COMMERCIALIZATION OF BIO-TECHNOLOGICAL VENTURES:

A BUSINESS PLAN ON VAYLENX LLC.

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by

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Introduction

Throughout the past four years of my undergraduate career I have dreamed of starting my own business. April 2014 I asked Dean Webster if it was possible to combine my passion of entrepreneurship with my honors undergraduate thesis. Upon his approval I got to work. I had a tutorial with Dr. Luke Pittaway, Director of the Center for Entrepreneurship, who worked with me through the ideation phase. I theorized a variety of startup ideas, but nothing struck my passions.

October of my junior year I worked with a diverse team on the Global Health Competition. We brainstormed a multi-faceted plan to help aid in slowing the spread of vector, or mosquito, borne disease throughout Guyana, specifically malaria. One facet of this plan was the use of carbon nanoparticles to stunt growth in mosquito larvae. My team and I won the entire competition and were rewarded the opportunity to travel down to Guyana in South America.

When we arrived in Guyana we saw first had the effects of mosquito spread diseases on the community. We met with key stakeholders, individuals in the government, and university professors, all who encouraged our idea; specifically, the use of nanoparticles. When we arrived back in the U.S. we decided to form a legal entity to chase down this path of nanoparticle larvicides.

Building on the encouragement from the positive feedback of those in Guyana, as well as a reignited purpose for those at-risk community members, we quickly began building the company. Last year at the innovation gala I received the "Most Outstanding Student Innovation" award, for the application of nanoparticles toward vector borne disease. I met with Dr. Pittaway and told him I wanted to pivot my thesis to reflect my current venture. He approved my choice and we began writing the business plan to a business I was congruently attempting to make a reality.

My team and I have since spoken to myriad new sources, won various competitions, including the Texas Christian University Founders Award at the Neeley Values and Ventures Competition. We have raised over $22,000 in non-dilutive funding and compiled a research advisory board. Most excitedly we have contracted with a researcher down in Ecuador to outsource and conduct the research on applied nanoparticle technology to vector control.

This path has taken me from a traditional student studying business at Ohio University to a semi-expert in mosquito spread diseases and full-fledged entrepreneur. The past two years have been a culmination of all that I have learned through my undergraduate career in an applied experience which I hope will end up to be a professional career. This thesis represents that work, and attempts to capture all the time and effort put in by my team and specifically myself toward trying to make the

world a better place. Please enjoy what you are about to read as I introduce you to Vaylenx.

Literature Review

The literature review is an important facet of a thesis, and is equally important for the writing of a business plan; however, often overlooked. For the purposes of this thesis and business plan I will implement a Systematic Literature Review. The review question will be one geared at looking into technology commercialization processes within startups. The following paragraphs outline what a Systematic Literature Review is and the protocol to draft one.

A Systematic Literature Review – or SLR is a more organized or, systematic way to conduct a literature review. According to Lynn Kysh (2013) a Systematic Review is a "high-level overview of primary research on a focused question that identifies, selects, synthesizes, and appraises all high quality research evidence relevant to that questions". While an SLR can be defined in many ways, it entails a more structured and focused method to writing and researching a literature review. The end product of an SLR is similar to a traditional literature review; however, it can often times entail meta-analysis and thematically map the outlined references.

A Systematic Literature Review (SLR) allows the researcher the ability to delve deeper into existing literature in order to identify challenges and innovations

alike within the specified area. To begin the SLR the review question needs to be identified along with a description of the question and the rationale behind the question. The process and methods within this SLR will take the form of a traditional literature review; however, with more organization and structure to alleviate future work load and increase comprehension of the process. Traditional databases via Ohio University's library resources (Alden) will be used, in addition to outside internet based research. These traditional databases include IBISWorld, Business Source Complete, and BizMiner.

When conducting a Systematic Literature Review one follows a more structured approach. The beginning of this approach begins with the drafting of a research protocol. This protocol serves as a base point for the SLR. Although this protocol is written first it is often times reiterated as the literature review itself changes through time. The protocol begins with a review of the question, an explanation of the process and methods, an overview of the types of data to be searched, a brainstormed list of the sources the data will originate from, search strings, inclusion criteria, exclusion criteria, rules for sorting the reviewed literature, a relevance assessment, an outline of the analysis and then finally a timeline.

