

From Grand Science to the
Hard Sell? 'Engineering'
university-industry networks in
the Southern Ontario auto
industry

Tod D. Rutherford,
Department of Geography,
Syracuse University,
Syracuse, New York 13244-1020
and

John Holmes,
Department of Geography,
Queen's University,
Kingston Ontario
Canada, K7L 3N6

• **SHIFTS IN STATE POLICY TOWARDS UNIVERSITY RESEARCH**

- *"national authorities are reacting to vigorous global competition in high tech not just by 'beefing up national technology policies' but also by changing their basic approach to funding R+D Traditionally governments provided funding for basic research for scientific development with few strings attached. Now however, there is a shift from basic subsidization towards directing funding research in ways to increase government's ability to establish and control research priorities. This has led to reduced autonomy for researchers as governments set time constraints stipulates outcome requirements and defines key priority areas" (Weiss, 2005, "Global governance, national strategies: how industrialized states make room to move under the WTO" **Review of International Political Economy** 732-733)*

- **IN PART REFLECTS LONG TERM DECLINE IN BASIC RESEARCH PERFORMED BY INDUSTRY AS GLOBAL COMPETITION INCREASES**

- *INCREASING EMPHASIS ON DEVELOPING UNIVERSITY-INDUSTRY NETWORKS AS CRITICAL TO REGIONAL DEVELOPMENT (SAXENIAN 1994; WOLFE AND GERTLER, 2003; ASHEIM AND COENEN, 2004; SSTI 2006; EUROPEAN COMMISSION, 2006)*
- *CREATION OF A MORE ENTREPRENEURIAL ACADEMIC CULTURE*
- *NETWORKS SEEN AS LARGELY HORIZONTAL/COLLABORATIVE*
- *BASED ON ARCHETYPES OF SILICON VALLEY, CAMBRIDGE UNIVERSITY AND ROUTE 128*

- *BUT GENERALIZING THIS MODEL FACES CHALLENGES:*
- *IN US DECLINES IN INDUSTRY FUNDING OF UNIVERSITY RESEARCH SINCE 1999*
- *TENSIONS BETWEEN UNIVERSITIES AND FIRMS INCREASING:*
- *“prominent industry and university speakers indicated that negotiations of sponsored research agreements, particularly disagreements over the treatment of intellectual property (IP), were negatively affecting the entire industry-university research partnership in the United States. It was pointed out that US companies increasingly choose to work with foreign rather than US universities, encouraged by more favourable IP rights that foreign universities offer and the strong incentives for joint industry-university research that foreign universities provide”*
National Science Foundation, 2006 “Where has all the money gone? Declining industrial support of academic R+D” Info Brief Science Resources Statistics, September

- *AT THE REGIONAL SCALE INDUSTRY-UNIVERSITY SPINOFFS MAY NOT BE LOCAL AND NETWORK RELATIONS MAY BE ASYMMETRICAL (MASSEY ET AL 1992; MALECKI, 1997; CHRISTOPHERSON AND CLARK, 2006)*
- *FORM OF INDUSTRY-UNIVERSITY RELATIONS CONTINGENT ON PLACE-BASED INSTITUTIONS BUT ALSO SUPPLY CHAIN RELATIONS AND NATIONAL STATE POLICY*

CANADIAN SCIENCE TECHNOLOGY AND INNOVATION (STI) POLICY AND UNIVERSITY-INDUSTRY RELATIONSHIPS

- *MOVE FROM DIRECT SUPPORT OF STI ACTIVITIES IN FEDERAL LABORATORIES TO DIRECT SUPPORT OF EARLY+ APPLIED UNIVERSITY RESEARCH*
- *CREATION OF SPECIALIZED DECENTRALIZED NETWORKS BY FOR UNIVERSITY RESEARCH E.G. NETWORKS OF CENTERS OF EXCELLENCE (NCE)*
- *SHIFT FROM DIRECT SUPPORT (SUBSIDIES) FOR INDUSTRIAL STI TO INDIRECT TAX CREDIT PROGRAMS*

- *UNIVERSITIES PERFORM OVER 30% OF CANADA'S R+D COMPARED TO 19% AVERAGE FOR G7*
- *CANADA'S SHARE OF UNIVERSITY R+D FUNDED BY INDUSTRY IS HIGHEST IN G7 AT 12 % COMPARED TO 5.5% IN THE US*
- *BUT DECLINES IN OVERALL UNIVERSITY INVESTMENT BY GOVERNMENT –ESPECIALLY IN ONTARIO*
- *AND CANADIAN BUSINESS REMAINS LOW R+D PERFORMER*

