

Encouraging the Development of the Medical Technology Cluster in the Greater Baltimore Region

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About the Hopkins Graduate Student Consulting Club Pro Bono Consulting (JHGCC PBC)

The Hopkins Graduate Student Consulting Club introduces management consulting to the Hopkins graduate student and postdoctoral community through general education, case competitions, and pro bono consulting. The pro bono consulting arm provides our members an opportunity to analyze and provide recommendations for real life engagements at no charge to our clients. Previously, we have worked with companies ranging from major pharmaceutical companies to local non-profit organizations to provide strategic recommendations on portfolio management, growth strategies, and more. Please see our website at jhgcc.weebly.com for pro bono project inquiries and more information.

Technical definitions and Terminology

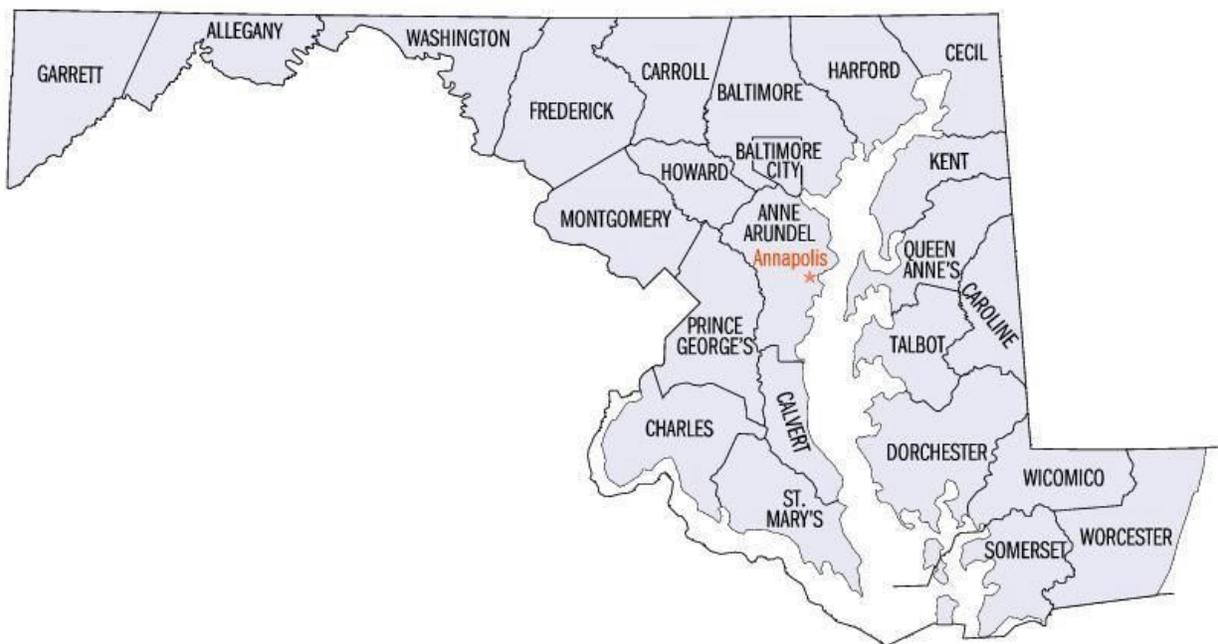
In this report, specific terms will be used throughout and are defined as follows:

“Medical technology” defined specifically as medical equipment and devices as well as health information technology (i.e software and wearable technology). This report also abbreviates this term as med tech.

“Cluster” or **“Community”** refers to the individuals, businesses and organizations at the grassroots, institutional and state level that support medical technology.

“Greater Baltimore” refers to the area of Baltimore County and surrounding counties, which includes Baltimore City, Baltimore County, Howard County, Anne Arundel, Harford, and Carroll County.

For the purpose of this report we define small businesses as having fewer than 500 employees or less than \$7.5 million in annual receipts. This definition is modeled from the US Small Business Administration.¹



¹ <https://www.sba.gov/content/summary-size-standards-industry-sector>

Executive Summary

This Hopkins Graduate Consulting Club Pro Bono Consulting (JHGCC PBC) report analyzes the strategic requirements to create and sustain a vibrant medical technology cluster in the Baltimore and Greater Baltimore region. The study was commissioned by the Maryland Technology Enterprise Institute (Mtech) at the University of Maryland on behalf of the Baltimore medical device community.

Interviews via phone or in person meetings were conducted with 20 med tech or business resource leaders to identify the needs of the companies/organizations in order to find the strategy needed to grow the region's med tech cluster.

The most common response from the interviews was a perceived lack of *capital* and *experienced management*. Specifically, companies were finding difficulty securing meaningful follow-on funding after initial seed funding. In regards to experienced management, a common sentiment was it was difficult to find experienced C-level talent to manage the growing companies.

