Path") program. Like the Bridge program, it provided workers with avenues for additional education, assistance in finding work within and outside of Microsoft, and an entrepreneurship track that included coaching and funding. While inspired by Nokia, Microsoft's program had a few key differences, including higher company investment per capita, health and wellness supports, and the higher average skill level among its employees.

*Sources: Stakeholder interviews and provided materials.*

### *Social impacts: best practices and regulation changes*

Nokia's Bridge program also inspired an update to 'Change Security', one of the main unemployment supports in the country. It now includes a requirement for employers to "provide dismissed employees the opportunity to participate in coaching or training that promotes employment, paid by the employer, if the employer regularly employs at least 30 people and the employee has been employed by the employer consecutively for at least five years before the end of the employment relationship".<sup>122</sup>



## Success factors

**Nokia successfully demonstrated its commitment to the reinclusion of workers** into the economy through the Bridge program. It followed a rapid design, launch, and implementation schedule. Nokia ensured its employees were aware of the opportunities available to them and of the different features of the Bridge program through an intensive information campaign, including workshops, electronic communications, internal promotion, and a Bridge Program Help Desk. In addition, it committed extensive and visible funds and other resources to each path, but particularly to the outplacement and entrepreneurship tracks, which were the most used.<sup>123</sup> The company confirmed its commitment through its collaboration with regional and national actors, including involvement in industrial recruitment at its previous factory sites. These actions increased worker confidence in the program and enabled smoother cooperation with external partners.

**The variety of paths available to employees** was vital to ensure a high participation rate. Nokia recognized that supporting a 5,000-person laid-off workforce would require a wide set of options. Through the Bridge program, workers could pursue different goals within one program. In addition, the paths were not mutually exclusive. A participant could draw support from multiple streams - for example, education programs, interview coaching, and management training - which provided further flexibility for workers to gain the skills they needed.

Stakeholders cited the **local flexibility of implementation** as a crucial factor for success. It provided room for additional customization within the five paths, allowing leaders to accommodate their strategies and specific offerings to the needs of each site based on its employees' experience, skills, goals, and different local economic landscapes.

**The entrepreneurship path** was highly innovative in both design and implementation. It effectively harnessed existing technologies and talent to launch hundreds of companies, some of which obtained or licensed Nokia products that their founders had developed during their time in the firm. It provided incentives to mitigate some of the risks of creating a startup, most notably through grants, but also through personal coaching and business guidance.

**The wider innovation environment** was critical for the implementation and success of various paths including re-education and, in particular, entrepreneurship. Many Nokia startups received additional funding and guidance from TEKES programs (including Innovation Mill), Finland's state-owned venture capital firm TESI, and other public and private actors. They were often also guided by regional accelerators and incubators, and benefited from local contacts and Bridge networking opportunities. For example, Finnvera, a public bank for corporate firms, collaborated with Nokia to provide more favourable loan terms to former Nokia employees.<sup>124</sup> These efforts largely took the form of bottom-up, localized coordination, as opposed to top-down coordination.



## Barriers

### *Participant barriers*

Several stakeholders identified **participants' lack of knowledge of the wider economy and job market** as a main obstacle that the Bridge program had to overcome. Employees were often unaware of the needs of other employers in the sector or outside of it, lacked the ability to appropriately market themselves to other firms, and had no experience outside of Nokia. In addition to these challenges, startup founders knew little of the entrepreneurship process or business planning in general.

Participants and training providers mentioned the **mental and emotional impact of job loss** as a factor that prevented some employees from fully taking advantage of the Bridge program.

**Different standards of implementation across regions and for workers who were impacted in later waves of restructuring** are a point of contention. Some participants and regional actors criticize certain changes to the program made after the initial implementation, and indicate that employees who joined the program later were at a disadvantage in terms of duration of support and shorter deadlines for applications to entrepreneurship grants. As an example, Nokia ended the initial two-month grace period which allowed employees to search for a job or develop a business plan while receiving their usual salary, in June 2012.