- Review of the question
- Process and methods
- Data types

- Sources
- Search strings
- Inclusion criteria
- Exclusion criteria
- Rules
- Relevance assessment
- Outline of analysis
- Timeline

Search strings are the keywords and Boolean search criteria which will be entered into the search bars of the engines or databases in attempts to locate the articles and information. A "*" character indicates the Boolean operative of the word. This allows for all different possible versions of the word from the "*" character on. For example, the word innovat* can be read through the search engine now as innovation, innovative, innovator, etc.

Inclusion criteria lists the different types of data or mediums of written works which will be included within the search and consequently not ignored. The inclusion criteria table includes a description behind the reason for inclusion. An example of an inclusion criteria would be University Reports and the reason for inclusion would be to provide a factual frame of reference for a University mission ultimately illustrating the learning ecosystem.

Exclusion criteria lists the different types of research, papers or information to be excluded and not counted nor reviewed within the SLR process. Similar to the inclusion criteria table, the exclusion criteria table lists the criteria itself and then the reason it is excluded. An example of an exclusion criteria would be Pre-2004 and the reason it is excluded would be relevance with modern technological innovation.

This Systematic Literature Review methodology is very useful, albeit taking more time and effort in the beginning. It allows the researcher to understand their sources more fluently and makes them more useful for the writing of the literature review and thesis. Since I am not writing a traditional thesis the results of my SLR will be most useful in understanding the processes through which technology businesses undergo when they start. The SLR methodology will be summarized again within the thesis in the literature review section.

Explanation of the Process and Methods

Review question

The best approach to examine literature regarding technology commercialization within academic entrepreneurs is by way of a Systematic Literature Review (SLR). An SLR allows the researcher the ability to delve deeper into existing literature in order to identify trends and themes within the specified topic. To begin the SLR the review question needs to be identified along with a description of the question and the rationale behind the question. The question will be identified later in this section.

The process and methods within this SLR will take the form of a traditional literature review; however, with more organization and structure to increase comprehension of the process. Traditional databases via Ohio University's library resources (Alden) will be leveraged, in addition to outside internet based research. These will all be elaborated on in further sections of this Systematic Literature Review Protocol.

The question which is to be elaborated on for the purpose of this review is as follows:

i. What are the current themes within relevant literature pertaining to academic commercialization of innovation?
ii. Reiteration: What key success factors are present for academic entrepreneurs attempting to commercialize an innovative technology?

The question at hand helps the researcher, in this case myself, better understand what it is I am looking to uncover throughout the review and what sort of information would be most suitable and pertinent in previous literature. The proposed venture looks to enter the pesticide and biotechnology industries; however, not all literature is applicable to these industries. The literature is pertinent in that it helps me, an individual within in the academic ecosystem, understand, assess and strategize key reasons for success of the commercialization of innovative technology from the university atmosphere to the commercial atmosphere. Ultimately, this information will assist in problem identification, benchmarking and feasibility testing.

Types of Data to be Searched

Per a traditional literature review a variety of resources were leveraged for the sake of this SLR. Resources include, but are not limited to, library resources of Ohio University's Alden Library which is member to an assortment of databases. These databases are professional in manner in terms of industry research and academic in terms of traditional empirical research. Additional resources include information from industry experts, in the form of interviews. Some of these interviews were conducted by the researcher, others from alternative sources; however, just as credible. Additionally, traditional internet research will assist in a base of understanding for information too complex within some research or journal articles. News articles and published industry research will also be regarded within this review as up to date business information is required for the inauguration of a new business.

The data within this SLR will be rather recent; therefore, the timeframe for research will be no later than the year 2005. This is not a large timeframe; however, when looking into innovative products and commercialization techniques, the more recent the information the better. Information becomes increasingly less reliable and less applicable the older it is, especially in the case of technological innovation. Keeping in mind though that a lot of case studies look at technology which may hit the market years after original invention in the academic atmosphere. This means that the studies might have occurred earlier then perceived by outside individuals. For

example, the Google™ algorithm was created at Stanford years before Google's popularity.