We believe these bottlenecks are 'critical mass' issues which are remedied when the hub has reached a particular size. Unsurprisingly, we found that capital and experienced labor are highly interdependent which produces a 'chicken-and-the-egg' situation whereby one item is required to produce the other. To effectively solve this problem, we believe a presence of mid-large size med tech anchor companies in the greater Baltimore region would provide the critical mass needed to attract both capital and experienced labor.

This report identifies possible solutions and on-going efforts to improve the medical technology cluster and make the region a 'med-tech hub'.

To sustainably grow the Greater Baltimore region to a medical technology hub, there exists a need for mid-large sized medical technology companies (Greater than 500 employees and/or greater than \$7.5 million in annual revenues) to create a critical mass. To achieve this, we recommend the following:

- 1) Attract mid to large medical technology companies to establish a 'presence' via innovation centers
- 2) Encourage mid- to large-sized, non-medical technology companies to enter the medical technology sector through partnerships with local startups
- 3) Continue to grow local medical technology companies by prioritizing later stage companies with more selective, but higher impact fundings

These recommendations do not focus on the highly important grassroots efforts already in progress. We believe these efforts should be continued to be sustained and supported, however we believe our recommendation addresses the long term requirements of the hub and presents a viable strategy to elevate its presence nationally.

Goals of Report

This report was written to provide strategic recommendations to **grow and sustain the medical technology cluster in the Greater Baltimore region.**

Methodology

To answer the issue of creating and sustaining a vibrant medical technology cluster in the Baltimore region. JHGCC performed the following analysis:

1. Benchmarked Baltimore to other successful med tech communities within the United States
2. Identified resources and advantages available to medical technology community in Baltimore and identify key opinion leaders including CEOs of medical technology companies in the Greater Baltimore community
3. Interviewed these identified key opinion leaders at the various level of this community cluster to identify and investigate needs. Also enquired their opinion on current hurdles within the eco-system
4. Analyzed the perceived needs and recommend areas for future stimulation of the cluster.

We considered the perceived 'bottlenecks' noted by the thought- and company leaders to make recommendations to improve Greater Baltimore's medical technology cluster as a whole, which may not address the needs of the individual companies/resources. Our recommendation is based on the principle that a healthy cluster will be made up of companies that span the range of large, middle, and small sized businesses. When a critical mass of these med tech companies of varying sizes can localize in one region, a 'hub' is formed.

Background

Medical Technology

With higher life expectancies and aging populations across the globe, the increased need for prevention, diagnosis, and medical treatment has risen. Unlike most of the industries during the past decade, the healthcare industry has flourished in many markets. To keep with the demand for effective healthcare, the medical technology sector has tried to satisfy the needs of the market. The North American market for medical devices in 2013 was \$187B and growing. (CAGR 2013-2018, 3.7%)² While the growth of the market has slowed considerably due to the economy, the medical device and technology market is still attractive and may provide an opportunity for investment. Growth associated with emerging medical technologies brings major economic impact. The medical technology industry provides millions of jobs of family sustaining levels and provides compensation levels of 1.85 times of the national average. Medical technology industry is research intensive, innovative, and

² BCC Reports.HLC170A - Medical Devices: Technologies and Global Markets

technologically sophisticated. These characteristics of the industry gives the United States a competitive advantage and creates barrier to entry for outside competitors. For every \$1 billion in advanced medical technology industry revenues in the U.S. generates an additional \$1.69 billion in national economic output, almost 13,000 jobs and \$778 million in personal income.³

Greater Baltimore

The Greater Baltimore region has a few advantages which should be considered when planning how best to stimulate the medical device sector. The two core competencies of the region which are important for med tech innovation are high state/federal funding and a highly educated workforce. These components coupled with the research facility infrastructure provide an environment which can support a vibrant med tech.

High State and Federal funding support

The National Institutes of Health funded for Maryland institutes and research facilities \$1.82 billion in 2014. Located in Baltimore, Johns Hopkins University is one of the leading medical research institutes and has consistently been ranked as the nation's' single largest recipient of federal R&D expenditure - almost twice as much as MIT or Stanford or even all the colleges in the state of California combined.⁴ This is important since Federal funding continues to play an important in innovation given how the success of obtaining venture capital/angel investor funding is becoming more and more difficult.

In addition to NIH grants which fund new research, federally funded programs such as the Small business Innovation Research (SBIR) and Small Business Technology Transfer Program (STTR) grants provide companies capital for research. In 2013, companies in Greater Baltimore and Central Maryland earned over \$92 million through government-funded SBIR and STTR awards in 2013 which is much higher than other markets.⁵

Highly educated workforce & university/federal research facilities

Johns Hopkins and the University of Maryland system are anchors of the innovation-driven economy which recruit a high population of young educated individuals. Maryland has the highest number of professional and technical workers amongst health sciences and second in Bio and Agricultural sciences with over 35% of the population with a bachelor's degree⁵.

