

An Innovation Economy Strategy for Metro Milwaukee

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This white paper represents one part of the larger “Milwaukee 7” economic strategy initiative. While descriptive of current state of the innovation economy in Metro Milwaukee, it also proposes broad new program initiatives for the region that, if launched together over the next five years, would transform the regional innovation economy. This paper has been vetted through the processes of authorship, editing, and round table discussions; and is *(prospectively)* endorsed by the following individuals (presented alphabetically):

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Summary

Metro Milwaukee ranks 48th out of the 50 largest cities in the United States on per capita measures of the innovation commercialization index. This index is derived from three simple measures: SBIR/STTR grants, venture capital investment, and IPOs. More importantly, it reflects the activity level of an entrepreneurial culture that is engaged in an innovation economy continuum: generating ideas, which turn into innovations, which are incorporated in local startups, funded with seed, early and later stages of venture capital, to grow successfully to become public companies. When this deal flow works well – as it does in a few metro areas in the US – it will generate wealth, jobs and a better standard of living.

This deal flow continuum is disconnected in Metro Milwaukee. The easiest and most logical place to direct efforts to develop deal flow is at the earliest stages. Metro Milwaukee research institutions have a unique strength in biomedical research, which represents a vast field of developing knowledge and opportunities for developing innovations that are appropriate to incorporate into startups and fund with venture capital. In terms of federal funding of civilian research, the majority is focused on biomedical and health applications.

Metro Milwaukee research institutions currently attract approximately \$150 million a year in research funding, led by the Medical College of Wisconsin. The research institutions have shown an important willingness to collaborate in research activities and in the TechStar initiative, which has enabled the institutions to establish leading metrics for spinouts per research dollar. As generators of innovative ideas, research institutions are an essential component of Metro Milwaukee's future economy. However, in comparing comparable metro areas, we conclude that the research expenditures of this community should be expanded by a factor of 2 to 3 times what they are today.

However, academic research by itself will not increase the innovation commercialization index of the metropolitan area; it must be tied to an entrepreneurial, smart and comprehensive system of moving inventions – in the form of patented technologies – into the private sector. The economic development value of licensing intellectual property to out-of-state companies is negligible; however, the ability to push the same intellectual property to local startups has the effect of beginning the kind of deal flow that has been the source of significant wealth creation for some of the strongest metro economies in the U.S. Metro Milwaukee should continue to support and develop the kind of technology transfer programs at our research institutions that can push intellectual property to startups.

Innovations require funds to translate to new ventures. Metro Milwaukee must develop continuing sources of research funding to stimulate collaborative, interdisciplinary, translational research. Finally, Metro Milwaukee needs to develop local seed fund sources that enable the formation of companies and the recruitment of skilled entrepreneurs to the region.

With this background, which is developed further in this innovation economy whitepaper, the authors recommend developing and supporting the following strategic initiatives:

- 1. BTA Endowed Chairs Program.** Growth in research and growth in the innovation commercialization requires leaders. The research institutions should be funded to hire new interdisciplinary and entrepreneurial faculty members. The goal is to hire 4 new lead investigators per year in BTA endowed chairs starting in 2007 and lasting through 2011. Anticipated cost: \$16 million per year for five years = \$80 million.
- 2. Follow-on Funding for Collaborative Grant Program.** The BTA Collaborative Grant Program grows academic research in Metro Milwaukee and provides funding for the kind of translational research that creates startup opportunities. Planning for the second phase of the collaborative grant program should begin now for distribution of funds between 2007 and 2011. Anticipated cost: \$14 million per year for five years = \$70 million.
- 3. Develop Institutional Tech Transfer Programs.** The areas technology transfer programs need continuing support of resources that push university research to spinouts. Tech transfer programs which produce quality startups are Metro Milwaukee's most promising source of deal flow. Metric goal: at least 8 spinouts for every \$100 million in research from 2007 through 2011. Anticipated cost: \$800,000 per year for five years = \$4 million.
- 4. Support for SBIR/STTR Grant Coach.** The SBIR/STTR program is one of the largest funds for translating research to startups in the world. The Metro Milwaukee area should maintain funding for a skilled SBIR/STTR grant coach that is well-versed in both science and business, who can help develop a strong pipeline of SBIR/STTR grants. Metric goal: \$15 million in new SBIR/STTR funding between 2005 and 2010. Anticipated cost: \$150,000 per year for five years = \$750,000.
- 5. Establish Metro Milwaukee Sources of Seed Capital.** To address the dearth in seed funds that will enable us to recruit skilled entrepreneurs to startups, we need to establish Metro Milwaukee sources of seed capital. Possibilities should include: university funds, state funds, angels, seed funds, and industry funds. Metric goal: half of all research institution startups capitalized with at least \$250,000 in seed funding from 2007 through 2011. Anticipated cost: \$10 million.
- 6. Develop Plans to Establish Shared Campus.** An envisioned shared campus will be required if Metro Milwaukee finds the resources to pursue the strategic initiatives listed above. Presuming the initiatives go forward, we should establish the following goals for the shared campus:
 - a. Grounds identified: by mid 2006
 - b. First building started: by beginning 2007
 - c. First building established by 2008

The strategic initiatives outlined above amount to a cumulative anticipated cost of \$165 million over the next 5 years, or \$33 million per year. Costs for the shared campus have been excluded. Financing a shared campus will be made possible with growth in both research programs and the innovation economy.

However, it should be emphasized that this white paper goes beyond a rational analysis of the current situation; it is linked to an aggressive program plan. It is important that Milwaukee is restored to its former status as a giant of industry and innovation. Since its founding in the 19th century, Milwaukee has witnessed a long line of private and public entrepreneurs who have created quality government, industrial excellence and a fine place to live. Over the past 25 years, some of that has come undone. This initiative, along with others in the metro area, could help create a new culture of innovation, progress and civic excellence.

Introduction

Goals and Purpose of this White Paper

This document – known amongst its creators as “the white paper” - has been the work of a small group of concerned citizens in the Milwaukee metro area. All of the authors are involved in one way or another in the fields of economic development, technology development and commercialization, research, regional planning, finance or new enterprise development. The paper has also benefited from input by experts elsewhere in the country who have studied or participated in the building of regional innovation economies.

