

INNOVATION AND LEARNING IN TORONTO'S BIOMEDICAL SECTOR

Local and Global Knowledge Dynamics

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OUTLINE

- Innovation, learning and the geography of knowledge flows
- Background: Toronto's biomedical technology and equipment sector
- Emerging themes
 - Variety and diversity in the local economy
 - Access to local and global markets
 - Access to local talent
 - Access to local and global knowledge circuits
- Summary and policy implications

INNOVATION, LEARNING & KNOWLEDGE DYNAMICS

- Primary H: economic and creativity performance of city-regions depends on
 - Strength of local knowledge circulation *within* clusters
 - Strength of local knowledge circulation *between* clusters (local knowledge diversity)
 - Strength of knowledge-based linkages between local and non-local actors (geographical knowledge diversity)

STRENGTH & NATURE OF LOCAL KNOWLEDGE FLOWS

- Power of **specialization**
 - Localization economies: external to a firm but internal to an industry (Marshall-Arrow-Romer [?] externalities)
 - Emphasis on common labour pool, skill base, specialized suppliers, educational institutions, other industry-specific complementary assets
 - Lower cost of supplies
 - Greater efficiencies from specialization
 - Knowledge-based advantages: learning by doing, knowledge spillovers are facilitated by specialization
 - Key mechanisms for local knowledge circulation
 - Intra-sector mobility of specialized labour, serial entrepreneurs
 - Learning by observing (density/concentration effects)

STRENGTH & NATURE OF LOCAL KNOWLEDGE FLOWS

- **Benefits of diversity**

- Jacobs (1969): new ideas formed by combining older ideas, or by applying knowledge that is 'routine' in one sector to problems in another sector (in which the same knowledge is 'revolutionary')
- richness of large, diverse urban economies
 - Mixing of many different industries, occupations
- Potential for knowledge transfer between industries
 - market exchanges and spillovers
 - Intended and accidental
- Diverse city-regions should
 - grow faster than more specialized ones
 - have higher levels of innovative dynamism (esp radical innovations)

- **Related Variety**

- Knowledge spills over more readily – and with a bigger payoff – between sectors that are 'related' to one another