Biotechnology is one of Baltimore and its surrounding region's brighter prospects. Baltimore, being in central Maryland, possess an array of research assets with over 550+ BioHealth companies as well as 59 federal laboratories, centers and institutes.⁶ Maryland's

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http://www.chi.org/uploadedFiles/Industry_at_a_glance/BattelleFinalAdvaMedEconomicImpactReportMarch2012.pdf

⁴ report.nih.gov

⁵ <http://www.greaterbaltimore.org/research/publications.aspx#industryprof>

⁶ <http://www.bio.maryland.gov/>

biotechnology cluster (consisting of the Baltimore Metropolitan Area and Washington D.C. suburbs) is among the top 5 in the nation⁷. This cluster is facilitated by the concentration of world class universities in Baltimore such as Johns Hopkins and the University of Maryland College System helps to provide infrastructure facilities such as the University of Maryland's bio-process scale up facility and the Maryland Bio-Park, of which both have assisted companies and provided opportunities for collaboration with other institutions and private companies. Additionally, proximity to the regulatory/governmental research agencies and lower operating costs compared to mature/established hubs such as Boston or Silicon Valley,⁸ should be economically attractive to big biotechnology firms looking to establish research hub that would have access to early innovations and raw talents present in these institutions.

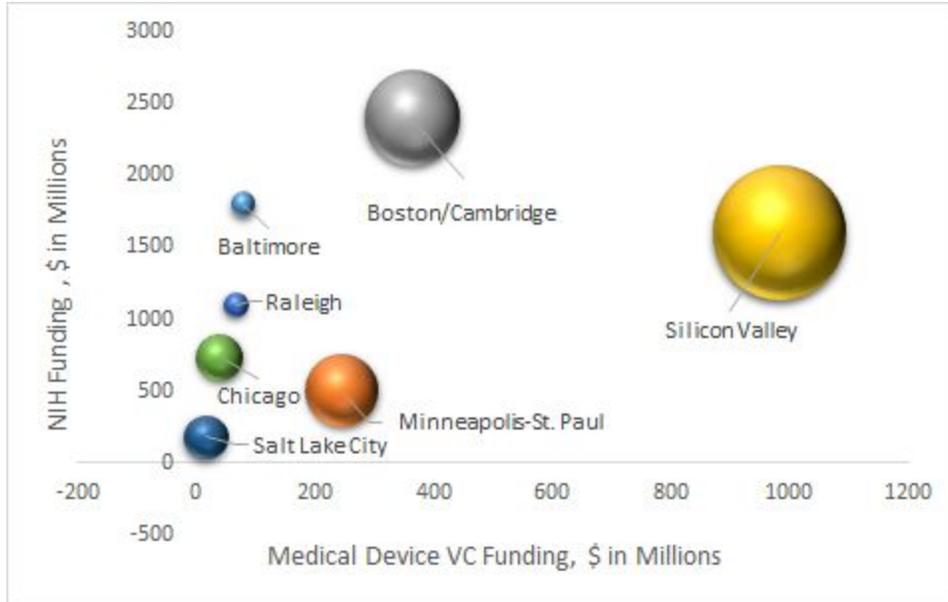
Comparable Models

In order to make a reasonable recommendation for sustainable growth of the region, we looked at other established medical device hubs as a reference for viable ideas and solutions. We assume that the strategies and outcomes that other hubs have made will work for Baltimore and can be repeated in similar fashion.

Established innovation hubs provide emerging companies and regions substantial benefits that would otherwise be difficult or infeasible without the geographic proximity. While technological advances have greatly reduced the need to be in the same location as a company's resources, there still exists many benefits that arise with geographical proximity. One such example is experienced labor and networking. As companies progress through their lifecycle, acquisition and transfer of human capital can occur which allows the local ecosystem to absorb the talent. This provides a steady source of experienced labor to move throughout the hub in a dynamic manner. Without a network of nearby companies, the experienced labor may be relocated to another hub and never return.