### *Program barriers*

The initial executive team appointed to the development of the Bridge program faced challenges in designing a program as comprehensive and inclusive as they wished it to be. **They lacked both precedent and a base model.**

The program faced social and regulatory obstacles in implementation. Initially, Nokia had to overcome **media and employee skepticism** regarding its commitment to transitioning workers, some of whom thought the Bridge program was a public relations ploy.

**The national government's inflexibility on taxation and unemployment rules** created problems for the Bridge program and participants, according to some stakeholders. During relevant negotiations, the national government remained firm in its decision to consider the entrepreneurship grants as taxable personal income. This meant that only half of the net amount received through this channel was available to startups, which some stakeholders believe may have undermined Nokia's incentivization. However, according to surveys, most entrepreneurs still listed the available funding as the most impactful part of the program. In certain cases, both the generous severance packages and the entrepreneurship grants affected employees' access to and eligibility for certain national unemployment supports.

## Lessons

While certain aspects of the Bridge program were unique and context-dependant, it offers clear lessons that could be applied to future such initiatives, in other jurisdictions. These focus around the involvement of local actors including national and local governments, active information sharing, accounting for the range of skill levels among affected employees, and considering entrepreneurship as a viable path to economic inclusion for some workers.

### 1. The importance of a collaborative, multi-sector network of partners

Engagement of national and local governments, training organizations, incubators and others was key to rapid and effective design, implementation, and rollout of the Bridge program. The development of a robust partner network was facilitated by previous relationship building. Prior to the Nokia shock, some municipalities discussed potential contraction scenarios and responses with local Nokia representatives, regional economic development workers, and national actors, positioning them to deploy resources quickly and efficiently when a shock did occur.

In addition, the selection of program leaders within Nokia, who were both impacted by the changes and well-linked to the local community, was cited as a vital success factor by many stakeholders.

### 2. The importance of information

Informing employees and community actors about the goals and different facets of the program was essential for their buy-in and support. With thorough knowledge of Nokia's initiative, workers felt more supported, and regional actors could provide complementary resources for those affected. Some community stakeholders, however, feel that if the company had been more transparent and forthcoming with specific layoff schedules and the skill profiles of workers, they would have been better positioned to provide more relevant assistance to participants. Nokia's investment in gathering information about impacted communities and employees was equally important. Bridge site leaders knew of the needs and goals of local employees through individual meetings and human resources surveys, and used this knowledge to develop an appropriate implementation strategy for each site.

### 3. The importance of flexibility

The Bridge program illustrated the importance of embedding flexibility into workforce training at multiple levels, especially when it is targeted to a large number of employees with a range of skill profiles who work in varied roles and regions. At the design stage, stakeholders stressed the importance of a solution that would make various paths available for workers with different goals. During the implementation stage, stakeholders recognized the value of local leaders developing site-specific implementation plans that accounted for the distinct economic reality of each community, the diverse needs of their employees, and Nokia's production targets.

### 4. The importance of fostering entrepreneurship

Nokia's entrepreneurship path supported a tenth of all Bridge participants, a proportion that exceeded both the designers' and site leaders' expectations. The provision of considerable funding as well as business training allowed workers to transition into various sectors, supported a wide range of ideas, and provided opportunities for people with different skill profiles. Stakeholders also emphasized the draw for workers

interested in continuing to drive forward the technologies and products they had developed while at Nokia, helped by the licensing negotiation option provided. For communities, the startup path proved to be key in diversifying local economies, fostering local innovation environments, while also supporting the economic inclusion of workers who had been laid off.

## IV. INSIGHTS FOR ONTARIO

Ontario, like many other jurisdictions, is undergoing significant economic changes as it adapts to the pressures of global competition, technological change, and the increasing importance of the services sector relative to the resources sector.<sup>125</sup> These trends have deeply affected the labour landscape, displacing certain workers and transforming the types of jobs being created, as well as the people to whom they are available. Mid-career workers with lower levels of formal education are among those most at-risk of exclusion, especially those within fast-evolving sectors such as mining or manufacturing. At the same time, there is a growing need for talent that can drive innovation and support the adoption and use of new technologies in all sectors.