- ***INNOVATION, RESTRUCTURING AND SUPPLY CHAIN DYNAMICS IN THE NORTH AMERICAN AUTOMOBILE INDUSTRY***
- *AUTOMOBILE MANUFACTURING MORE DESIGN AND KNOWLEDGE INTENSIVE (BELZOWSKI ET AL 2003; SCHAMP ET AL, 2004)*
- *US ALLIANCE FOR TECHNOLOGY AND ENGINEERING FOR AUTOMOTIVE MANUFACTURING ESTABLISHED 2004 – FOR PRE-COMPETITIVE RESEARCH*
- *CONSOLIDATION OF SUPPLIERS-TIER ONE EMERGING AS SYSTEMS INTEGRATORS (SIs)*
- *OEMS INCREASING OUTSOURCING OF ENGINEERING, DESIGN AND R+D TO SIs*

- *CONTEXT OF FALLING MARKET SHARE/PROFITS AND INCREASING COST PRESSURES INFLECT KNOWLEDGE/INNOVATION STRATEGIES*
- *"One of the major challenges knowledge initiatives face is that companies make funding decisions based primarily on the cost reduction potential[which are] viewed as tactical rather than strategic initiatives" (Belzowski et al, 2003)*
- *FORMAL R+D CONCENTRATED IN OEMS AND SI-MOST SUPPLIERS HAVE INCREMENTAL PRICE DRIVEN FOCUS:*
- *"The car companies ultimately determine successful intellectual property, which is evident to the extent that it is incorporated into vehicle designs. Relatively few companies are rewarded for a strategy of original product development. In contrast a company being perceived as being a low cost, high quality "build-to-print" supplier is always valued –products at a lower price is the prime competitive requirement in the industry. (National Forum on Automotive Innovation and Investment, 2002, 5).*

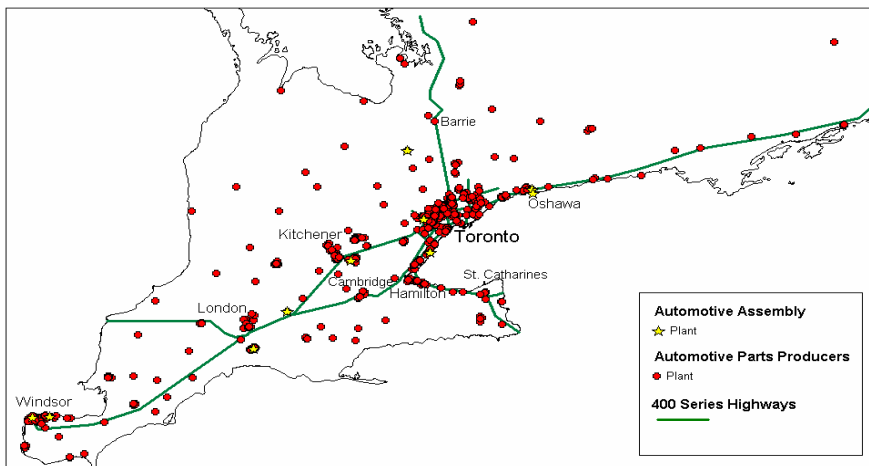
THE CANADIAN AUTO INDUSTRY:

- *EIGHTH LARGEST IN WORLD 2.5-3 MILLION CARS TRUCKS/YEAR (17 PER CENT OF ALL NAFTA PRODUCTION)*
- *ONTARIO NOW LARGEST AUTOMOTIVE PRODUCING JURISDICTION IN NORTH AMERICA*
- *HISTORICALLY LITTLE R+D BUT THIS STARTING TO CHANGE –MAINLY FOR BIG THREE OEMS:*
 - *Daimler Chrysler/University of Windsor Automotive R&D Centre,*
 - *GM Canadian Regional Engineering Centre at Oshawa,*
 - *GM Beacon Project,*
 - *KEY ROLE OF AUTO 21 NCE PROJECT*