⁷ <http://www.genengnews.com/insight-and-intelligence/top-10-u-s-biopharma-clusters/77900393/>

⁸ <https://drive.google.com/drive/folders/0B6HUKbFVvJpvcnIPMmt6c3hDWUk>



Comparable Med Tech Hubs				
Markets	Number of Medical device employees	Medical device VC investing	NIH funding	Number of Public Companies
Greater Baltimore	No Data	\$75M ⁹	\$1.8B (NIH, 2014)	3 (MD)
Minneapolis-St. Paul	27,718	\$245,6 M	\$505M	28 (MN)
Boston/Cambridge	18,893	\$363,9M	\$2.4B	48 (MA)
San Jose / Silicon Valley	9,372	\$983,4M	\$1.6B	96 (CA)
Los Angeles	29,104	\$207M	\$1.3B	
San Diego	7,614	\$48M	\$521M	
Salt Lake City	?	\$16.4	\$176M	10(Utah)
Chicago	13,026	\$39.8M	\$733M	11(IL)
Raleigh	1,486	\$67.4M	\$1.1B	3(NC)

⁹ <http://www.pwc.com/>

Source:qmed.com¹⁰

Findings from interviews

We interviewed 20 CEOs of med tech companies, economic development offices, and venture capital firms in the Greater Baltimore region and asked how to stimulate and sustain the Greater Baltimore medical technology cluster. (3 from VC and capital sources, 9 from Med Tech companies, 8 from non-government organizations including universities)

The majority of the interviewees concurred that they were optimistic about the Greater Baltimore region. Many cited that they had seen positive changes in the entrepreneurial environment in Baltimore. Most were happy that there were many examples of early stage funding despite some caveats (*vide infra*) including NIH's SBIR/STTR¹¹, TEDCO's MII or CTF¹², TCP's Propel¹³, and Abell Foundation¹⁴. The majority of interviewees agreed that the high levels of NIH research and development funding was an advantage in addition to the talent of the graduates from the University of Maryland and Johns Hopkins University. Also, 22% of the interviewees cited the proximity to the FDA gave Baltimore a regulatory advantage which is crucial to the med tech industry.

The disadvantages cited primarily were experienced labor (83%), late stage funding (61%), and manufacturing (50%).

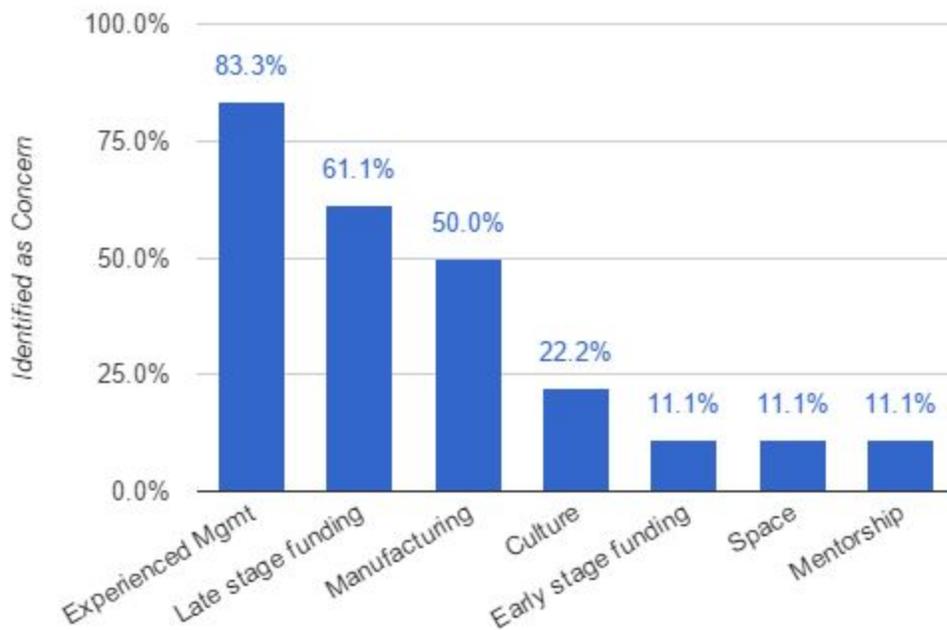
¹⁰ <http://www.qmed.com/mpmn/gallery/top-10-us-cities-medtech-innovation>

¹¹ <https://sbir.nih.gov/>

¹² <http://tedco.md/programs/>

¹³ <http://tcp.vc/funds/propel-baltimore-fund/>

¹⁴ <http://www.abell.org/health-human-services>



The most common cited reason for the failure of Greater Baltimore region to grow as a hub was the lack of experienced labor with 83% agreement. Specifically, C-suite management was difficult to find or hire to Baltimore. While educated labor such as PhDs and Bachelors level employees in the region was cited to be an advantage, management with experience as not as readily available. Many people stated that the desired labor was located in established hubs.

Late stage funding was the second most cited bottleneck to the medical cluster development with 61% agreement. The main complaints were the lack of VC firms and available late stage funding in Baltimore. Most people who cited this issue noted that if VC funding could be secured, the startup companies were asked to move to an established hub like Boston or Silicon Valley, thus either funding was unavailable or the successful companies would exit the region when funding was secured. Most interviewees also agreed that once there was enough 'VC deals' in Baltimore, more VC firms would come and companies would move less often. A partial remedy that was mentioned was the increase in non-dilutive matching capital from the state¹⁵.