These changes have led actors from various jurisdictions and sectors to recognize both the need to encourage innovation and technological adoption that fosters economic growth, and the need to help workers adapt to disruption in a way that fosters inclusion. However, these goals are often pursued separately. Policies that adopt a dual purpose, such as DSIPs, can enhance both outcomes and make them more sustainable.<sup>126</sup>

Federal, provincial and municipal governments are increasingly concerned with supporting displaced or at-risk workers, and the development of new skills required in the changing economy. Whereas previous government programs focused mainly on youth and the unemployed, recent provincial and federal budgets also acknowledge the need for training in high-demand future skills for those already in the workforce, as well as the necessity for industry, education, and government actors to work together to identify needs.<sup>127</sup> Public, non-profit, and private actors throughout the province are exploring models to address both the talent needs of innovative firms and the upskilling needs of workers. These programs, some of which are listed below provide a starting point for new or expanded approaches.

Despite these efforts, there are still significant gaps in the province's programs and ample room for improvement. In 2016, for example, Ontario's Auditor General found that less than 15 percent of workers who participated in Employment Ontario retraining programs found jobs in their new field. This was attributed to factors such as a lack of alignment of initiatives with employer needs, labour market data limitations, and inadequate communication channels between industry employers, government, and labour representatives.<sup>128</sup> Ontario is also no stranger to plant closures or to company restructuring, which contribute to job losses and shifting job wages and skill requirements.<sup>129</sup>

Both the Finnish and the North Carolinian experience demonstrate that industry, government, and training actors all play an important part in successful worker reinclusion efforts. They provide lessons that could inform new approaches to linking innovation-driven growth and inclusive growth goals in the province, and more effective roles for stakeholders.

## IN THE SPOTLIGHT: STARTING POINTS FOR EXPANDED INCLUSIVE INNOVATION MODELS

### Second Career

Ontario's Second Career program is a financial assistance program that helps laid-off workers retrain for 'second' careers in high-demand sectors by providing skills training and financial support. Applicants work with their local employment services agency to complete their applications, and successful participants can receive funding to cover college or other instructional costs. Applicants must show that the skills they will acquire are needed by employers, and that the jobs into which they are transitioning are in high-demand sectors. These are determined yearly by labour market indicators, and must have 'above average employment prospects' either listed in Ontario Job Futures profiles or assessed based on local economic conditions. The 2018 provincial budget announced that the program would be redesigned to ensure its efficiency and alignment with Ontario's changing labour market.

### Local Employment Planning Councils

In 2016, the Ministry of Advanced Education and Skills Development (via Employment Ontario) launched Local Employment Planning Council (LEPC) pilots, with the aim of implementing region-based workforce development and training using local approaches and labour market data. Pilots are currently ongoing in eight communities (Durham, London-Middlesex-Oxford-Elgin, Ottawa, Peel-Halton, Peterborough, Thunder Bay, Timmins, and Windsor) and are set to end in September 2018.

### Northern Centre for Advanced Technology

The Northern Centre for Advanced Technology (NORCAT) in the Greater Sudbury Area is a non-profit organization that specializes in programming for workers, entrepreneurs, and small and medium enterprises (SMEs) in Northern Ontario. Founded in 1995, NORCAT works towards supporting sustainable economic and social prosperity in the area. The Centre provides a series of training and development programs for sectors such as manufacturing, mining, construction healthcare, and oil and gas, with additional supervisory, health and safety, and productivity programs.

### Manufacturing plant closures: two Ontario cases

In 2008, workers laid off from a Concord plastics company, Progressive Moulded Products Ltd., created a Workers Action Centre funded by the Ontario Ministry of Training Colleges and Universities and the Canadian Auto Workers Union. The Centre aimed to help displaced workers improve their skills and retrain for other jobs.

More recently, the scheduled closure of the General Electric (GE) plant in Peterborough in the fall of 2018 has generated concern for displaced workers. While the path forward is not clear, the workers' union chapter has said that it would support retraining efforts. In turn, GE has suggested that it is willing to help workers during the transition period, including through retraining initiatives.