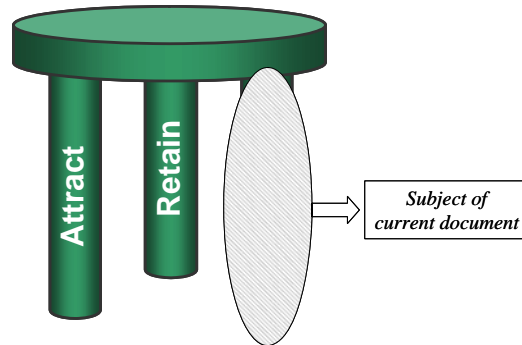
The goals to be served by this document are simple:

- To educate and inform a wider swath of stakeholders – including the general public – about the workings of what has been called the innovation economy, as well as to articulate the potential benefits for greater Milwaukee in incorporating an innovation economy mindset and strategy into its own future planning and actions
- To provide a benchmarking assessment of how well Metro Milwaukee is doing in terms of building a high knowledge, technology-based innovation economy
- To pose a set of action recommendations via which Metro Milwaukee could increasingly incorporate elements of the innovation economy into its economic development strategy

The current document departs from previous strategic planning efforts in two ways. First, we focus on Metro Milwaukee rather than the State of Wisconsin. The latter is well served with such efforts as the Wisconsin Technology Council, the 2020 Report, and the Governor’s economic growth initiatives. However, the Metro Milwaukee area is a unique economy in itself, which requires its own strategic vision and this paper intends to address the Metro Milwaukee economy specifically.

Second, in this paper, we focus more on strengthening the economic development infrastructure to grow new, technology-based companies that will be staffed by high skill, high-wage employees, as opposed to attracting established companies from elsewhere. Nonetheless, the strategies advocated in this paper are quite compatible with supporting established companies in Milwaukee that are knowledge-based, innovative and growing high-skill, high-wage jobs. In other parts of the country, such companies have been very important as leaders in fostering university-industry cooperative research, in functioning as beta sites for new technologies being commercialized, and as being early investors in startup ventures. In addition, we believe that there is strong potential for convergent innovations in the region, where for example, the development of new medical devices may draw from new advances in biomedical science, as well as existing strengths in advanced materials and precision manufacturing. An overall economic development strategy is represented by a three-legged stool: where one leg represents strategies to retain and support established companies, one leg represents strategies to attract established companies from outside the region, and one leg represents strategies to grow new companies (see diagram).

Three-Legged Stool of Economic Development



This paper focuses primarily on the latter, although it should be understood that launching new companies often involves creative partnering between established companies and new startups, and there is great potential for this in Metro Milwaukee.

As a first step, let us describe what we mean by an “innovation economy,” particularly how it differs from the durable goods manufacturing economy that has been the traditional bulwark of greater Milwaukee and indeed the entire upper Midwest.

Ingredients of the Innovation Economy

What we are calling the innovation economy has been labeled by others as the “new economy” or the “information economy.” We think that those terms are somewhat confusing. For example, the notion of an information economy seems to imply that all of its elements are tied to computers, computer science and associated hardware and software. While information technologies have indeed been an important part of the developing innovation economy worldwide, they are being supplanted and supplemented by advances in areas such as materials, biotechnology, sensors, transportation, energy systems and a host of fields. In fact, one of the more interesting characteristics of the innovation economy is the “convergence” of different fields of science and technology into novel applications. The authors have also shied away from the “new economy” terminology. The new economy nomenclature has too often been tied to the agendas of particular political parties or industry interests, and it ignores the fact that many of the companies leading the charge in growing an innovation economy have been around for years. GE Medical, with a strong presence in the metro area, is an illustration. What is really new about the innovation economy is the extent to which it setting the pace for wealth creation and regional development throughout the world and accounting for an ever-larger share of US commerce.

What then are the defining characteristics of the innovation economy? Most students of the field suggest various admixtures of the following:

- The innovation economy is characterized by products and services that have origins in cutting edge research and development. Intellectual property (IP), in the form of patents, is often a key relative advantage.

- The innovation economy has close links to research institutions, particularly major universities, which are sources of both new IP as well as graduates who have advanced training in the newly emerging areas of science and technology.
- Compared to previous eras, much of the cutting edge technology in the innovation economy is developed and commercialized in smaller enterprises and startups, which seem to have more organizational and technical flexibility to exploit new technologies.
- The innovation economy relies more on new forms of capitalization including venture capital (VC), angel investors, and various forms of public-private partnerships.
- The innovation economy is national and global, and success demands the capacity to master trade in high-margin goods. Globalization, in turn, has been facilitated by advances in information systems (e.g., the internet) and transportation technologies.
- The innovation economy has raised the bar for employees' skills and educational levels, with the entry-level norm being some postsecondary coursework, certifications and/or degrees. The number of baccalaureate and graduate degrees in the workforce of the innovation economy is notable.
- The innovation economy in the US is highly regionalized, with some states and metro areas having attained national and international standing therein, and many laggards trying to catch up. Most metro areas that have succeeded in the innovation economy have involved extensive public and private partnerships, new public policy directions, major long term investments of public funds and dedicated leadership. The Research Triangle Park region in North Carolina, greater San Diego and its CONNECT program, the state of Pennsylvania with its Life Science Greenhouse initiative¹, metro Atlanta and the Georgia Research Alliance, and Silicon Valley are illustrative.
- The innovation economy is heavily reliant on key innovators – inventors, researchers, investors, and entrepreneurs – who are very much in demand and highly mobile. Those states and regions that can retain and attract such individuals will thrive; those who suffer from “brain drain” will not.

Given these generally agreed-upon understandings of what constitutes an innovation economy, how does Milwaukee measure up in 2006? This question, as well as trying to identify the key challenges that the metro area needs to address, will be the focus of the next section.

1 · With the leadership of Governors Hodges, Sanford, and Hunt, the North Carolina created a blue print for the Research Triangle, and in 1981 launched the North Carolina Biotechnology Center, a major strategic planning resource and catalyst for economic development that now receives \$8 million per year in funding;
 · UCSD President Richard Atkinson established UCSD Connect in 1985 and now through BIOCOM, an association of life science companies, the region continues to develop 5 year strategic development plans;
 · Beginning in 1999 with the leadership of then Governor Tom Ridge, Pennsylvania committed \$11.3 billion of its national tobacco settlement to health- and life science-related research and commercialization initiatives -- current Governor Mark Schweiker, continues to support this initiative saying it will help the Commonwealth become “the best place in the world to build and grow life science businesses.”

Benchmarking Milwaukee on Innovation Economy Indicators

As regional economic development leaders have become more understanding of the promise and features of the innovation economy, a parallel activity has ensued which constitutes comparative or “benchmarking” analysis of nations, states, metro areas, universities and industries. The basic approach is fairly straightforward: First identify statistical indices that directly measure (or are proxies thereof) various features of the innovation economy. Second, look at an array of representative communities (or states, or universities) and see how they stack up. In some cases the indices are direct measures of outcomes, such as average number of new startup companies, patents and so on. In other cases, the indices are input variables to the innovation process (e.g., university research expenditures).