Sources of Data

Data for this systematic literature review will include a variety of database sources. Most of these sources, as stated above, will be provided by the Ohio University Alden Library resources. A complete list of their resources is below; however, which specific databases will be used is to be determined. The individual database as related to the individual journal article will be tracked and accounted for within this SLR.

iii. Business Source Complete
iv. LexisNexis Academic
v. Mergent Online
vi. EBSCOHost
vii. IBISWorld

Search Strings

Academi*	Innovat*	Entrepreneur*	Commercialization	Universit*
Academi* AND Innovat*	Innovat* AND Tech*	Entrepreneur* AND Academic*	Commercialization AND Academi*	Universit* AND Innovat*

Academi* AND Innovat* AND Commercialization OR Venture	Innovat* AND Entrepreneur* AND	Entrepreneur* AND Tech* Commercialization	Commercialization AND Venture OR Innovat*	Universit* AND Commercialization OR Academi*
Academi* OR Universit* AND Entrepreneur* AND Commercialization	Innovat* AND Academi* OR Universit* AND Tech*	Commercialization AND Effort* AND Tech* AND Universit* OR Academi*	Commercialization AND Process AND Universit* OR Academi*	Universit* AND Innovat* AND Academic OR Universit*

Inclusion Criteria

N	Criteria	Reason for Inclusion
1	Theoretical Papers	Provide a background on research from the past
2	Industry Reports	To review current corporate efforts and research. This includes consulting reports
3	News Articles	Provide comparison between opinion and theoretical knowledge

4	Individual Company/University Reports	In depth understanding of each effort
5	Case Studies	For real world examples of academic commercialization
7	Interviews	To see what current entrepreneurs are doing
8	Website Articles/Forums	Looking at what experts' opinions are
9	Global Companies	Looking at global innovations within US and other nations, not just outside US

Exclusion Criteria

N	Criteria	Reason for Exclusion
1	Pre- 2005	Relevance with modern technological innovation. *Note exception
2	Knowledge Network Commercialization	Came across this during some preliminary research. Exclude as it does not pertain to technology
4	Studies in a different language	For comprehension purposes
5	Articles lacking an abstract	Articles lacking an abstract are often times not credible sources

Specified Rules

Rules for the specific efforts within this Systematic Literature Review include all the information in the exclusion criteria, meaning no information or research before 2005. There is however an exception. Research dated pre-2005 may be used if it does not pertain to quantitative assessment or application of technology, but rather qualitative or theoretical commercialization techniques. Additionally, when a search

offers more than 200 search queries the search will be refined. The new search terms and criteria were added to the protocol. The optimal number of search queries per search was approximately 50. Some search results repeated. If this was the case the article was excluded from relevant and useful information within the search.

Relevance Assessment

Relevance Criteria					
Element	Level				
	0- Absence	Low	Medium	High	Not Applicable
1. Theory Robustness	This article, element or information does not provide enough information to be relevant to the study				Element, information or article not applicable or relevant to study
2. Implication for Practice	This article, element or information does not provide enough information to be relevant to the study				Element, information or article not applicable or relevant to study
3. Methodology Data Supporti	This article, element or information does not provide enough information to be				Element, information or article not applicable or

ng Argumen ts	relevant to the study				relevant to study
4. Relevanc e of three areas: - Findings - Theories - Methods	This article, element or information does not provide enough information to be relevant to the study				Element, information or article not applicable or relevant to study

Outline of Analysis

In the process of this Systematic Literature Review I overviewed relevant articles through reading the abstracts and identifying key terms through the search keyword table, the inclusion criteria table and the exclusion criteria. I then identified if the article was relevant through application of the relevance table. If the abstract was deemed relevant, then I added it to my ProQuest Flow account for further review. I then read the sum total of articles I had prior to writing the SLR. I identified the key articles relevant to writing the SLR then eliminated any further irrelevant articles upon the further assessment of the sum total of the articles.

Upon completion of those steps I created a thematic map of the various themes throughout the literature. In order to accomplish this step in the process, I skimmed the abstracts once over again, individually, in order to realize themes. While reading each abstract I looked to identify key themes within each source. Some sources had multiple themes, others had a single theme. The themes were then categorized using excel and logically organized. Originally there were 18 themes, after a few iterations themes had been combined and only ten main themes were left. After a visual thematic map was created for comprehension purposes. Looking at how the literature is organized and how interrelated it is helped me understand key themes and areas of opportunity within this space of research.