### Hamilton Skilled Trades Consortium

The Hamilton Skilled Trades and Apprenticeship Consortium (HSTAC) aims to help the local steel making industry fill important talent needs while helping potential employees gain in-demand skills. HSTAC convenes a diverse community of stakeholders, including 30 local employers (including SMEs), United Steel Workers representatives, the Canadian Skills Training & Employment Coalition and Mohawk College. The College operates as a program anchor, providing a co-op Diploma Apprenticeship as well as a Mechanical Techniques program for HSTAC sponsored youth.

*Sources: Labour Market Indicators For Second Career, 2017; Local Employment Planning Councils (LEPC), 2016; Lamb, Munro and Vu, 2018; Many Former Plastics Company Workers Still Out Of Work A Year Later, 2009; Grech and Grasser, 2008; Clysdale, 2017; Talks Break Down Between General Electric, Unifor On GE Peterborough Plant Closure Agreement; Workers Upset They Are Being Asked To Help Overseas Plants In Taking Over Their Jobs, 2018; Delaney, 2015.*

## CREATING PATHWAYS FOR PARTICIPATION IN AN INNOVATION ECONOMY

As Ontario looks to tackle these challenges, building from existing initiatives, it should consider a number of lessons from the BioWork and Bridge program case studies. These lessons are relevant to leaders from government, companies, unions, education and training institutions, and regional economic development organizations. When looking to design initiatives that reinforce innovation-driven growth in particular industries and regions while also supporting displaced or at-risk workers, these actors should consider the importance of:

### 1. Resilient networks

These case studies exemplify the value of effective multi-level networks. Previous trusted relationships were vital in establishing the programs, and in weathering adverse political and economic conditions by allowing actors to redistribute responsibilities and provide appropriate support. Aligning services, funding, expertise, and information around shared goals enabled the design and implementation of programs that were tailored to the needs of workers, employers, and local economies. These case studies also demonstrate the importance of anchor organizations, such as Nokia and the Biotech Centre, in leading program development and acting as central nodes for partner coordination.

### 2. Accurate knowledge of demand and supply

These cases also highlight that design and implementation decisions should be made with current and accurate knowledge of the demand they aim to satisfy. Programs focused on retraining and bridging workers into new jobs will not be successful without industry input regarding skill demand, training design, and credentials. BioWork ensured its alignment with industry demand by involving firms from the design phase through implementation. In the Finnish case, there was a clear need for technology experts as various sectors of the economy made intentional pushes toward digitalization and other technology adoption to remain competitive. Supply-driven policies like the Bridge program must also identify the skills of employees, as well as their needs and goals, to properly incentivize employee participation and successfully support them in finding new employment.

### 3. Information-sharing

Detailed information is key for anchor organizations, as well as sharing it with partners such as regional economic development actors and funders to maximize their support and impact. Coordination of the multiple actors needed to make these initiatives a success requires transparent and continuous information-sharing regarding talent needs, worker skills, workplace disruption, and available supports. Stakeholders need to know what is being done, and by whom, in order to deploy available resources and open appropriate channels of cooperation.

### 4. Flexibility to adapt to changing needs

Programs should include avenues for evolution from their design stages, and implementation partners need to be responsive to changes in order to ensure long-lasting relevance. These two case studies demonstrate that adapting to emerging industry or workforce needs, allowing flexibility in implementation for different local circumstances, and adjusting to economic and political obstacles are vital for success.

## 5. Recognizing that any worker can be an engine of innovation

Workers from different educational and skills backgrounds can contribute to an innovation economy. Workforce training programs that provide foundational and transferable knowledge can prepare participants to adapt more easily to technological change and to directly contribute to process innovation and technology development. In turn, enabling workers to upskill for roles in innovative, technology-intensive firms benefits these firms by increasing their efficiency, competitiveness, and profitability, and allowing them to remain viable in quickly-evolving sectors.