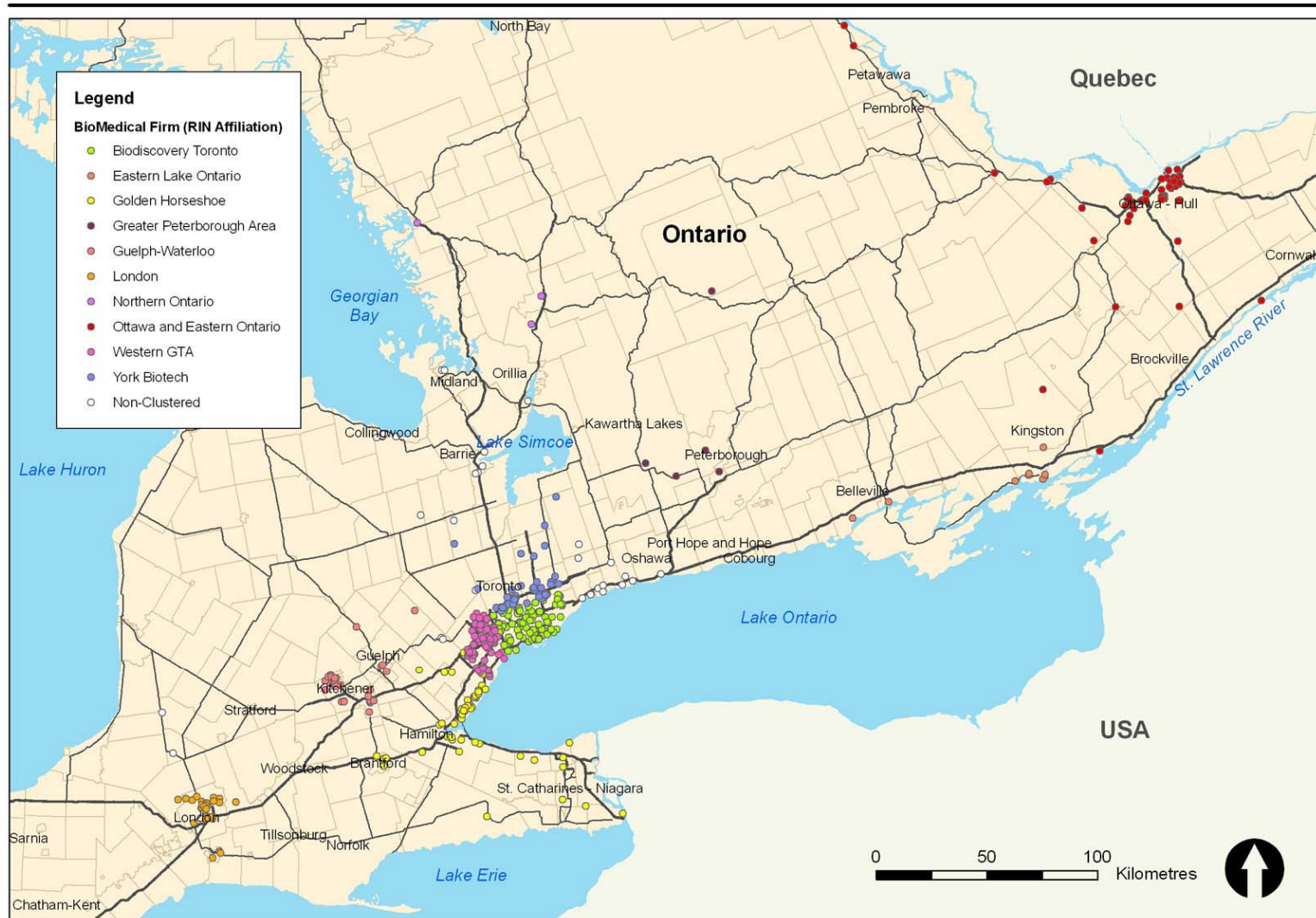
INNOVATION AND KNOWLEDGE: VALUE OF **NON-LOCAL** LEARNING

- Local self-sufficiency: unrealistic, undesirable
- Local 'buzz' and global 'pipelines' (Owen-Smith & Powell 2004; Bathelt et al 2004)
 - Local innovative dynamism (also) depends on local actors' ability to establish channels, networks to access knowledge from *distant* centres/nodes of knowledge production
 - From an evolutionary perspective, pipelines increase variety of locally available knowledge by linking firms to multiple selection environments, knowledge pools – i.e. *non-local learning has its own advantages*

COMPARATIVE RESEARCH DESIGN

- Case study of Toronto's biomedical technology and equipment sector in comparative perspective
 - database provided by htx.ca, The Health Technology Exchange
 - 577 firms in Ontario's biomedical technology and equipment sector (medical, assistive, diagnostics, imaging and ICT/photonics activities)
 - 36 in-depth interviews with biomedical equipment and technology firms
 - Greater Toronto (Biodiscovery Toronto, Western GTA, York Biotech), as well as Golden Horseshoe, Ottawa and smaller centres
 - consistency with previous study of Toronto's emerging biomedical cluster (Gertler and Lowe 2005) and the current MCRI project (Themes I and II)

ONTARIO'S BIOMEDICAL SECTOR: FIRM LOCATIONS



Regional Innovation Networks (RINs)

ISRN City Regions / HTX Study

November, 2007

ONTARIO'S BIOMEDICAL SECTOR: FIRM CHARACTERISTICS

- dynamic / young sector dominated by small, specialized firms
 - 38% of firms have less than 10 employees
 - 36% of firms founded after 1990
 - 75% of firms are Canadian-owned
- diversity / variety of activities
 - 84% of firms specialize in only one of the core areas (medical, assistive, diagnostic, imaging, ICT/photonics)
 - e.g. data management software, disinfecting chemistry, imaging technology, assistive devices for mobility

DIVERSITY IN THE LOCAL ECONOMY

- Variety of motivations for firm formation / product development
 - evolution based on prior **experience in other industries**
- In large centres, firms are able to draw on assets in diverse, local economy
 - in Greater Toronto, biomedical equipment and technology manufacturers identified that the local presence of automotive suppliers meant available expertise in plastic molding, etc.
 - in Ottawa, firms draw on technological strengths developed in pre-existing ICT and photonics industries

DIVERSITY IN THE LOCAL ECONOMY

- “By putting much of the cleverness into the design rather than into the assembly, we were able to make it cheaper to make in Canada than it was in China. We have an injection molding company, we use a blow molding company for the bottles.”