Lastly, manufacturing was the third most cited issue for the med tech sector. As a relatively unique aspect of the industry, the manufacturing capabilities were perceived as limited, however prototyping was available. It was agreed that while Baltimore has a manufacturing history, the labor and industry as a whole has left Baltimore for several years

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<http://www.channelnewsasia.com/news/specialreports/budget2014/news/budget-2014-s-150m-for/1008070.html>

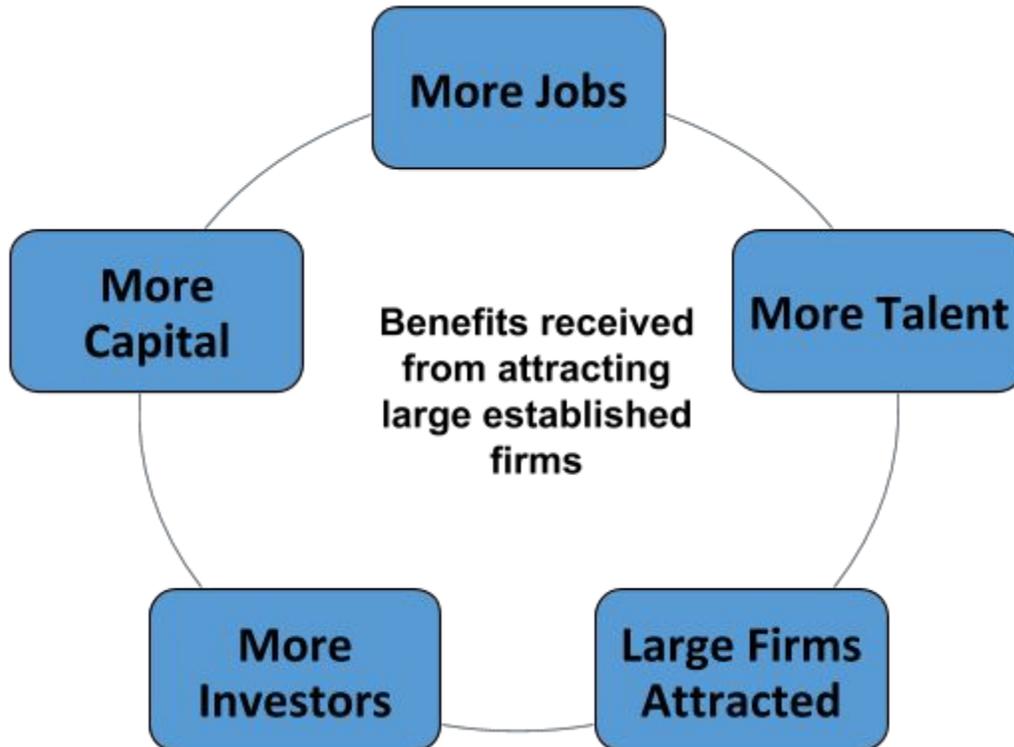
and would have to be reinvented if necessary. It is important to note that 50% mentioned manufacturing was an issue, while the other 50% did not cite it as an issue or felt it was easily outsourced.

As it became clear that experienced labor and late stage funding was becoming the consensus, we wanted to know if the problem facing Baltimore was a critical mass issue. 44% of participants felt it would be helpful if there was a leading 'anchor' company in the region. For both of the two highest cited bottlenecks, interviewees generally agreed that the issues were interrelated and one was dependent on the other, presenting a 'chicken-and-the-egg' scenario where the resolution of one issue was the answer to the other. Most people felt the talent will follow the money and vice versa.

Our recommendation

Based on the perceived impedances for growth of the medical technology cluster, we hypothesized that the main issue is the lack of a critical mass of medical technology companies that defines those established hubs. We believe that once the region achieves a certain level of successful med tech companies which include small to medium sized companies, the hub will attract both talent and labor in a robust and self sustaining manner. Furthermore, if the status of the region can be recognized as a med tech 'hub' other benefits would likely appear such as increased entrepreneurial culture, arrival of more services to fill the needs of these companies, and increased employment. We believe this 'critical mass' can be achieved in two ways:

- 1) Attract mid-large sized med tech companies to Baltimore**
- 2) Develop small med tech companies into large sized med tech companies**



The attraction of large companies will benefit university eco-systems since the presence of such established firms would result in a “talent magnet” whereby more top researchers and graduate students would be attracted to the city. Importantly, the attraction of talent will not be limited to research and development given how established firms will also bring in their own pool of experienced talent to guide their new facilities and this in turn increases the overall population of c-suite or high level experienced individuals. Most importantly, the presence of more firms results in potentially more strategic collaborations between academia and industry.