Entrepreneurship supports can also leverage the innovation potential of workers. In the case of Nokia, workers with little or no previous business experience launched their own companies with reasonable success and drove technologies to market. This initiative also had profound and lasting spillover effects, leading to the extensive development of entrepreneurship culture in the regions where it took place.

## V. CONCLUSION

There are many paths to inclusion in an innovation economy. Individuals can adapt to the changing skill demands of innovative companies and industries, drive innovation through R&D, engage in entrepreneurship that brings technological advancements to the market, and inform process innovations from the manufacturing floor. However, without deliberate, thoughtful innovation policies and programs that link inclusion and economic development objectives - referred to by Zehavi and Breznitz as DSIPs - a significant number of individuals could face limited or no pathways to participation in Ontario's innovation economy. As illustrated by the BioWork and Bridge program case studies, initiatives that seek to link these goals should be adaptable and tailored to the particular needs, strengths, and goals of different industries, regions, and people. An innovation economy benefits when any worker can find a path to inclusion, and carefully designed initiatives, simultaneously focused on innovation-driven growth and inclusion, are required to maximize the number of people who are able to do so.

## APPENDIX: STAKEHOLDER INTERVIEW LIST

Count	Region	Institution	Name	Role
1	Finland	Nokia	Pekka Pesonen	Manager, Organizational Development; Former Bridge Program Manager
2	Finland	TreLab	Kimmo Saarela	CEO and founder; Ex-Nokia Employee and Bridge Program Entrepreneur
3	Finland	Quupa	Kimmo Kalliola	CEO and co-founder; Ex-Nokia Employee and Bridge Program Entrepreneur
4	Finland	HRM Partners Oy	Elina Palmroth-Leino	Director, Business Coach and Partner; Bridge Program Training Provider; Bridge Program evaluator
5	Finland	Nokia, US	Lior Nir	Former Director, Portfolio Management & Business Development; part of the Bridge program management team in the US in 2011/12.
6	Finland	Business Tampere	Seppo Haataja	Director, Intelligent Urban Development ; Ex-Nokia Employee and Bridge Program Site Manager
7	Finland	City of Tampere	Kari Kankaala	Director, City Development
8	Finland	City of Salo	Anita Silanterä	Programme Manager, Strategic Development
9	Finland	Business Oulu	Janne Mustonen	Key Account Director, ICT sector
10	Finland	Confederation of Finnish Industries	Jouni Hakala	Director, Entrepreneurship and Business Environment, Member of Executive Board; TEKES Chairman of the Board; Previously State Secretary to the Ministry of Employment and the Economy
11	Finland	Microsoft	Max Mickelsson	Director, Government Affairs Finland and Ireland; Polku Program
12	Finland	Independent consultant	Roger Wessman	Nokia Shock Researcher
13	Finland	Journalist		
14	Finland	ETLA	Petri Rouvinen	Research Director
15	Finland	SAK - Central Organisation of Finnish Trade Unions	Hannu Jouhki	Director, Growth and Advocacy
16	Finland	SAK - Central Organisation of Finnish Trade Unions	Laina Patrizio	Economist



Count	Region	Institution	Name	Role
1	North Carolina	North Carolina Biotechnology Centre	Kathleen Kennedy	Former Vice President of the Education and Training Program
2	North Carolina	North Carolina Biotechnology Centre	Ken Tindall	Senior Vice President, Science and Business Development
3	North Carolina	North Carolina Biotechnology Centre	Laura Rowley, PhD	Associate Director, Technology and Talent
4	North Carolina	BioNetwork, North Carolina Community College System	Brent Harpham	Executive Director, BioNetwork and Life Sciences
5	North Carolina	BioNetwork, North Carolina Community College System	Scott Siler	Instructional Designer
6	North Carolina	NC Community College System	Matthew Meyer	Associate Vice President, Educational Innovations
7	North Carolina	Golden LEAF Foundation	Mark Sorrells	Senior Vice President
8	North Carolina	NCBIO	Brenda Summers	Director, Communications and Projects
9	North Carolina	Durham City, Office of Economic & Workforce Development	Andre Pettigrew	Director
10	North Carolina	Pitt County Development Commission	Wanda E. Yuhas	Executive Director
11	North Carolina	NCWorks Customized Training	Lynn Creech	Regional Director
12	North Carolina	NC Justice Center, Raleigh	Adam Svolto	Deputy Director, Policy & Engagement
13	North Carolina	NC Justice Center, Raleigh	Allan Freyer	Director, Workers' Rights Project
14	North Carolina	University of North Carolina	Nichola Lowe	Associate Professor, City and Regional Planning, UNC-Chapel Hill
15	North Carolina	Wake Tech Community College	Melanie M. Glen	BioWork Instructor and previous participant
16	North Carolina	Wake Tech Community College	Gerald (Jerry) Picard	BioWork Instructor
17	North Carolina	Wake Technical Community College	Mike Morgan	Director, BioWork Program
18	North Carolina	Johnston Community College	Leslie Holsten	Director, Biotechnology Programs