Timeline

The timeline for this systematic literature review will commence immediately following the completion of this protocol, estimated to be March 31, 2015. The end date for this systematic literature review will occur by the start of the Fall Academic Term of 2015 at Ohio University listed Monday, August 24th 2015, according to the Ohio University registrar, it will be completed no later then December 10th, 2015; the end of the fall semester.

Between those dates multiple milestones will be set up between the researcher, Noah Rosenblatt, and the overseer of the SLR and thesis advisor Dr. Luke Pittaway. Weekly meetings will serve as minor checkpoints for the SLR on Tuesdays for one

hour between 10am and 11am. Meetings will be cancelled as necessary per each individual's schedule. Additionally, additional meetings will be added if necessary. In addition to writing the systematic literature review, various aspects of the business plan will be written in unison. This will maximize time efficiency.

Thematic Coding

First Iteration	Articles	**Second Iteration**	Articles
Academic Commercialization	33	Academic Commercialization	33
Corporate Commercialization	20	Corporate Commercialization	20
		Startup Commercialization	13
Realized Innovation	19	Realized Innovation	19
Supportive Collaboration	15	Government & Policy	10
Startup Commercialization	13	Market Strategy	14
Governance	13	Supportive Networked Collaboration	27
IP strategic Processes	12	Networked Knowledge & Communication	16
Support Networks	12	IP Strategic Processes	12
Networked Communication	11	Role Identification	10
Role Identification	10		

Market for Ideas	9	University Support	6
University Support	6		
Public Policy	6		
Operational Mapping	5		
Product Adoption	5		
Knowledge Transfer	5		
Government Funding	4		

Thematic Map

This section will overview what a thematic map is and its usefulness. It will also discuss each of the themes within the graphical representation in brief. The themes will be academically analyzed and elaborated on in further sections of this literature review.

The thematic map is a graphical representation of the differentiation and linkages between themes throughout the analyzed literature. After reading and analyzing 72 documents, themes between the documents begin to appear. After first compiling the themes into 17 different theme categories, I went back and combined some to get ten main theme categories. These are the ten categories you see above. The graphic represents how the themes are linked together.

The three main pillars of the themes throughout the literature are the commercialization sectors; academic, startup and corporate. These three sectors stand separate from each other as they represent three different ecosystems. The academic section represents institutions of higher education (IHEs), or universities. The startup section represents mainly ventures that have recently incorporated and are in the early or mid stages of their business. This section also includes companies that have formed as spin-offs from IHEs. Lastly, businesses lumped in this section are concerned only within technological markets. The corporate sector represents long established firms. These firms are usually looking to increase their repertoire of products or services and as a result lease or license technology from universities, or startups; in some cases, they may acquire startups as a whole.

The three commercialization sectors are unified by an underlying market for ideas and strategy. This section includes the market for potential innovation, consumer demands and product adoption characteristics. The market strategy looks more in depth at how the entities within the three commercialization sectors strategically penetrate their markets.

The realized innovation theme is linked between the academic and startup commercialization themes because the common theme is that ideas created or spawned through research at IHEs which are proved to be novel or especially innovative spin-off into their own companies; however, only if this technology is seen to be revenue

generating. The reason behind linking realized innovation between only academic and startup commercialization is due to the fact that corporate firms lease or license technology that is already proven for success (Snow, C. C., Fjeldstad, Ø D., Lettl, C., & Miles, R. E., 2011).

Government policy is a section because it serves as a guideline or regulatory body for existing firms. Sanctions, policies, laws and regulations can have the largest effect on corporations. Although they can have an effect on universities and startups, for commercialization efforts, corporations are most effected.

Role identification examines how individuals within academia see themselves and how this impacts and influences their decisions to commercialize. Academics who see themselves as researchers or scientists have alternative incentives for developing innovative technology and commercializing if versus academics who see themselves as entrepreneurs.

Support networks and collaboration act as a gateway for both corporations and IHEs. Corporations network with universities for a variety of reasons; however, research shows that one reason is for access to highly innovative and modern technology. Universities partner and collaborate with corporations because it allows them a network for them to license technology.