The analyses presented below include several types of indicators. It should be emphasized that these data are by no means a complete statistical picture of where Milwaukee is relative to the innovation economy. They are more suggestive than comprehensive; a complete statistical analysis would go beyond the purposes of this white paper, and encompass many more pages of text and tables.

Indicators of the Innovation Economy I: Commercialization and Finance. Metro areas are potentially well suited to commercializing technological innovations, because knowledge is generated, transmitted, and shared more efficiently in close proximity. A metro area with a top biotechnology cluster will have more innovations, and fewer will escape to other regions, or at least, they will do so at a slower rate. However, the successful commercialization of technological innovation into products that succeed in the marketplace is highly contingent on pulling together creative combinations of early stage capital to support the development process.

Joshua Rosenbloom, professor of Economics at the University of Kansas, made an assessment of several financial variables that capture this activity.² He studied 50 metro areas in the US and used SBIR/STTR grants, venture capital investments, and initial public offerings (IPOs) as good proxies for the financial dynamism that is seen in the innovation economy.

Parallel analyses support his choice of metrics. The sector that grows through new company startups and venture capital is a robust locus for employment growth in the US. According to the National Venture Capital Association (NVCA), venture capital backed companies employed more than 10 million American workers and generated \$1.8 trillion in sales in 2003. Employment in venture backed companies jumped by 6.5 percent between 2000 and 2003, while national private sector employment shrank by 2.3 percent. In particular, strong employment gains were recorded in the heavily ventured medical sectors between 2000 and 2003.³

The table below summarizes his results for the 50 metro areas. As can be seen, Milwaukee fares rather poorly. This benchmarking analysis places Metro Milwaukee 48th out of 50 on the composite indicator. This should be a wake-up call. Metro Milwaukee and state economic

² “The Geography of Innovation Commercialization in the United States during the 1990s,” Joshua L. Rosenbloom, 2004. Paper still in work at: <http://people.ku.edu/~jrosenbl/workingpapers/innov5.pdf>

³ <http://www.nvca.org/>

leaders should have good reason to focus attention on this component of the innovation economy in the Metro Milwaukee region.

Index of Innovation Commercialization

MSA/CMSA	Rank	SBIR/STTR Grants per Capita	Venture Cap Funds per Capita	IPOs per Capita	Innovation Commercialization Index
San Francisco	1	36.1	100.0	100.0	100.0
Boston	2	100.0	39.3	44.2	77.7
Denver	3	62.0	28.6	40.1	55.3
San Diego	4	56.6	22.7	37.9	49.7
Austin	5	34.4	34.7	32.0	42.8
Washington DC	6	44.3	13.7	23.7	34.6
Raleigh	7	29.5	21.7	28.1	33.6
Seattle	8	23.0	16.8	28.2	28.8
Salt Lake City	9	22.0	7.5	19.6	20.8
West Palm Beach	10	2.0	8.1	38.3	20.5
Minneapolis	11	14.7	8.7	23.6	19.9
Philadelphia	12	16.3	7.5	18.9	18.1
New York	13	10.0	9.7	22.5	17.9
Los Angeles	14	18.8	7.4	15.1	17.5
Atlanta	15	10.1	10.6	20.3	17.3
Houston	16	6.1	4.9	29.3	17.1
Hartford	17	20.2	6.0	14.1	17.1
Dallasa	18	3.8	10.1	20.4	14.6
Pittsburgh	19	12.1	5.8	14.1	13.6
Nashville	20	4.8	7.3	19.0	13.1
Buffalo	21	15.7	1.8	11.4	12.2
Portland	22	8.0	8.1	11.8	11.8
Kansas City	23	3.7	3.3	19.6	11.3
Charlotte	24	3.0	4.9	17.8	10.9
Miami	25	1.7	5.3	18.1	10.6
Orlando	26	13.2	5.2	6.1	10.4
Louisville	27	5.1	2.3	16.3	10.0
Phoenix	28	8.0	4.3	11.3	10.0
Chicago	29	4.7	4.8	13.8	9.9
Columbus	30	12.2	4.2	6.5	9.7
Detroit	31	11.4	1.3	9.8	9.6
Cleveland	32	14.3	2.2	5.7	9.4
Rochester	33	7.7	5.1	9.1	9.3
St. Louis	34	5.5	6.0	10.3	9.2
Indianapolis	35	2.2	2.0	17.4	9.1
Tampa	36	2.7	2.7	15.3	8.7
Cincinnati	37	11.1	2.1	6.7	8.5
Greensboro	38	5.3	1.4	10.7	7.3
Birmingham	39	5.8	2.3	9.2	7.3
New Orleans	40	2.8	3.2	7.5	5.7
San Antonio	41	8.2	1.0	4.2	5.7
Sacramento	42	5.8	3.5	3.7	5.5
Norfolk	43	8.3	0.4	4.3	5.5
Providence	44	7.8	1.5	2.8	5.1
Oklahoma City	45	3.5	1.5	6.2	4.7
Jacksonville	46	0.0	1.8	9.1	4.6
Memphis	47	1.5	2.2	5.9	4.0
→ Milwaukee	48	2.4	0.8	5.9	3.8
Grand Rapids	49	1.7	0.2	6.5	3.6
Las Vegas	50	0.7	0.1	2.1	1.2

Indicators of the Innovation Economy II: Academic Research. Academic research and development has become one of the key drivers of regional economic growth. Metropolitan areas that have academic institutions performing large amounts of R&D are more likely to attract and grow technology companies, as exemplified by Boston with its linkage to MIT and Harvard,

the San Francisco Bay area that is home to Stanford and two University of California campuses, and the Research Triangle Park area of North Carolina that hosts Duke, North Carolina State and the University of North Carolina. As reported recently by the Wisconsin Technology Council, academic R&D is an integral part of the innovation economy, with contributions in the form of patents, new commercial products, skilled employees, new companies, job creation, and tax revenues.⁴ The Association of American Universities concluded that there is an economic multiplier of 36 jobs per \$1 million spent on academic R&D.⁵

Using available and comparable data for 2003, Metro Milwaukee had roughly \$150 million in academic research expenditures. Of this, the Medical College of Wisconsin had the largest portion, at approximately \$109 million, followed by UW-Milwaukee with \$27 million, Marquette with \$11 million, MSOE with \$2.5 million, and UW-Parkside with \$0.5 million.⁶ Between 1998 and 2003, Metro Milwaukee research institutions have shown significant growth in research spending: MCW – 94%, UWM – 31%, Marquette – 68%, MSOE – 44%, and UWP – 200%.