## ENDNOTES

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- <sup>1</sup> Aghion et al., 2015; Parilla and Muro, 2017
- <sup>2</sup> Zehavi and Breznitz, 2017.
- <sup>3</sup> Sucher & Winterberg, 2015a.
- <sup>4</sup> Dragicevic, 2014; Oschinski, Chan, and Kobrinsky, 2014.
- <sup>5</sup> Fantauzzi and Hennessy, 2016, p. 12.
- <sup>6</sup> deepcentre, 2015.
- <sup>7</sup> Lamb, Munro and Vu, 2018.
- <sup>8</sup> The reason behind the difficulty in finding talent is ambiguous. It could be caused by labour shortages, a lack of tools to find or train workers, or insufficient levels of compensation.
- <sup>9</sup> Lowe, 2012.
- <sup>10</sup> Lowe, 2012.
- <sup>11</sup> Jones and Silvestri, 2010.
- <sup>12</sup> In 2000, these three subsectors accounted for almost a fifth of manufacturing employment in the state. By 2016, this proportion had dropped to 12 percent (BLS).
- <sup>13</sup> Goldstein, Lowe, and Donegan, 2012.
- <sup>14</sup> Lowe, 2012.
- <sup>15</sup> Lowe, Tewari, and Lester, 2015
- <sup>16</sup> Lowe, 2012.
- <sup>17</sup> Lowe and Feldman, forthcoming.
- <sup>18</sup> About Us - NC Biosciences Organization, NC, 2018.
- <sup>19</sup> Lowe and Feldman, forthcoming.
- <sup>20</sup> Golden LEAF is a not-for-profit economic development agency charged with deploying funds from the tobacco settlement to help regions previously dependent on tobacco production transition to new areas of the economy.
- <sup>21</sup> North Carolina Biotechnology Center, 2009a.
- <sup>22</sup> Lowe and Feldman, forthcoming.
- <sup>23</sup> Lowe and Wolf-Powers, 2017.
- <sup>24</sup> Lowe and Feldman, forthcoming; Lowe, 2012.
- <sup>25</sup> Tindall and Kennedy, 2003; Balchunas and Kennedy, 2012.
- <sup>26</sup> Balchunas and Kennedy, 2012.
- <sup>27</sup> Stakeholder interviews.
- <sup>28</sup> Lowe, 2012.
- <sup>29</sup> Stakeholder interviews.
- <sup>30</sup> Stakeholder interviews.
- <sup>31</sup> Novozymes, "Our History", 2017
- <sup>32</sup> Stakeholder interviews.
- <sup>33</sup> Lowe, 2007.
- <sup>34</sup> Stakeholder interviews.
- <sup>35</sup> Fitzgerald, 2006
- <sup>36</sup> Stakeholder interviews.
- <sup>37</sup> Lowe, Tewari, and Lester, 2015; Goldstein, Lowe, and Donegan, 2012; Lowe, Goldstein, and Donegan, 2010.
- <sup>38</sup> The GoldenLeaf Foundation is funded through the tobacco class action suit settlement provided to the state, and is charged with increasing economic opportunity in North Carolina's rural and tobacco-dependent communities.
- <sup>39</sup> North Carolina Biotechnology Centre, 2000, p.9; Stakeholder interviews.
- <sup>40</sup> North Carolina Community College System.
- <sup>41</sup> North Carolina Biotechnology Centre, 2003.