UNIVERSITY-AUTO INDUSTRY NETWORKS AND CLUSTER DEVELOPMENT: WINDSOR AND KITCHENER ONTARIO

- EVIDENCE DRAWN FROM PROJECT FUNDED BY SSHRC OF CANADA ON CLUSTERS
- 80 INTERVIEWS
- **Windsor**- +500 plants 50,000 employees
- OEMs –Daimler-Chrysler/Ford
- “world class” Machine Tool Die and Mould (MTM) cluster +150 firms 10,000 employees
- “automotive intellectual capital of Canada” University of Windsor – Daimler-Chrysler R+D Centre
- Five Industry Research Chairs + Auto 21
- **Kitchener** – smaller +100 plants smaller 10,000 employees
- OEMs - Toyota
- Lower profile MTM
- University Waterloo – strong industry links generally
- Co-op program
- WATCAR auto related research consortium

All Automotive Parts Plants, 2002, Southwestern Ontario



DEVELOPING INDUSTRY-UNIVERSITY NETWORKS

- **WATERLOO**
- *activity comes right at the grassroots level [with the] faculty member who either has had a relationship with a company or companies before coming here, or develops one while here because graduate students have moved off into the particular industry and now continue a relationship with their former advisor. We have, because of the co-op program, students out in industry, so that provides a two-way form of activity; they come back to the classroom with some ideas and concepts they've seen and talked to their prof. about it, at the same time, they're in the industry, they may carry to the industry sort of comments of what they've seen in the classroom and what their prof. is involved in so that they can generate some interest that way (Research officer, University of Waterloo July 2004)*
- *Waterloo is a very, very applied place. I mean we have strong theoretical people, we have strong blue sky kind of people... but we actually have a real major core of activity which is industrial. I think the co-op does reflect back on the culture in the place, because we have so much industry interaction. (University researcher University of Waterloo July 2004)*

- **WINDSOR:**
- *the university had always a very high quality but rather small engineering program and for some reason the outreach between and the links between the university and local industry had always been on a rather small scale and somewhat isolated. Every once and a while somebody would do something with local industry but often not (University of Windsor engineering researcher1 March 2005)*
- *Yves Landry (Chrysler) who traveled around the world and said what is the future for this area if we want to capture investment in the auto sector? And it was Windsor shouldn't be the manufacturing capital but Windsor should be the intellectual capital –that's where all the smart guys are so what we've got to do is more R+D more sort of involvement in this –it was Landry and the then president of the university and I think they sort of put a team together and they went to the states, they went to the UK, they went to Germany, and came back and said these are the best practices what seems to work --this is how we've got to move forward. I think that was the catalyst. (University of Windsor engineering researcher2 March 2005)*
- **THUS WATERLOO EMERGED FROM A CLUSTER WHILE WINDSOR HAS ATTEMPTED TO LINK WITH A PRE-EXISTING ONE**

KEY SHIFTS IN STATE INNOVATION POLICY

- *NSERC peer review processes did not look very favourably upon industrial research –they wanted to see grand science and doing something with industry was seen as low quality, weak, not worthy of peer reviewed funding....Now since then NSERC has instituted a number of policies – industrial research chairs, industrial research programs of all stripes and varieties that are intended to foster this environment and get them going....That's why Auto 21 has taken the position that we place a high value on the level of interest from the auto industry. The fact that a university professor thinks it's a great idea doesn't necessarily make it a worthwhile idea for us. The fact that somebody in industry says it's a great idea –that's what makes it a great idea. (University of Windsor engineering researcher 1 March 2005)*

....I think the creation of this national program has elevated the profile of University research in automotive significantly. I even get a lot of the US companies, "what is this Auto 21 thing ?" And let's face it, the federal government and the provincial government in the last 5-8 years has been a real bonanza of funding. It's sort of golden days in terms of the amount of dollars that are around for, and it is all tied to industry leverage, I mean, every big program that I can see has that requirement. So that being the case, companies see that and they want a piece of it (University of Waterloo engineering researcher, July 2004)

AND IN OEM R+D STRATEGIES...