Networked knowledge and communication is similar to the prior except between startups and universities. Universities share knowledge with startups and communicate with startup ventures to allow for expedited commercialization methods or as spin-offs from their own university.

The next section of the literature review will be the analysis and review of the literature according to the themes outlined in the previous section. Each section is broken up by theme and will go in depth on the main points outlined in the previous paragraphs. Some sections will include supplemental information or information otherwise not stated in the above section of the systematic literature review.

Academic Commercialization

Academic commercialization of technology deals with the initiative movement of academic research and turning those results into tangible products for revenue generating businesses. Many researchers or scientists in a university ecosystem have the opportunity to take the results of their research and turn them into actionable and revenue generating businesses. This section of the literature review will address some of the catalysts and hindrances of the academic commercialization process. Before beginning it is important to understand the true meaning of commercialization, as it can be cross referenced for a variety of other meanings. For example, Diana Boehm and Teresa Hogan state that commercialization of ideas is also a method of moving scientific knowledge to the industrial space for further use, not commercialization of products necessarily. For the purpose of this literature review commercialization will

be used in the tense of moving ideas to tangible product lines., services and revenue generating businesses.

There are a few main factors which affect commercialization and its success from the academic atmosphere to the industrial or startup atmosphere. Casper, (2013) examined the spill-over theory, saw that direct contacts between university settings and industry settings are important in the success of commercialization. Networked communication and how embedded the university is in its entrepreneurial or corporate geographic environment is also an important driver. Lastly, there is a high level of importance played by the university's IP department, usually called a technology transfer office.

Direct contracts between university scientists and industry scientists drives commercialization efforts. Larger and more interconnected inventor networks leverages higher yield of commercialization efforts. Reiterating from earlier, the level of how embedded a university is within regional networks of innovation can help spur the commercialization of academic innovation (Casper, 2013). When analyzing the location of knowledge transfer and access of technical innovations from existing firm's researchers saw that existing firms were able to gain access to innovative technology through academic entrepreneurs (Gittelman, 1999). Gittleman, (1999) saw that there was significant knowledge transfer from entrepreneurial firms started by academic researchers to existing firms. There are also however, various hindrances for

commercialization of academic research. For example, role identification can serve as an impasse for commercialization, this will be elaborated on in further sections.

Commercializing results translating into product innovations from academic research holds various barriers. One of the most serious barriers for commercialization of these results to the product environment is the lack of funding and an early stage investment model (Gunter Festel, 2011). To overcome this barrier, universities are implementing founding angel investment models which come into play before dealing with venture capitalists and venture firms. Venture firms are typically more difficult to receive funding from as an early stage startup (Festel, 2011). Through this method the engagement of founding angels is not through monetary compensation, but through equity of the company. This may not seem like a necessarily new investment structure; however, its application to the university and academic ecosystem is (Festel & Kratzer, 2012). Many global universities are recently adapting to this change in methodology and organization; however, many U.S. universities have already adapted to it.

Technology transfer or licensing offices are created at institutions for higher education as the body that handles the management of all technological licenses (Ohio University, 2015). These technology transfer offices greatly increase the success of commercialization of new innovative technology from universities (Markman, Gianiodis & Phan, 2009). According to Markman et al. (2009) these offices are more

successful when they are autonomous, as individuals within these offices are handsomely rewarded for more licensing contracts.

There is a lot of potential opportunity being an academic looking to commercialize an idea; however, there are also a lot of challenges facing those looking to do so. Realizing the innovation or potential of the idea can serve as a catalyst in the time it takes to commercialize an idea. Alternatively, many ideas never move past the university ecosystem due to the scientists not being willing or able to move outside of their current role. This is identified in this review as *Role Identification*.

Startup Commercialization

Startups go through the commercialization process very similarly to academics. That is, they both struggle with similar general challenges; funding, partnership, scalability. Unlike academic ventures and commercialization efforts, startup commercialization efforts have one significant advantage. These ventures often utilize incubation or accelerator programs. Programs like these often have specializations in their core capabilities and these specializations assist startups through specific aspects of their business, commercialization is simply one of them (Malek, Maine & McCarthy, 2014). Some universities have implemented their own incubator programs; however, this will be elaborated upon briefly in the *University Support* section of the literature review.