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<sup>42</sup> Enrolment numbers for the 2017-2018 year are not yet finalized.

<sup>43</sup> Biowork FAQ, Wake Technical Community College, 2018.

<sup>44</sup> Stakeholder interviews.

<sup>45</sup> Stakeholder interviews.

<sup>46</sup> Lowe, Goldstein, and Donegan, 2010.

<sup>47</sup> Stakeholder interview.

<sup>48</sup> Goldstein., Lowe, and Donegan, 2012.

<sup>49</sup> Goldstein, Lowe, and Donegan, 2012.

<sup>50</sup> Lowe, Goldstein, and Donegan, 2010.

<sup>51</sup> Goldstein, Lowe, and Donegan, 2012.

<sup>52</sup> Lowe, Goldstein, and Donegan, 2010.

<sup>53</sup> Lowe, Goldstein, and Donegan, 2010.

<sup>54</sup> For participants laid off fewer than five years before completing BioWork.

<sup>55</sup> Goldstein, Lowe, and Donegan, 2012.

<sup>56</sup> Goldstein, Lowe, and Donegan, 2012.

<sup>57</sup> Lowe and Wolf-Powers, 2017.

<sup>58</sup> Lowe and Wolf-Powers, 2017.

<sup>59</sup> Community college stakeholder interviews; Goldstein, Lowe, and Donegan, 2012; 2009 saw BioWork's highest enrolment numbers to date. See Figure 5.

<sup>60</sup> North Carolina Biotechnology Center 2009b; North Carolina Biotechnology Center, 2009c.

<sup>61</sup> North Carolina Biotechnology Center, 2009c.

<sup>62</sup> Lowe and Wolf-Powers, 2017.

<sup>63</sup> Lowe, 2007.

<sup>64</sup> Balchunas and Kennedy, 2012; Tindall and Kennedy, 2003; Balchunas and Kennedy, 2012.

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<sup>65</sup> Lowe and Wolf-Powers, 2017; Lowe, 2012.

<sup>66</sup> Lowe, 2012.

<sup>67</sup> Lowe, Tewari, and Lester, 2015.

<sup>68</sup> The North Carolina Commission on Workforce Development, 2011.

<sup>69</sup> Lowe, Tewari, and Lester, 2015.

<sup>70</sup> Goldstein, Lowe, and Donegan, 2012.

<sup>71</sup> Goldstein, Lowe, and Donegan, 2012.

<sup>72</sup> Lowe, Tewari, and Lester, 2015.

<sup>73</sup> Goldstein, Lowe, and Donegan, 2012.

<sup>74</sup> The North Carolina Biotechnology Center, 2004

<sup>75</sup> Wilson Community College, n.d.; Stakeholder interviews.

<sup>76</sup> Options offered by WakeTech Community College and Johnston Community College respectively; WakeTech Community College, n.d.; Johnston Community College, n.d.

<sup>77</sup> Lowe, 2007.

<sup>78</sup> Community college stakeholder interview.

<sup>79</sup> North Carolina Biotechnology Centre, 2004; Community college stakeholder interview.

<sup>80</sup> As can be seen in Figures 6 and 7, of the six colleges that continue to offer BioWork, five are within 50 miles of the Research Triangle Park area; the state's biomanufacturing epicentre.

<sup>81</sup> Lowe and Feldman, forthcoming; Stakeholder interviews.

<sup>82</sup> Lowe and Wolf-Powers, 2017.

<sup>83</sup> Lowe and Wolf-Powers, 2017.

<sup>84</sup> Lamb and Seddon, 2016.

<sup>85</sup> Autor et al. 2017, p. 23.