- *What I do believe, is that that it is the longer-term research they [the OEMs] are trying to farm out and that's where we come in ... [but]... It's such a lean industry. In some ways they are not a lot of fun to work for. We've even talked to one OEM in particular who tells us, that they are actually audited on their overhead costs, and they are not even allowed to do research anymore. It is a cost, I don't know if they are just giving me the line or not, on why they don't want to give us much money. But, literally that particular company is telling us that ... (University of Waterloo researcher, July 2004)*

Intellectual Property Issues

- *we have got a lot of formal relationships now –much more formalized than they used to be a lot more definedthe reason being is that particularly in the auto sector which is very competitive is that they are very keen on protecting their IP. That is a really big issue to them and we've learned that simple things like if you say can we come talk to you [means that] we will sign your non-disclosure agreement and you can sign ours. (University of Windsor Engineering Researcher 2, March 2005)*
- *that's a really nasty issue --- a really difficult issue is IP with respect to universities This university has the very intelligent policy that the professor owns it [IP] which is identical to the Waterloo policy and the universities that don't have that policy I can tell you right now are running into very serious issues and a lot of industry is saying we won't work with them –we don't care how expert they are –it's not worth it. If we can't control it and benefit from the IP the heck with it –we'll get it somewhere else.I know there are Auto 21 projects that have gone in one direction rather than another direction specifically because of university IP policy –to be candid with you it is some of the largest universities which have the most unworkable policies and they are now beginning to suffer (University of Windsor Engineering Researcher1 March, 2005)*

IP

- *To an OEM it [IP owned by the researcher] is absolutely an unattractive feature. In fact, it gets in the way. Companies do not typically like to deal with individuals, they like to deal with institutions, because there is a certain predictability with institutions [and] perhaps not faculty members....., I think the larger corporate institutions, don't like that setup to the point where there are several companies we are currently contracting with [that] we have actually been given the choice of signing a master agreement where we give up that IP right. We sign it back to the institution. (University of Waterloo Engineering researcher, July 2004)*

But what do OEMs really want?

- *we have a special working relationship with the university –in general its about providing future engineers and we work with university-co-op programs and most of our co-ops are engineers. We also have some industrial metal research at the university and so for the most part it is the traditional mechanical engineering program and the graduates that are meeting our needs (Windsor based OEM, October, 2003)*
- *Some of the groups we deal with, want to view research almost as technical marketing, they never tell us that, but I recognize that a lot of what we do could be construed as technical marketing support, cause they want to be able to show that they have a certain level of expertise in what's coming down the road, so whether there is a product intent on any of our programs exactly is sometimes questionable as opposed to just general expertise. That is not always the case, but often. (University researcher, Waterloo July 2004)*
- *All the agreements are due to the fact that they want a steady supply of graduates and that's what it really comes down to... As somebody said about Auto 21, if you look at if you look at the total money spent on R+D it's equivalent to about 45 minutes worth of research in the States, so really research is a vehicle for us to turn out a certain type of graduate (University of Windsor Engineering Researcher2, March 2005)*

• **Local linkages: relatively weak or OEM focused:**

- *SMEs --They are a real tough nut. I've done some small direct contracts. You know they own everything IP wise, they pay for everythingand, [it's] hard work,...we really earned our money with those projects., I don't want to be quoted as criticizing that group, but I mean, they're long term picture is nothing like an OEM or a materials company. (University of Waterloo researcher July 2004)*
- *I think [in university engineering] there is a lot of one-upmanship that goes on at the intellectual level and a lot of peer pressure –believe it or not-guys don't want to say something for which they can be criticized.I found that in our Industry especially , I don't know of one more shop owner that graduated with a business degree and chose mould making as a profession. They are all guys who come up from the floor. So a lot of shop owners can be intimidated by higher education (Windsor MTM owner October 2003)*
- *the university is a strange thing.I'm not sure where the link with industry is..... I go to the mould makers meetings ...and this is where I think people at the university should be getting involved. They don't attend these meetingsYou get to meet and network with people and I think that's where they should be networking. I guess the sexy companies are the Daimler-Chryslers and so forth, and it's nice to be seen with these people, but if you want to start working with the smaller guys you are going to have to network with them. (Ontario government Ministry of Enterprise, Opportunity and Innovation, Windsor August 2003)*

- *Locally, it [relationship with firms] is almost zero, but not quite. There's a little bit of interaction, mostly because the expertise base here, is actually Tier 1,... There is Toyota, but there is no research activity out of that, it's a plant basically there is not really research activity there.... I've seen some things at some companies that were Tier 1's. I do not want to say that they were not innovative at all, it's just that it doesn't happen to be sitting in Kitchener Waterloo right now ... (Waterloo engineering researcher, July 2004)*
- *The problem with working with smaller companies is they're not easy to access them as a receptor ...but they are doing innovation all the time but it just may not look like innovation to an outsider. Also the kind of innovation they do is not typically the sort of thing university regard as worthy of their time. If you figure how to take two seconds off the cycle time of your injection molding machine –how do you write a paper on that? Well a lot of faculty people take the position that its not worth looking at and that's driven by the reward system –the peer review system. (University of Windsor engineering researcher1, March 2005)*