There is great diversity among the individual Metro Milwaukee research institutions: a medical school, a dental school, a rich spectrum of engineering disciplines, technical colleges, clinical programs, biotech programs, three business schools, a law school, and collaborative programs with regional hospitals and state businesses. Metro Milwaukee is home to some of the most advanced basic research accomplishments, particularly in the areas of: functional MRI, systems biology, molecular genetics, bioinformatics, functional genomics and proteomics, rehabilitation engineering, therapeutics, medical diagnostics, water science, and cardio vascular science.⁷

While Milwaukee is beginning to show significant growth in academic research expenditures, it has a way to go to be nationally or even regionally competitive. Typically, larger metropolitan areas with several research institutions inside their urban boundaries lead their states in per capita R&D spending. The table below represents several metro areas in the Midwest with similar populations and their respective per capita R&D spending relative to their state levels based on comparable numbers from 2001.

Per Capital R&D Spending for Selected Metro Areas Compared to State Levels

MSA (Metro Statistic Area)	MSA Population	MSA Institutions	MSA 2001 R&D Dollars	MSA Per Capita R&D	State Per Capita R&D	Delta	Delta %
Pittsburgh	2,400,000	3	\$496,000,000	\$207	\$136	\$71	52%
St. Louis	2,700,000	4	\$450,000,000	\$167	\$120	\$47	39%
Minneapolis	3,000,000	5	\$465,000,000	\$155	\$93	\$62	67%
Cincinnati	2,000,000	3	\$207,000,000	\$104	\$87	\$17	19%
Cleveland	2,100,000	4	\$212,000,000	\$101	\$87	\$14	16%
Metro Milwaukee	1,500,000	4	\$117,000,000	\$78	\$132	(\$54)	-41%

As can be seen, Milwaukee ranks at the bottom of this comparison group of cities on both a measure of academic per capita, as well as a measure of the extent to which the metro area

⁴ The Economic Value of Research and Development in Wisconsin, September 2004, by the Wisconsin Technology Council.

⁵ www.bea.gov/regional/rims/brfdesc.cfm

⁶ <http://www.nsf.gov/statistics/nsf05320/tables.htm>

⁷ A recent, more comprehensive report of areas of excellence in Metro Milwaukee academic R&D has been developed by Bill Hendee at the Medical College of Wisconsin; whendee@mcw.edu.

dominates the state R&D figures. In Wisconsin, most academic research is still concentrated in Madison. In other states, major metro areas have a greater concentration of academic research and a leg up on competing successfully in the innovation economy. For example, Pittsburgh is the home to Carnegie-Mellon University and the University of Pittsburgh. Minneapolis is the location of the main campus of the University of Minnesota. Looking nationally, metro San Diego is the home of the University of California at San Diego and San Diego State University, which account jointly for over \$700 million in research.

There is one other area in which Metro Milwaukee research institutions have made significant progress. They are active collaborators with one another and increasingly with industry. There are numerous joint research and education programs and many research faculty members that are shared between institutions. Such programs include the Functional Imaging and Biomedical Engineering Programs shared between MCW and MU; the Medical Informatics programs between MCW, MU, UWP and MSOE; and the Medical Informatics Program between MCW and UWM. The institutions also collaborate via TechStar, a technology transfer and business venturing organization.

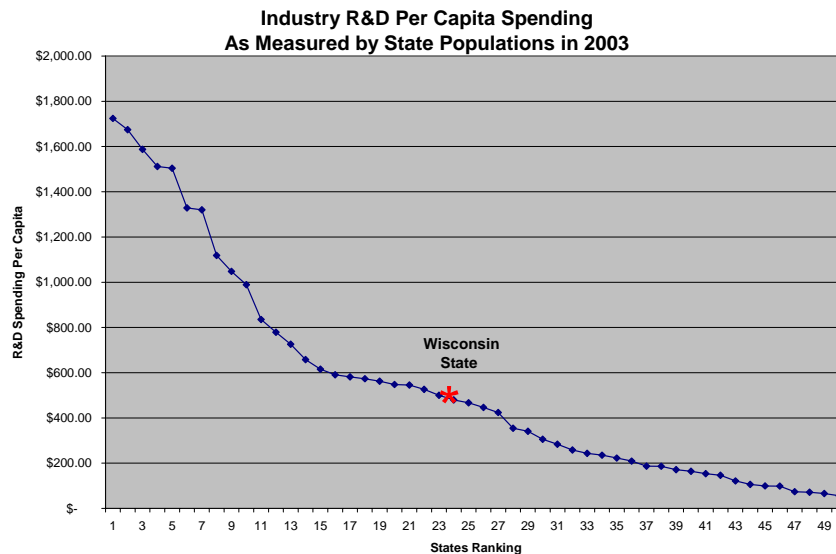
In Metro Milwaukee, MCW is a clear early leader in academic R&D, but MCW's spending levels are far short of the level needed to bring Metro Milwaukee to comparable metro areas. To achieve more competitive levels of academic R&D spending in the city of Milwaukee, and to give a breadth and depth in unique areas that support both MCW and a developing metro economy, R&D spending levels at UWM should be above \$100 million per year – roughly triple current levels. Given the importance of academic R&D in the tech-led economic development continuum, improving R&D talent and spending levels should be a clear imperative for Metropolitan Milwaukee and the state of Wisconsin.

There are limiting factors that should be addressed in growing Metro Milwaukee's academic R&D. For example, while student count among the Metro Milwaukee universities is almost identical to UW-Madison, there is a much greater emphasis on research-focused graduate training at Madison. Moreover, the academic research in Metro Milwaukee is parsed among five schools with very different missions, histories and research traditions (or the lack thereof). While there are islands of specialized research talent in each school, there are relatively few conduits to engage one another in inter-institutional research projects and major initiatives.

There are also significant historical disparities between Madison and Milwaukee in the allocation of state financial resources to support the development of interdisciplinary R&D infrastructure in each region. Additionally, within the UW System, there are wide disparities in the distribution of operating funds. Though both Madison and Milwaukee schools are research oriented, operating funds for Madison are \$28,659 per student, but for Milwaukee funds are \$17,719.⁸ If Milwaukee were allocated the same per student operating funds as Madison, operating funds to Milwaukee would be increased by over \$114 million per year. Alternatively, and perhaps more realistically, if UWM could “enrich” its support formula via incentives for increases in research and graduate training, the support and performance gap could perhaps be closed more rapidly.