Examples of an established firm moving into emerging cities known for niche technology areas can be seen in the case of Uber moving to Pittsburgh¹⁶. Pittsburgh boasts Carnegie Mellon University (CMU) which is well known for producing groundbreaking technology in computer sciences and robotics. It is highly likely that while mature hubs like Boston or Silicon Valley has institutions which could potentially rival CMU, other inherent advantages such as lower operational costs and a history of excellence in “driver-less” technology in the universities in Pittsburgh could have played a role in Uber’s decision.

Similarly, it was reported in end 2014 that vaccine pharmaceutical GlaxoSmithKline (GSK) would be shifting operations to a new hub in a suburb in Washington, D.C., Rockville, Maryland for vaccine research and development. The move will consolidate all vaccine R&D activities currently conducted at other GSK facilities in Philadelphia and Cambridge, Mass into

¹⁶<http://www.citylab.com/tech/2015/06/how-ubers-driverless-cars-could-make-pittsburgh-americas-next-great-tech-hub/394691/>

a centralized location¹⁷. While no financial incentives were cited for this move, it could be inferred that one of the biggest decisions to relocate include potentially lower operational costs, access to raw talent and importantly, close proximity to “national and global organizations” such as US department of Health and Human Services (which includes FDA, NIH and Biomedical Advance research and development authority).

We recognize that market conditions and company leadership are ultimately the deciding factors in the decisions of the company. Therefore, the actions we recommend are through economic incentives and development of organizations with private partnerships.

Recommendation 1: Attract external established firms to come into Baltimore to establish partnerships

Impact	Feasibility
High	Moderate

The attraction of large companies to come to a new region requires a significant amount of capital and resources. It is not a decision that policy or advocacy can make for a company. However, a solution to attract larger companies to establish a ‘presence’ in the region is through the use of innovation centers.

Ideally, innovation centers are vertically integrated organizations and facilities that cater to the needs of startup by connecting the startups with the resources they need at the different stages of development from incubation, legal advice, clinical services, gap and follow-on funding, to international soft landings. As private-public partnerships, these centers give access for the larger companies to work with economic development resources and startups in their industry. In return, the large established firms can support the innovation center members through, capital and expertise.

This arrangement helps the two major bottlenecks to the growth of the med tech cluster. Capital become much more accessible as VC firms and the funding from the innovation center is exposed to the startup. Also, experienced c-level labor is available for advising with a focus to develop the startup company leaders. The limitation of such centers to stimulate the clusters would be scalability and limited interaction with the large companies. These centers have finite capacity which limits the number of startups that can access their resources, but also ensures that the accepted startups have gone through rigorous vetting to increase the likelihood of success. Secondly, a partnership with innovation centers is not the same as relocating or opening an office in a new region due to the lower commitment in monetary and human capital by the large companies. Therefore, the partnership of the large

¹⁷ http://articles.philly.com/2015-04-04/business/60790705_1_gsk-vaccine-research-melinda-stubbee

companies with these innovation centers can lower the barrier to establish a presence in a region.

An example of this partnership is BioHealth Innovation Inc (BHI). This non-profit organization is regionally orientated that aims to align local technologies assets and resources to sustain an innovation economy in Maryland¹⁸. BHI acts as an intermediary to connect startups with physical resources, capital, labor, etc. BHI currently partners with well known biotechnology brands such as MedImmune Inc, Qiagen, Becton Dickinson, Roche, Emergent Biosolutions and Human Genome Sciences (recently acquired by GSK). It has also expanded its entrepreneur-in-residence team and in-collaboration with Montgomery County and ProductSavvy Consulting, has created an accelerator that aims to promote the healthtech sector industry. Importantly, apart from partnerships with well-established pharmaceuticals, BHI also provides advisory services for regulatory and subsequent payer issues via in collaboration with Center for Medical Technology Policy (CMTTP). Such services which provide an insight into the minds of payers and providers is important as it is increasingly being recognized that the “feasibility” of using a new medical device or diagnostic transcends beyond the standard requirements of “safety” and “efficacy” evaluations¹⁹. It is worth noting that even if a company can get past pivotal trials with its current management and funding, there are no guarantees that excellent clinical trial data will result in post-trial adoption. This is because following clinical trials, market adoption is determined by a different set of regulatory agencies/committees and institutions that might have a different criteria in determining “feasibility”^{20,21}.

Another innovation center with a similar model is the MaRS Discovery district (MaRS EXCITE) which is a nonprofit innovation center that connects and fosters collaboration amongst the entrepreneurial community in Toronto, Ontario in Canada. Established in 2005 as a non-profit similar to BHI, MaRS has shown great growth in their entrepreneurial and venture efforts in health, cleantech and ICT sectors. Such ventures have raised over \$1.3 billion and made \$640M in revenue²². As a testament of their ongoing innovation, Johnson & Johnson earlier this year has decided to open their first non-US innovation center at this district, thereby reinforcing Ontario and this initiative as one of the world’s leading life sciences cluster.