• **Challenges to Sustaining University-Industry Networks**

• **Culture Clash:**

- *the dean has now mandated that he wants all the engineering faculty to spend one day/week in industry doing something. I don't know how he's going to get some of the older faculty to do that. If you get young kids in there, you can tell them anything and most of the time, they'll do it. (Industry-University liaison Windsor August 2003)*
- *I think what we've adopted here is more the German model where the interface between the university and the for the want of a better word the industrial engineers is not as discrete and rigid – now that has not been easy because it's a culture change [A professor] might be a university prof but when he is the Daimler Chrysler chair he might lead a team in industry and we've got about four-five more examples of that now, but as they say moving a university is like moving a cemetery –its not easy (University of Windsor engineering researcher 2, March 2005)*

- *.... the personal reward within a merit structure has not been sorted out yet. It's a difficult task to do that because universities still by and large want to have a commonality in terms and conditions of employment or the collegial or the Communist manifesto approach ...but ...most of the time those rewards are going to be financial or a reduction in other work—that's about the only things we can do but you obviously got to have some stops and checks in the system –the reason why you need the stops and checks is if I come to university particularly within the Canadian system and think I'll be a full time researcher then my feeling is don't come then. Go to a full graduate research school like the University of Chicago (University of Windsor engineering researcher2, March 2005)*
- *You know if I don't have a relationship with an OEM, I am still going to get paid, and I'm still going to pay the mortgage (University of Waterloo, engineering researcher, July 2004)*

what happens to teaching/basic research?

- *....with the companies that understand what Universities can do, it's never really a problem, because they have an expectation that is reasonable and if not we let them know [but] Auto 21 hasa genuine interest to see things done at the product level, which is interesting, because that immediately becomes more short term and you have to decide whether we should be doing short term work in the University or not. Some groups are capable of it, but certainly student based work is rarely in my opinion able to do that, and that is part of what we do right is the training component. (University of Waterloo engineering researcher, July 2004)*
- *....if you really want to do [basic] research in my opinion at a university you've got to do some contract research to produce funds so you can do the stuff you really want to do so you've got to work closely together with the local industry (University of Windsor Engineering Researcher 2, March 2005)*
- *Part of the problem frankly is that a lot people in Canadian academe don't have a lot of extra time –we teach more than academics in other countries and that is a very serious issue ...mostly it is we don't have the critical mass—we don't have enough people on the ground and enough equipment on the ground to do the work (University of Windsor Engineering Researcher1 March 2005)*

Overall lack of government resources to higher education...

- *It is two different cultures that don't understand each other very well. But they realize there is a need for symbiosis, but they frustrate one another. This is an area that needs dramatic improvement. Government policy today for R&D and innovation is to get private industry to work with educational institutions and government research centers to develop innovation strategies and agendas. But what industry tells us is that educational institutions and the research establishments are ill-equipped to meet their needs. They either don't have the skills, the resources, or they can't meet the timelines or the cost lines....The universities tell us that they would also like to participate, but they are resource constrained – faculty have to do teaching and publications, so there is not as much time available for interactive R&D partnerships with industry. But that is what government is rewarding, but it is not going far enough in creating the conditions that would allow those partnerships to flourish. If government policy is to build innovation around expertise at universities, and that's the way the tax credits and NSERC programs are, they are going to have to build up the capability of the universities to fulfill that role – and it's not happening. All it is doing is frustrating all the parties with a few notable exceptions where it is really working well. (Windsor Local Economic Development Officer, August 2003)*

Conclusions

- *Development of university-industry networks in Waterloo/Windsor differs from archetype models*
- *Reflects shifts in industry supply chain and state innovation strategies*
- *Few spin-offs --links mostly in R+D and skilled graduates to large OEMs*
- *Relations in some cases more collaborative but also more complex – especially over IP*
- *Local linkages to SMEs very weak*
- *A more entrepreneurial culture but still bounded by university security and academic reward system*
- *Increased resources to industry-university research by governments may be contradicted by fewer investments to support teaching and other research*