⁸ <http://www.legis.state.wi.us/lab/reports/04-10full.pdf>

Indicators of the Innovation Economy III: Industrial Research. While the importance of academic research cannot be overemphasized, by itself the research university cannot drive a robust technology sector. No metro area or state has yet succeeded in being competitive in the innovation economy without having a strong base of industry research, and several have failed. For example, the Research Triangle Park area of North Carolina did not really take off until IBM and several biomedical companies established themselves in the region. Moreover, the presence of those companies had a twofold impact: it not only provided hundreds of high-paying, high skill jobs, but also functioned as a seed bed for entrepreneurial ventures and startup companies. In contrast, states such as Louisiana, despite hosting institutions such as Tulane and LSU have experienced great difficulty in building an innovation economy in what has historically been a low wage, low tech industrial base, except for the oil industry in the Gulf.



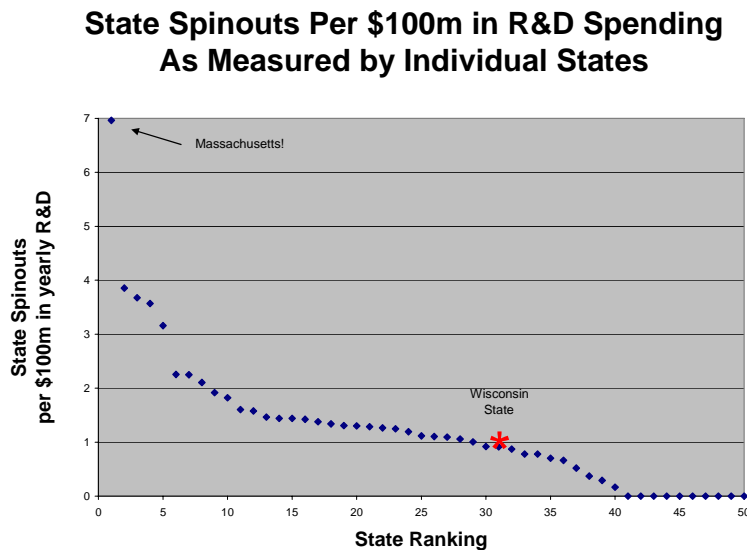
The picture for Wisconsin and Milwaukee is somewhat mixed on this score. At a state level, Wisconsin ranks near the national median (24th) in terms of industrial research per capita, and a good fraction of this is accounted for by companies in the Metro Milwaukee area. Milwaukee is home to numerous health, technology and service companies that conduct their own proprietary R&D and collaborate with research universities.

GE Medical, the largest biomedical products employer in Metro Milwaukee, is building a large information technology facility next to MCW. Unfortunately, GE’s biomedical research facilities are located in Connecticut. Furthermore, because of the size of the company, GE typically makes strategic acquisitions of larger, more well-established biomedical companies, rather than dedicating resources to engaging startups. With headquarters in Milwaukee, GE Medical has a steady need for trained graduates in biomedical fields. One of the most promising opportunities with GE is in designing academic and research programs to prepare university graduates for employment.

Indicators of the Innovation Economy IV: Startup Activity. An important characteristic of innovation economies, state or regional, is the rate at which new technology-based companies are formed. Typically, these startup companies are either spinouts of university research or

existing technology companies. Startups have the ability to be flexible and act quickly in bringing to market cutting edge technologies. Startups tend to stay “at home” early in their growth cycle, thus anchoring jobs and economic activity in a region or metro area.

States and metro areas can be compared or benchmarked relative to their peers on the basis of spinouts per research dollar from their academic research institutions. The data points on the graph below represent each state in the US on the basis of spinouts per \$100 million in academic R&D spending.⁹ The state of Wisconsin demonstrates only mediocre metrics for converting research into spinouts that contribute to regional innovation commercialization.



In contrast to Wisconsin as a whole, the spinout metrics of the research institutions in Metro Milwaukee are 4.3 spinouts per \$100 million and the city of Milwaukee’s metrics are 5.1 spinouts per \$100 million.¹⁰ In Metro Milwaukee several research institutions have established “technology transfer” programs that make it a priority to spinout new technology companies to the local economy. In the last few years, Metro Milwaukee research institutions licensed technologies into 15 local start-up companies.¹¹ This is an emerging metro strength that the region can clearly leverage in the future.

As an indicator of what is possible in spinout metrics, consider MIT: with \$485 million in annual research spending, they spin out roughly 150 companies per year, or roughly 31 spinouts per \$100 million in research. In 2003, MIT started 17 companies that were capitalized with at least \$500,000 of external funding, down from their average of 22 per year.

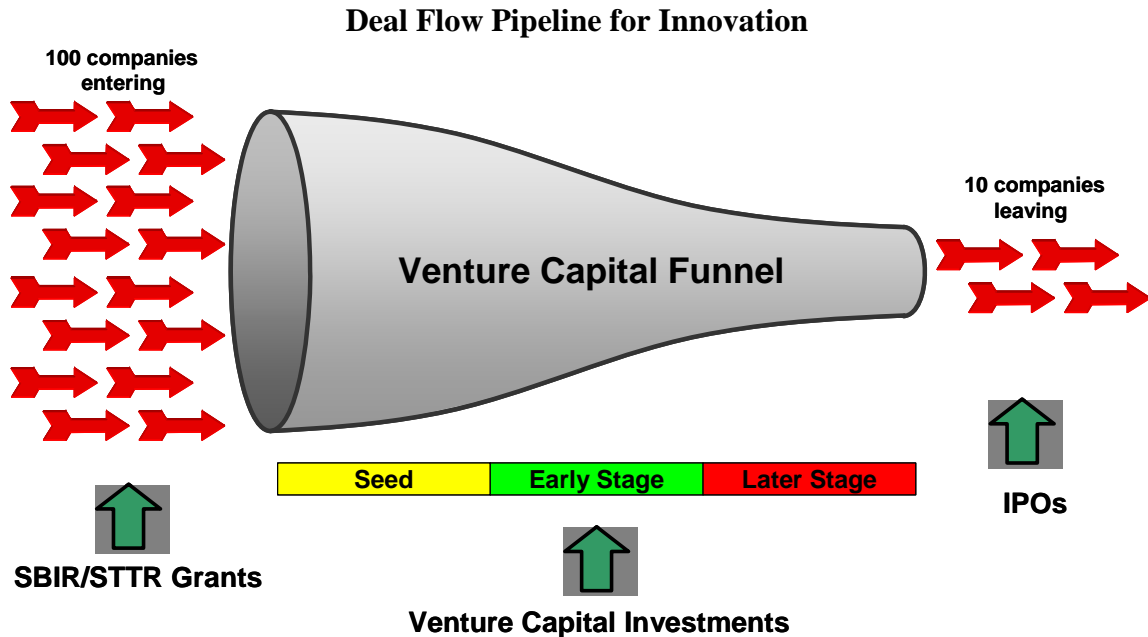
What Does Metro Milwaukee Need?