These models for partnerships with large companies help to address the primary issues of access to capital and experienced management while lowering the barriers for the large companies. The exposure to new technologies and potential additions to the portfolios of the large companies can incentivize sustained partnerships when relocation would be too expensive. We recommend continuing or expanding these innovation centers to increase capacity and exposure to the Greater Baltimore med tech cluster.

¹⁸ <http://www.biohealthinnovation.org/about-us>

¹⁹ <http://www.nejm.org/doi/full/10.1056/NEJMp0901355>

²⁰ <https://www.atkearney.com/documents/10192/5227116/Medical+Devices+-+Equipped+for+the+Future.pdf/778dea53-76e8-4cc9-ae9-b9753679b14c>

²¹ <http://www.cmtpnet.org/resource-center/view/understanding-the-role-and-evidence-expectations-of-health-technology-asses/>

²² <http://www.marsdd.com/systems-change/mars-excite/value-of-excite/>

Recommendation 2: Encourage local established companies to enter med tech market through partnerships

Impact	Feasibility
High	Moderate

We recommend the encouragement of local mid-large sized non-med tech companies to enter the med tech sector through partnerships with local med tech companies. A major advantage of utilizing the currently present companies in Baltimore is the ability to build on their success and market advantages. Established Baltimore companies have already proven to be successful at making a profit, but also have attained brand awareness, experienced leadership, and possibly engineering, R&D, or manufacturing capabilities. In return for the partnership with the local med tech company, the larger established entity can diversify their revenue streams and gain entrance into a new market without performing all the initial research and IP development. The smaller med tech would benefit from the experienced labor, capital, and possibly other synergies such as knowledge transfer and other capabilities depending on the partnering company.

Baltimore is currently still experiencing the migration of early and mid stage startup firms to med tech hubs such as Boston and the Bay area since these regions provide better funding resources as well as expertise levels and talents pools. Thus, there is a need for the med tech cluster in Baltimore to improve the expertise and collaboration with existing players in the industry in order to retain these companies. Through these partnerships with established companies in Baltimore, the med tech cluster will be able to retain small startup companies in the local area and avoid them from moving to med tech hubs which provide expertise as well as resources to grow the business. Thus, we recommend that the med tech cluster in Baltimore faces the retention of local medical device companies in the region not only by supporting funding of startups to bring them to the late stage but also significantly partnering with local established companies which are interested in diverging into the medical device industry.

To implement this recommendation, we support the allocation of funds through cost-matching or grants to facilitate local mid-large companies to partner with smaller med tech companies provided both companies stay in the Greater Baltimore region.

As precedent for this model, we considered MedImmune, a biologics pharmaceutical company and MedImmune Ventures, the wholly-owned venture capital fund. MedImmune Ventures is seeking investments in medical device, diagnostic, imaging and healthcare IT companies outside its major pharmaceutical areas. One medical device company in their portfolio, Cerapedics initiated PMA module submission to FDA approval of their medical

device for enhancement of cervical spine fusion after completing the Series C round of financing totaling \$19 million led by MedImmune Ventures. Besides direct investment, MedImmune could also leverage their expertise and talent from their own operations that they can bring to use into start-ups and help to fill C-level positions.

Currently, it appears the Baltimore-based fortune 1000 company, Under Armour has begun to examine this model with three partnerships/acquisitions. Under Armour is an athletic apparel company, but has started the exploring digital health and medical device industry. In 2013, Under Armour started the Head Health Challenge with the NFL and GE, to encourage medical technology innovations about brain injury. One of the final winners, BrainScope Company, is located at Bethesda, MD, and developing a miniaturized EEG-based brain injury detection tool and is working on a system to test patients for concussion. Another example is the acquisition of Texas-based MapMyFitness, which provides suite of mobile apps and websites building a digital fitness community, for \$150M in 2013.²³ Lastly, Under Armour also acquired two health and fitness app makers: San Francisco-based fitness platform MyFitnessPal for \$475 million and Denmark-based Endomondo for \$85 million.

These acquisitions provide a clear illustration of the business opportunity for Baltimore-based digital health companies. We believe mobile health medical technology is a niche that Baltimore can seek synergize with the local technology partners.