(Firm 4, Toronto)

MOST IMPORTANT SOURCES OF IDEAS IN DEVELOPING NEW PRODUCTS AND SERVICES

	GTA	Ottawa	Other	Overall
R&D unit (in-house)	1	1	1	1
marketing department	4	4	4	4
suppliers	6	9	6	7
competitors' products	9	--	--	11
federal/provincial agencies or research institutes	7	7	--	9
venture capitalists or other financial services	9	9	--	10
production engineering staff	4	4	6	5
management	3	2	3	2
customers / clients	2	2	4	2
university researchers and laboratories	9	7	2	6
consultants (academic or professional)	7	6	--	7

LOCAL AND GLOBAL CUSTOMERS

- Ontario firms serve local and national markets
 - 26% of firms have customers / clients within their city-region and 21% have customers within the province
 - 38% of firms have customers in the rest of Canada
- Ontario firms also serve global markets
 - 53% of firms have customers / clients in the United States
 - 18% of firms have customers / clients outside of North America
- However, proximity important for **access to key customers**
 - 58% of firms thought it was important to be close to customers for innovation
 - higher in Greater Toronto (70%) compared to Ottawa (50%) or elsewhere (50%)

PROXIMITY TO LOCAL CUSTOMERS

- “Inventing is very easy if you have a good problem to solve. [When] we first talk to the customer, we might have a seed of an idea, but then we get them interested and get into a contract position. That way we are sure the development is really hitting the customers’ requirements.”

(Firm 4, Toronto)

- “Being close to the customer means you’re going to get the feedback. In the end if you want a customer to buy you have to make it really easy for them to buy, which means you produce something that is exactly what they require...by perfecting it for one hospital, we then can cookie cut it for the other 160 hospitals in Ontario.”

(Firm 13, Golden Horseshoe)

BARRIERS TO ACCESSING LOCAL MARKETS: HOSPITALS

- only 36% of firms had formal links to Ontario hospitals
 - 31% of firms in Greater Toronto and 40% of firms in smaller centres had formal links with hospitals compared to none of the Ottawa firms
- firms had difficulty accessing Ontario hospitals unless they already had a proven 'success story' in an individual hospital
- by contrast, firms often found it easier to access US markets

BARRIERS TO ACCESSING LOCAL MARKETS: HOSPITALS

- “Most of the Tier One hospitals have an unlimited budget for our type of product. So for them, **cost is not a huge consideration, it’s more a matter of buying from a name brand.** They will buy from GE, Phillips or Siemens and pay the extra money to deal with a name brand.”

(Firm 6, Toronto)

- “Hospitals, since they’re not accountable, tend not to worry too much about the cost of things because of the government’s propensity for covering costs. So often they know **they can mitigate risk by going with an IBM or a GE or a big name** in healthcare and so sometimes that makes it **difficult for the smaller guys, like myself, who have the real innovative technology.**”

(Firm 9, Other)

SUCCESS IN ACCESSING GLOBAL MARKETS?

- “The nature of health care [in Canada] is risk averse. They’re very conservative. A lot of the stuff we’re doing is very much leading edge and so the hospitals tend to look at each other to see who’s going to make the first commitment towards us.”
(Firm 9, Other)
- “In the States, if you have something interesting and there is a return on investment you can show, you walk into virtually any door. In Canada, it’s who you know that gets you in to any door.”
(Firm 5, Toronto)

BARRIERS TO ACCESSING KNOWLEDGE & MARKETS: FINANCING

- firms access financing through a variety of mechanisms
 - revenues from product sales (34%), personal savings (38%), bank loans (28%)
- 61% of firms suggested that access to financing was a major challenge
 - this was higher in Ottawa (86%) and elsewhere (56%) compared to Greater Toronto (50%)
 - however, the interviews revealed that regardless of location, firms faced major hurdles in accessing finance since the sector is not well understood

BARRIERS TO INNOVATION & REACHING MARKETS: FINANCING

- “Toronto VC does not venture very far.”
(Firm 14, Golden Horseshoe)
- “Eighty percent of bank finance goes to large business...it’s unfortunate [that] in Canada VCs are just ineffective.”
(Firm 13, Golden Horseshoe)
- “Most Ottawa investors are wary of anything outside of telecom.”
(Firm 33, Ottawa)
- “Capital is very scarce in Ottawa and throughout Canada. Canadian financiers do not understand medical devices and are unwilling to take the risk.”
(Firm 31, Ottawa)

TALENT ATTRACTION & RETENTION: ACCESS TO LOCAL TALENT

- access to local talent (47%) was cited as the top growth factor
 - “I always think of Toronto as being sort of the heart of Canada. A lot of talented people are driven to Toronto because they are looking for the most challenging jobs and they are looking for the best of the best. A lot of successful companies are based in Toronto and I think that's sort of a driving element. It is a big city, it attracts a lot of talent. I do have a lot of talent to review when hiring someone. That's why I am quite pleased.”

(Firm 25, Toronto)

TALENT ATTRACTION & RETENTION: ACCESS TO LOCAL TALENT

- few coherent recruitment strategies due to firm size
 - 55% of firms recruit using social/professional networks and word-of-mouth
 - 48% of firms also rely on educational institutions
- talent retention
 - firms in Greater Toronto did not report difficulty in retaining workers
 - in Ottawa, 75% of firms faced challenges in retaining workers due to higher salaries and/or competitive benefits packages from other employers in the region
 - “the public service can provide salary and benefit packages which SMEs cannot compete with.” (Firm 29)

TALENT ATTRACTION & RETENTION: CROSS-SECTORAL KNOWLEDGE FLOWS?