⁹ http://drc.cfed.org/measures/univ_spin.html

¹⁰ Remember: this metric is a ratio – Metro Milwaukee is skilled in the numerator, but deficient in the denominator.

¹¹ MCW – Medical Advances, PointOne, Prodesse, PhysioGenix, ArgiNOx, Cytometix, Bioinnovation, Neurognostics, OncoDetect; UW Milwaukee – NovaScan, PackageScan, Intelligent Maintenance Systems, JunTech; Marquette – Parident Therapeutics; MSOE – 3D Molecular Designs.

These data are both sobering and informative. They suggest that Metro Milwaukee has the potential to be a force in the new innovation economy, but has many challenges to overcome. At this point, it is useful to review Joshua Rosenbloom’s Innovation Commercialization Index, which is based on three simple variables: SBIR/STTR grant awards, venture capital investment, and initial public offerings (IPOs). We can integrate these three variables and present the concept of a healthy innovation economy in the deal flow pipeline diagram, below.



Moving through a funnel are companies, represented by arrows. The funnel itself represents our venture capital investment activity – in the front part of the funnel are seed investments, and then early- and later-stage investments at the narrowing end of the funnel. Typically, only those companies that make it through the funnel would qualify for an IPO. The funnel representation of venture capital makes sense because not all companies that begin with seed investments will satisfy the criteria for later stage venture investment. Hence, to get just a few companies that move all the way through the funnel, we need many more companies entering the front end. As can be seen from the diagram, the three metrics relating to the innovation commercialization index are directly related to the number of companies entering and flowing through this pipeline.

From the diagram, we conclude that any plan to move Metro Milwaukee up in the innovation commercialization index requires us to build a pipeline of ideas – that turn into innovations – that can be converted into companies – that are fundable with venture capital investment to market products to national and international markets. In Metro Milwaukee, the easiest place to influence and increase this kind of deal flow is at the front end, or at earliest stages of the venture capital funnel.

A strategy to influence and increase deal flow requires us to assess and develop the earliest stages of the startup infrastructure, from idea generation, research and development, through company formation activities, the capabilities of the entrepreneurial community, and the availability of seed and early stage capital. This leads us to the following interim conclusions:

1. **University research is an idea generator for innovation.** Policymakers from many metro areas are rethinking the role of universities and technology transfer in building regional economies.¹² Knowledge and new technology are driving the innovation commercialization and university research is giving birth to new products and companies. We have well-established foundations in our research institutions. Supporting the growth of our research institutions in Metro Milwaukee is a top priority for our innovation economy efforts.
2. **Inter-institutional collaboration offers great potential.** There are five diverse academic institutions in Metro Milwaukee that actively engage in research. Together, they cover a broad spectrum of expertise and research specialties. Inter-institutional and interdisciplinary collaborations are some of the best foundations for idea generation and innovation. The five institutions are public and private, their specialties, missions, charters, the strength of their research, the commitment to economic development all differ. Though all collaborate willingly, consensus decisions take more time, and speaking with a unified voice is not always possible.
3. **Tech transfer to startups.** An essential element of an innovation economy is deal flow. Research institutions can serve as engines of idea generation. But research spending and numbers of patents across metro research institutions are not sufficient. Continuing development of tech transfer programs that facilitate the translation of intellectual property to regional startups is critical.
4. **Capital for seed-stage companies.** Capital for seed-stage companies is critical for establishing a healthy deal-flow pipeline. The entire state of Wisconsin is anemic in seed funding. SBIR grants take time. Angels are picky. Our local venture capitalists have shown limited activity at seed stage. To effectively address Metro Milwaukee's seed sector of the economy, we need to develop more capital at the seed stage in Metro Milwaukee.
5. **Growth requires a long-term vision and commitment.** There will be no quick fixes in developing the innovation commercialization infrastructure for Metro Milwaukee. Stanford's tech transfer program is 30 years old; it took them 15 years to break even. We will need a long-term vision and commitment to push this initiative over the many obstacles that will be encountered.
6. **Milwaukee's innovation economy is just getting started.**¹³ Milwaukee doesn't have a long-history of technology transfer and seed stage venture capital. We don't have the success stories and the community of researchers, entrepreneurs, and investors who have done it before. That means we start from scratch, boot strap, take risks, and blaze new trails. It also means that we can learn from the hard-won lessons of other communities and regions.
7. **Growth doesn't occur without public investment.** The State of Wisconsin and State University System are unaccustomed to thinking about Milwaukee as a center for research and innovation. Growing the research base in Metro Milwaukee will require significant financial support over the long-term from these constituencies. In making this

12 "Accelerating Economic Development Through University Technology Transfer." 2005, http://www.innovationassoc.com/docs/CT_NatRpt.pdf

¹³ Actually, as presented in John Gurda's book "The Making of Milwaukee," Milwaukee past has inspiring stories about corporate venturing in the manufacturing sector where successful spinouts from established companies were common.

commitment, it is important that government agencies and taxpayers look at these expenditures as an investment rather than sunk costs. Wisely managed, they will produce a more robust metro economy, with high skill, high wage jobs for Wisconsin residents.

8. **Entrepreneurs.** In some metro areas, there is an established population of entrepreneurial business leaders that pull innovations into businesses at very early stages. Business leaders with a track record make a big difference in attracting institutional venture capital investments. Wisconsin and Metro Milwaukee do not have significant populations of entrepreneurs who have successfully cycled through the startup process.
9. **Cultural Practices.** Community and institutional cultures are an essential ingredient in developing an innovation economy. Public and institutional policies, which provide acknowledgment, incentives and promotion for people who participate in the entrepreneurial process, can change the culture. These cultural practices need to be renewed in Metro Milwaukee, and focused on the biomedical technologies.