- <sup>86</sup> Bellemere, 2016.
- <sup>87</sup> Petricevic, 2014.
- <sup>88</sup> Pelkonen, 2008; Aaltio and Heilmann, 2006.
- <sup>89</sup> Pajarinen and Rouvinen, 2013.
- <sup>90</sup> Academy of Finland, 2018
- <sup>91</sup> Lemola, 2003.
- <sup>92</sup> Lemola, 2003.
- <sup>93</sup> Facts About Sitra, 2018.
- <sup>94</sup> Tekes became Business Finland as of 2018; The Finnish Funding Agency For Technology And Innovation - Internal Market, Industry, Entrepreneurship And SMEs - European Commission, 2018.
- <sup>95</sup> Research Media and Pujiang Innovation Forum, 2013, October.
- <sup>96</sup> Ali-Yrkko et al., 2013.
- <sup>97</sup> A third of the eight-percent drop in Finnish GDP during the recession in 2008-2009 is attributable to the company's decline (Pajarinen, M., & Rouvinen, P. (2013). Nokia's Labor Inflows and Outflows in Finland. *ETLA Reports*,10.)
- <sup>98</sup> As announced. Sucher and Winterberg, 2015, p.17
- <sup>99</sup> Stakeholder interviews; Sucher and Winterberg, 2015a, p.9.
- <sup>100</sup> Sucher and Winterberg, 2015a, p.8
- <sup>101</sup> Sucher and Winterberg, 2015a.
- <sup>102</sup> Stakeholder interviews.
- <sup>103</sup> Stakeholder interview; HRM Partners Ltd, 2014.
- <sup>104</sup> HRM Partners Ltd, 2014.
- <sup>105</sup> Sucher and Winterberg, 2015a; HRM Partners Ltd, 2014; Kiuru, Handelberg and Rannikko, n.d.
- <sup>106</sup> Of those who were reemployed, 44 percent were in permanent positions, and 13 percent in temporary roles.
- <sup>107</sup> The remaining one percent of respondents picked an 'other' option; The survey was sent to 1743 ex-Nokia employees who had attended HRM outplacement training from 2011 to 2013, and received 894 responses. One stakeholder familiar with the survey recognizes that is slightly over-representative of the capital region, but considers it generally accurate; HRM Partners Ltd, 2014
- <sup>108</sup> HRM Partners Ltd, 2014.
- <sup>109</sup> HRM Partners Ltd, 2014.
- <sup>110</sup> HRM Partners Ltd, 2014.
- <sup>111</sup> HRM Partners Ltd, 2014.
- <sup>112</sup> Prime Minister's Office, 2016; Sucher and Winterberg, 2015a.
- <sup>113</sup> Stakeholder interview.
- <sup>114</sup> Kang, Rannikko and Tornikoski, 2017.
- <sup>115</sup> Kiuru, Handelberg and Rannikko, n.d.
- <sup>116</sup> Kiuru, Handelberg and Rannikko, n.d.; However, it was noted that survey responses were over-representative of the Helsinki Metropolitan and Oulu regions, and under-representative of the Salo region.
- <sup>117</sup> Kiuru, Handelberg and Rannikko, n.d.
- <sup>118</sup> Sucher and Winterberg, 2015b.
- <sup>119</sup> Stakeholder interviews.
- <sup>120</sup> Sucher and Winterberg, 2015b.
- <sup>121</sup> Prime Minister's Office, 2016.
- <sup>122</sup> Change Security For Dismissed Employees, 2018.
- <sup>123</sup> Some stakeholders also cite the size of entrepreneurship grants as a key factor of success.
- <sup>124</sup> Kiuru, Handelberg and Rannikko, n.d.
- <sup>125</sup> Ministry of Labour, 2017.
- <sup>126</sup> Lamb, Munro and Vu, 2018.

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<sup>127</sup> Budget 2018: Chapter 1 - Growth, 2018; Tibando and Do, 2018.

<sup>128</sup> Ontario Auditor General report, 2016.

<sup>129</sup> Many Former Plastics Company Workers Still Out Of Work A Year Later, 2009; Clysdale, 2017.

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