- “Ottawa has a good labour pool in high-tech, a lot of those skills are transferable to medical technology.”
(Firm 33, Ottawa)
- “Ottawa has employees with a lot of manufacturing experience. This skill set, however, is disappearing as these former tech employees age and retire.”
(Firm 32, Ottawa)

TALENT ATTRACTION & RETENTION: DIMENSIONS OF QUALITY OF PLACE

- ‘Quality of Place’ for talent
 - 50% of firms in Greater Toronto cited cultural opportunities as important to talent attraction
 - Ottawa firms emphasized the availability of outdoor and recreational opportunities, as well as having a clean, safe city
 - outside of the major centres, housing costs were cited as major factor that attracted talent (63%)
- ‘Quality of Place’ for firms
 - 42% of firms identify quality of physical, transportation, and communication infrastructure as an important factor in their growth / success
 - higher in Greater Toronto (67%) compared to Ottawa (27%) and elsewhere in Ontario (20%)

ACCESS TO KNOWLEDGE CIRCUITS: RESEARCH INSTITUTIONS & UNIVERSITIES

- 22% of firms report that relationships are important for the development of new products and services
 - this was much higher in smaller centres (50%) compared to Greater Toronto (7%) and Ottawa (18%)
- 71% of firms have formal links with specialized research institutions and/or universities
 - lower in Greater Toronto (57%) and Ottawa (75%) compared to in smaller centres (90%)
- while these linkages were primarily with **local** institutions, 18% of firms had **international linkages**
 - critical for firms to access specialized expertise and knowledge regardless of location

ACCESS TO KNOWLEDGE CIRCUITS: RESEARCH INSTITUTIONS & UNIVERSITIES

- tensions between ‘technology push’ from universities vs. ‘market needs’ of firms (different priorities/interests)
 - “We see some niche opportunities in the market where our product could sit and then we attempt to develop the technology to fit that niche. From the academic perspective, they are creating products for which they have no idea whether there is a market or not...There is a fundamental difference in the two attitudes.”

(Firm 3, Toronto)
- timelines and organizational cultures (‘mentality’) different between these actors
 - “They go university speed and we go the speed of business and they are two very different speeds.”

(Firm 4, Toronto)

RESEARCH INSTITUTIONS & UNIVERSITIES: NEGOTIATING IP RIGHTS

- the negotiation of intellectual property rights presented firms with challenges in collaborating with universities
 - “There are such huge restrictions on what will happen with that IP when it becomes commercializable.”
(Firm 3, Toronto)
 - “We have commercialization agreements with ten different universities and they are all different.”
(Firm 1, Toronto)

ACCESS TO GLOBAL KNOWLEDGE CIRCUITS: TRADE SHOWS

- 33% of firms in Greater Toronto and 30% of firms in smaller regions said that they attended trade shows
- trade shows are a critical venue for:
 - learning about competitors
 - accessing leading edge technologies and understanding global market trends
 - meeting existing and potential clients
- however, firms suggested that this was a costly activity for which there was little financial support

ACCESS TO GLOBAL KNOWLEDGE CIRCUITS: TRADE SHOWS

- “We go to a trade show, we meet a lot of customers, we scope out the competition and then we come back and work through the leads.”

(Firm 4, Toronto)

- “We need to know everything that is going on on a global basis. So that’s why we spend a lot of money to go to major tradeshows. Now they’re getting so expensive that we go to them maybe every other year, because a major tradeshow is costing \$15-20k by the time we go and exhibit.”

(Firm 3, Toronto)

SUMMARY & CONCLUSION

- Firms rely on broader local and regional assets
 - strength of the local talent pool
 - diversity of local economic activity
- Firms access knowledge through a wide variety of channels
 - Local and non-local knowledge circuits
 - customers
 - specialized research institutions and universities
 - trade shows
 - Distributed and diverse

SUMMARY & CONCLUSION

- Challenges faced in accessing both local and global knowledge circuits
 - Institutional barriers to access local markets (esp. local hospital system)
 - Different practices between universities and firms hinders development and collaboration
 - Access to local venture capital and other sources of financing
 - Difficulty in attending trade shows

IMPLICATIONS FOR POLICY

- Access to financial assistance
- Access to local and global markets
 - Consider more carefully potential of Ontario health care system / hospitals as a customer
- Assist firms in accessing trade shows and other venues to access non-local knowledge pools / information exchange

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