Programmatic Accomplishments to Date

Over the past few years, despite limited available resources and modest attention from the media, significant groundwork has been laid to foster an innovation economy in Metro Milwaukee. Some of the intellectual framework for those efforts was established when in November 2000, regional leaders from Metro Milwaukee drafted a visionary whitepaper addressing the needs of the knowledge-based economy for the first Wisconsin Economic Summit.¹⁴ With identification of key clusters and illumination of critical success factors, this document served as a roadmap for the development of the innovation economy in Wisconsin, with particular attention to Metro Milwaukee. Many of the ideas in this document were subsequently expressed in new or expanded programs and activities. In this section of the white paper, we will briefly describe those accomplishments,

A Capsule Overview of Initiatives

Among the list of substantive and programmatic accomplishments in fostering an innovation economy in Metro Milwaukee since November 2000 are the following:

- **Academic Research:** MCW became one of the fastest growing research institutions and received an endowment of \$300 million, the new Chancellor of UWM - Carlos Santiago - made it an institutional goal to triple the amount of sponsored research in ten years. Growth targets were also developed at UWM and other research institutions in the metro area are willingly engaged in economic development initiatives.
- **Academic Collaboration.** The Biomedical Technology Alliance (BTA) Collaborative Grant Program was launched to facilitate growth in collaborative academic research in the Metro Milwaukee area. (The BTA will be discussed in more detail below.)
- **Technology Transfer:** TechStar and CATI were created to facilitate commercialization opportunities among research institutions, the Medical College of Wisconsin Research Foundation (MCWRF) was expanded, WiSys began serving UWM, and a precedent for transferring intellectual property to local startups was established
- **Industry Collaboration:** eInnovate was created to network entrepreneurial IT professionals, and another programmatic thrust of the Biomedical Technology Alliance (BTA) was set up to facilitate collaborations within biomedical research and development.
- **Entrepreneurship and Startups:** The State launched the Wisconsin Entrepreneurs Network (WEN), and the Governor's business plan competition was established. TechStar and CATI facilitated the launch of 17 startup companies in the Milwaukee area, including Prodesse, Physiogenix, and Neurognostics. Over \$20 million in grants and seed funding was raised for these companies
- **SBIR/STTR Grants:** The Regional Economic Partners funded a SBIR/STTR grant specialist, approximately \$11 million in grants were awarded to early stage companies in the Metro Milwaukee region between 2000 and 2005.

¹⁴ See "Critical Success Factors for Knowledge-Based Industrial Clusters in Wisconsin," by Mark Mone, John Torinus, Brenda Blanchard, Timothy Sheehy, and Joseph Shepley, November 2000.

- **Angel Funding:** Silicon Pastures and the Golden Angel investment groups were created; the State launched the Wisconsin Angel Network and created tax credits for angel investments in Wisconsin startups (SB 255).
- **Facilities:** The Cozzens-Cudahy Center was developed to accommodate translational research from UWM, the Milwaukee County Research Park was updated with new wet lab space to accommodate the relocation of ZyStor from St. Louis, and MCW has a new \$130 million biomedical research building under construction.

Clearly, the November 2000 whitepaper served its purpose. Though the sentiment is still contemporary, we have run the ball down field and the chains need to be moved. In this paper, we benefit from the lessons learned over the last five years and we confront the challenges of the next five. We also integrate the higher level strategic perspective with tactical plans to bring the community together in a common vision for setting goals and implementing them. In the balance of this section of the paper we will provide more detailed information on two accomplishments that will be important in further advancing an innovation economy in greater Milwaukee:

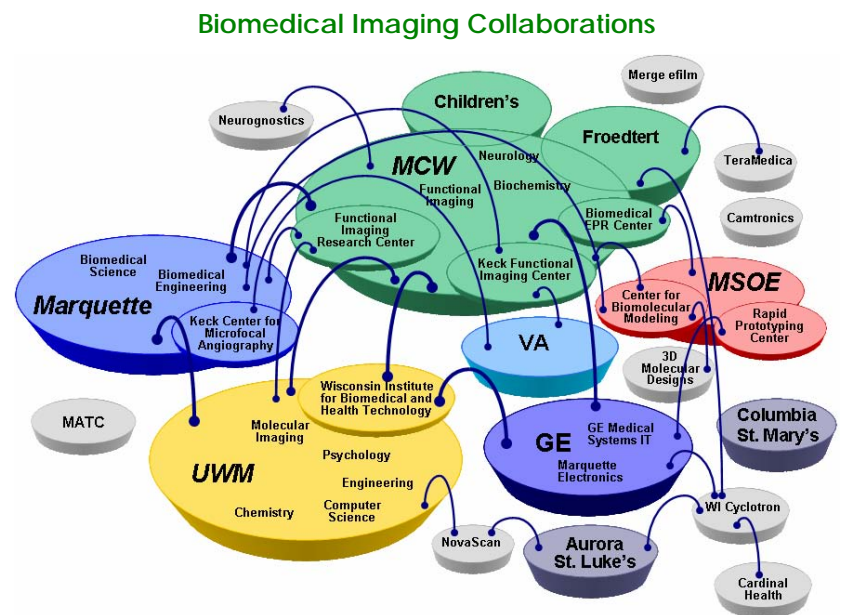
- Biomedical technology as a key focus
- The establishment of the Biomedical Technology Alliance (BTA)

Defining an Area of Innovation Economy Strength: Biomedical Technology

Looking elsewhere in the US at success stories in building regional innovation economies, virtually every case involves the early and disciplined identification of an area or areas of technology concentration. For virtually all successful metro areas this usually means one or a small handful of emphases. For example, San Diego has focused on information technologies and biomedical, as has the Research Triangle Park metro region in North Carolina.

After considerable study and deliberation the authors of this report have concluded that the field of biomedical technology is the most prominent, widely distributed, and successful cluster around which to build an innovation economy in Metro Milwaukee. The Medical College of Wisconsin and GE Medical are leaders in national research and industry in the biomedical fields. As far as analysts can see, health care will be a growing industry developing with introductions of new technologies, startup companies, and investment capital. Biomedical technology should be the focus of our economic development efforts for Metro Milwaukee as it will provide the biggest impact for our economic development efforts. The rationale and cornerstones for Milwaukee's strengths in this area include the following:

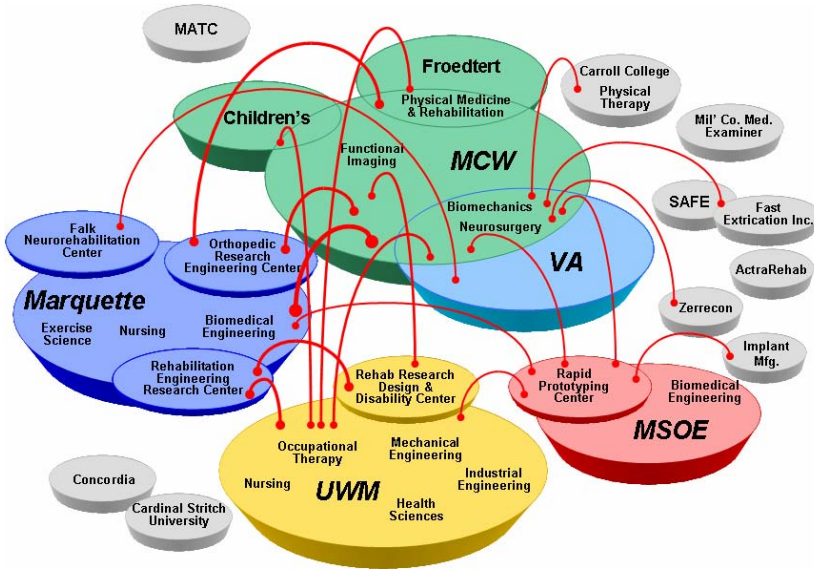
- Academic Research.* Academic research in Metro Milwaukee should exceed \$200 million annually within the next few years, with the majority of that concentrated in biomedical areas, particularly in MCW. With a more focused effort, and some program innovations (discussed below), the growth rate could be even accelerated.
- Clinical Populations.* Another critical element of biomedical research in the Milwaukee region is the clinical population. Involvement of practicing clinicians, and large and diverse patient populations, are essential to the development of new technologies to ensure that they address real clinical needs (the “clinical pull”). There is also a significant opportunity to involve public health organizations in the region more closely with the biomedical technology development process to help identify patients appropriate for clinical trials. A clinical trials consortium aimed at giving researcher access to relevant clinical populations would be a significant advantage to researchers in the area.
- Biomedical Imaging.* Biomedical imaging, an important and growing field, has extensive roots in the metro area. This field spans a range of technologies that



includes MRI, CT, PET, nuclear medicine, molecular imaging and functional MRI (fMRI). The health issues addressed by research in biomedical imaging include: Alzheimer's, Parkinson's, ADHD, Multiple Sclerosis, pain management, Cancer, Cardiopulmonary, Renal, Osteoporosis, and Addiction. GE Medical Systems is already a major industry player in this area, and there are opportunities for research-based collaborations with metro area academic institutions.

Illustratively, functional imaging is an important area of strength with two centers dedicated to functional imaging – the Functional Imaging Research Center (FIRC) and the Keck Functional Imaging Center.

Rehabilitation and Biomechanics Collaborations



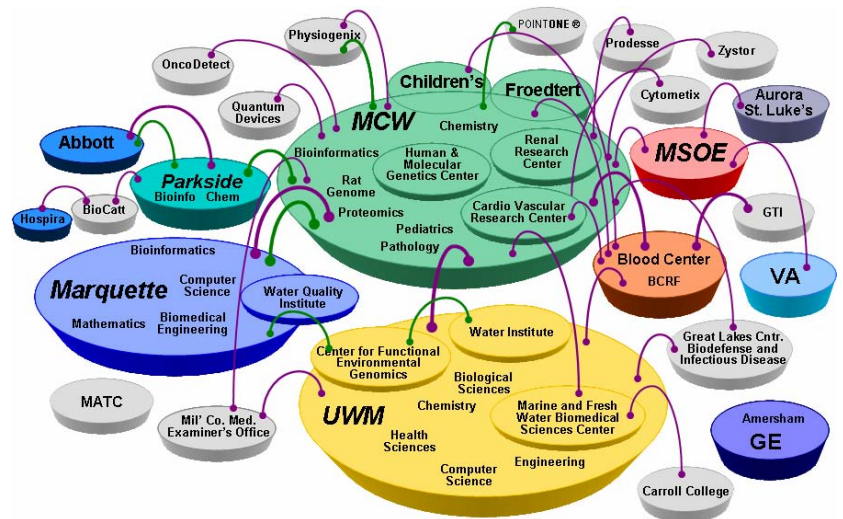
Other research centers involved in biomedical imaging include the Keck Center for Microfocal Angiography at Marquette and the newly formed Wisconsin Institute for Biomedical Health Technology. These centers are drawn on core departmental strengths at Marquette, MCW and UWM that include biomedical engineering, biochemistry, engineering and computer

science.

- Rehabilitation and Biomechanics.** Rehabilitation and biomechanics addresses the body's muscular, skeletal and neurological systems. Health issues addressed by researchers working in this area include: stroke, spinal injury, aging, access and assistive technology, spasticity, amputee rehabilitation, walking and gait analysis, neurorehabilitation, cerebral palsy and ALS.

The Milwaukee-area Veterans Administration facility and Froedtert Hospital represent

Genetics, Proteomics and Biochemistry Collaborations



important clinical sites for research in rehabilitation and biomechanics. MCW's resources in this area include the Physical Medicine and Rehabilitation Department located at Froedtert and biomechanics and neurosurgery capabilities centered at the VA. At Marquette, the Biomedical Engineering department and three rehab-related centers – the Orthopedic Research Engineering Center (OREC), the Rehabilitation Engineering Research Center (RERC) and the Falk Neurorehabilitation Center – are the basis for significant collaborative research. UW-Milwaukee's resources include the Rehabilitation Research and Design Center (R2D2) as well as departmental strengths in Nursing, Occupational Therapy, Health Sciences, and Mechanical and Industrial Engineering. The Rapid Prototyping Center (RPC) at MSOE is an important resource that is used in a variety of collaborations.

Medical Informatics. Medical informatics involves the merging of information technologies – hardware and software – into the delivery and management of patient care. Emphases in medical informatics include: diagnostics via expert systems and neural network software, electronic medical records, and sensors and associated software for patient monitoring and diagnostics. It is an area of growing importance to the health care system nationally and a growing resource in the Milwaukee region. Education and training are important as well as research, and are a strength of the regional academic institutions in the area of medical informatics. There are a growing number of small companies working in the area as well as large companies such as GE Medical Systems that are commercializing products in this area.

Genetics and Proteomics. Resources in genetics, proteomics and bioinformatics play an important role in the Milwaukee region's capabilities in drug discovery. There is an opportunity to more closely link these resources with biochemistry research in the area and public health for a unified drug discovery and assessment capability. Key areas addressed by research in genetics, proteomics and bioinformatics include: drug discovery, animal Models, rat genome and personalized medicine.

While we focus significant efforts towards the area of biomedical technologies in this paper, we acknowledge that other knowledge-based clusters in Metro Milwaukee also have innovation commercialization potential. Those include: information technologies, financial services, visual display technologies, advanced manufacturing technologies, energy and environmental technologies. As these clusters develop, we may also develop specific infrastructure and programs to support them.