David Hsu (2006) discusses how startup firms backed by venture capitalists are more likely to engage in cooperative commercialization strategic activities. These activities could be in the form of strategic alliances between startups and universities, or other firms. Additionally, it could also mean these startup firms are more likely to license technology from a university setting. According to Hsu (2006) the more heavily partnered a startup venture is, the more successful they will be.

Analysis shows that, startup firms have general lifecycles within a commercialization pattern. They face the same challenges and disruptors that many IHEs face; however, also have some unique challenges as their resources are sometimes less. To overcome this issue, the startup firms will partner with venture capital firms or other such support organizations. Some universities spin their own innovations off into startup firms, but maintain a level of involvement and support throughout the commercialization process.

Corporate Commercialization

An ability to commercialize technology, especially new technology, "quickly and efficiently will be a key success factor for companies" (Nevens, Summe & Uttal, 1990, p. 3). According to the study conducted by McKinsey, reiterated and paraphrased in the McKinsey Quarterly journal article by Nevens, Summe and Uttal (1990) the successful commercialization of technology is not dependent of inspiration, but more so the discipline of the company. To be successful the companies need to

“set clear, actionable adjectives, build functional skills and break down functional barriers” (Nevens et at., 1990, p. 3). As a result, companies look for new sources of technology to commercialize.

Many existing firms acquire technologies from existing sources, in fact the number is only increasing (Lichtenthaler, 2008). These firms have started to look elsewhere for technology to acquire or license. Some firms have moved into the academic ecosystem, while others have moved into the startup ecosystem leveraging semi-developed technology, versus rapidly innovative research licenses (Lichtenthaler, 2008).

Institutions for Higher Education are attempting to satisfy the increase in economic development through sharing knowledge throughout an alliance network of associated firms. This allows for an increase in innovation and from a corporate commercialization aspect an increase in product commercialization as access to innovative ideas increases (Lopez, 2013).

Corporate commercialization takes a variety of forms; however, most often preexisting and established firms will either license technology from the academic setting or purchase entire startup firms. Upon reviewing the literature, corporations commercialize technology because of how innovative it is and its ability to serve a large market.

Realized Innovation

Realized innovation deals with the ability of individuals, firms or organizations to recognize that usefulness and potential of an idea (Keinz & Prugl, 2010). A lot of research is never commercialized by the scientists because of this. Role identification can serve as another hindrance toward the lack of commercialized ideas; however, it will be discussed in a later section.

Realizing the usefulness of an innovation is one of the initial steps in a successful commercialization strategy as it allows the inventor the ability to understand the potential for a business opportunity. Within the university ecosystem, many researchers create innovations for motivations other then that of two significant highlighted motivations "innovation and wealth creation" (Keinz & Prugl, 2010, p. 269). This however, can be damaging in the success of the innovations commercialization as the innovation itself will remain under utilized and unrealized as viable business product (Keinz & Prugl, 2010).

One study saw that limitations existed between realized and exercised entrepreneurial activities and entrepreneurial research. The authors proposed that policy changes were the only method to which society could overcome the proposed limitations (Guerrero, Urbano, 2014). There was higher level of entrepreneurial activity and research at entrepreneurially focused universities (Guerrero, Urbano, 2014).

The innovation will never move through the commercialization process to production, unless all resources are managed properly. Therefore, one issue brought to light was the fact that not only did the innovation's potential need to be understood and realized, but so did the base of resources required to commercialize it (Harryson, 2008). If the correct "complementary assets" (Harryson, 2008) were not in place, then the innovation, no matter how appreciated the potential impact may be, will never be produced or adopted successfully.

After reviewing the literature, it can be confirmed that the ability to realize the importance and application of the innovation from the aspect of the entrepreneur is incredibly valuable. This will help kick off the initial commercialization process. More research could be done looking at specific case studies as none were found relating to the specific commercialization processes of an individual academic innovation.

Market Strategy & Market for Ideas

One factor which plays into the success of technology commercialization, streaming across all three areas; startup, academic and corporate, is a market for ideas. The two main influencing factors within commercialization and the market for ideas include identifying the correct market for the innovation and realization if a market exists.