A variation on this approach could be the utilization of Baltimore’s unique core competencies in healthcare and partnering with Johns Hopkins University and University of Maryland through their technology ventures. Through expansion into the med tech industry in Maryland, mid- to large size companies will be able to expand their local network and expertise as well as generate potential additional revenue streams from these medical device start-up ventures.²⁴

Recommendation 3. Continue to grow local medical technology companies by prioritizing later stage companies through more selective, but higher impact funding

Impact	Feasibility
Moderate	Moderate

²³ <http://phys.org/news/2015-02-armour-evolving-technology-company.html>

²⁴ <http://www.medimmuneventures.com/about-us.html>,
<http://www.medimmuneventures.com/portfolio-companies.html>

We recommend to organically grow med tech companies within the Greater Baltimore region by narrowing the focus on later stage companies and to support them with a lower volume, but higher impact funding. We found that the sentiment among thought leaders was that the current small levels of funding (\$10K-25K), while well-meaning, are not helpful when the amount of funding is too small to be impactful for a med tech company. Medical devices and biotechnology require more inputs to get through the pilots stage as compared to IT or consumer products due to higher regulatory barriers, higher safety, and testing requirements. The strategy of making many small grants may help the funding agencies or accelerators lower risk by avoiding losing too much money on any one entity. However without reaching a critical level of capital support, a new med tech company would have a low probability to reaching its next milestone.

This recommendation somewhat follows the industry trend of biotech funding where the total number of funded companies are stable, but the funding sizes are larger. We recommend decreasing the total number of companies funded due to feasibility issues, where additional funding would be difficult to allocate. It is also important to note that, the top 7-8% financings accrued 45% of all biotech funding in the second quarter of 2015 which may also suggest that the industry is moving to a more selective, higher impact model of financing for biotech.²⁵ This may reflect the realities of the higher startup costs incurred by biotech companies and also likely by medical technology companies as compared to traditional technology companies. To implement this recommendation, we suggest that funding agencies adjust their funding amounts to a higher amount to match the high cost of this industry. There are certain risks associated with this strategy. Particularly about how the state funding agents choose which company to fund and how much fund to give. Those specific strategies need to be further analysed.

Additionally effective strategies to grow within Baltimore regions include incentives from tax. We wanted to note a current initiative that we believe is effective in growing the med tech cluster. The Biotechnology Investment Incentive Tax Credit (BIITC) was highly cited in our interviews to be helpful in creating companies in Maryland. Started in 2006, the cumulative funding of up to \$76M and has attracted a cumulative investment of over \$138M in investments. Several companies have reported including individuals from our interview research have said that such funding has helped the company in leveraging for more capital from venture capitalists and private investors. Importantly, the financial support obtained subsequently paved the way for more jobs. In our research, we were able to obtain data from tax incentives from the established med tech hub in Boston. As expected, the tax incentives were successful in creating jobs which is an important success factor necessary for cluster stimulation.

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<http://www.forbes.com/sites/brucebooth/2015/07/23/the-venture-funding-boom-in-biotech-a-few-things-its-not/>

Tax incentive program in Boston				
Year	2010	2011	2012	2013
Size of the tax incentive	\$17M	\$14M	\$20M	\$24M
Total number of awards provided	24	26	24	32
Hired and maintained employees	In total 4478 jobs from 2009-2012			1230 new jobs

Source:Massachusetts Life Sciences Center²⁶

A potential outcome of organic growth of Greater Baltimore based companies is the increased likelihood of acquisition by a larger entity. Once local companies from the region become more profitable, they also become more attractive to established companies for potential mergers and acquisitions. Therefore, the goal of the growth may not necessitate growing a company until it reaches a global giant instead we want to make Baltimore region attractable for future buy-ins. We look to the the case of Medimmune’s acquisition by AstraZeneca as an example of this growth. In 2007, the Maryland biotech company was acquired for \$15.6 Billion. This acquisition led to the growth of the company from 1,700 employees to 2,600 in Maryland and 4,000 globally.²⁷ Today, the Gaithersburg area is rapidly becoming a biotech hub with the new arrival of GSK and other biotechs emerging nearby.

Limitations of our recommendation

- We interviewed only 20 people who do not reflect the entirety of opinions in the region. Hence, this report should not be considered as a comprehensive collection of all viewpoints from all relevant stakeholders. Those interviewed should be considered as a sampling of all relevant perspectives.
- Report is static and used information up to 2014.
- There might be other innovative ways to improve the sector, however, this framework was a consensus given the information and research available to us.

²⁶ <http://www.masslifesciences.com/wp-content/uploads/2014-Annual-Report-FINAL.pdf>

²⁷

http://www.washingtonpost.com/business/capitalbusiness/was-medimmune-worth-156-billion/2012/08/03/cc396e4c-dccf-11e1-9974-5c975ae4810f_story.html

- We made recommendations on increasing funding or matching funding, but did not recommend a specific amount and criteria. We need further analysis to make the specific suggestions.

Conclusions

The Greater Baltimore region appears primed to become a hub for Medical Technology due to its high level of R&D funding, density of educated labor, and anchor institutions which produce innovative solutions. While it is facing issues that any emerging hub faces such as limited late stage funding and lack of experienced talent, it appears there are solutions in progress that may allow the region to reach a critical mass for growth.

Acknowledgements

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