According to Keinz and Prugl (2010) searching for the market for ideas is the source of one issue. The truth lies in the approach taken to identify the market for the innovation itself. In fact, Keinz and Prugl saw that using a "solution-based instead of problem-based approach" is a leading shortcoming in the success of product commercialization (Keinz & Prugl, 2010, p. 269). That entrepreneurs need to identify the problem they're trying to solve then create a solution, versus creating a solution and trying to identify if there is a problem marketable for the innovation. Unfortunately; however, this does not correlate with the current paradigm in university research. As previously identified, most innovation from academic research is a realized innovation seeking a befitting problem to solve.

Through a short analysis of preexisting literature, it can be seen that a market for ideas is essential in the success of any commercialization attempts. By identifying the problem, the entrepreneur is trying to solve and then either plugging in their innovation or research an innovation for that idea researchers can circumvent the potential issue of having an innovation outside of the market for ideas.

Networked Knowledge & Communication

The relationship between startups and universities with relation to innovation has proven to be a driver in successful product commercialization through literature examination. According to research conducted by Toole, Czarnitzki and Rammer (2015), university connections with startup firms actually prove to be a job creation mechanism. Those firms which partnered with universities versus those that did not

saw a growth in jobs. If we analyze these results it is possible that the job creation is in part due to commercial success of the startup firm. In fact, 3.4% of the total jobs created were attributed to alliances between the university and startup, which 7% of firms maintained (Toole, Czarnitzki, Rammer, 2015).

A major benefit of networked communication between universities and startup firms is the sharing of resources. Harryson (2008) examined that *Anoto,* a startup, lacked specific expertise to continue through the commercialization process. As a result, the entrepreneur navigated through a network of alliance-university resources to find individual to fill product integrator and marketer roles.

One study by Lopez (2013) saw that in general Institutions of Higher Education (IHEs) are shifting toward taking a "more active role in economic development" (Lopez, 2013, p. 1). As a result, universities have tried to accomplish this by outwardly licensing technology or innovation discovered and created through academic research to firms within the geographic region of the university (Lopez, 2013). IHEs are also attempting to satisfy the increase in economic development through sharing knowledge throughout an alliance network of associated firms. This allows for an increase in innovation and from a corporate side and an increase in product commercialization as access to innovative ideas increases.

It is evident through reviewing previously existing literature that networked knowledge and communication between startup ventures and IHEs can help the commercialization process. The higher degree of collaboration between startup ventures and IHEs, the higher level of success within each sectors venture. Let's not forget that this paper focuses mostly on commercialization of academic innovation though. Therefore, by collaborating ideas and sharing resources Institutions of Higher Education have a higher chance of successful commercialization of new and innovative ideas fresh out of the lab.

Government Policy

Governments assist universities through various policy and initiatives. Intervention between governments and IHEs is supposed to lead to increased output from Intuitions of Higher Education (Gulbrandsebn and Rasmussen, 2012). Some research shows that the collaboration of IHEs and entrepreneurial pedagogical methods encourage a market for ideas. This market is supplemented by various policies instituted by governments (Lundstrom and Zhou, 2011). Some industries, such as materials and technology, are limited due to policy interventions. Additionally, these industries are supplemented by proposed policy recommendations which focus on the challenges (Maine and Garnsey, 2007). In some instances, specific to individual countries, governmental bodies have instituted policies which force institutions of higher education to create channels for transferring and managing technology through the university into industry for the sake of economic development (Paymu, Gang, Pulumbarit, Jones, Maredia & Grimes, 2012).

Although government policy does not play as large of a role in commercialization of academic entrepreneurial innovations as other themes, it can be inferred it is very important. Being that government policy can overarch the entire entrepreneurial ecosystem as well as disrupt it; understanding the polices is valuable. Analysis of the literature shows that in some instances, collaborating or attempting to work proactively against policy reforms can actually expedite the commercialization processes.

Role Identification

One large factor playing into the success or failure of the commercialization of an academic innovation is role identification. Many times the researcher, scientist, or academic is the individual who discovers or invents to innovation. That being said they often times struggle within their role and the ability to see product commercialization potential as a result of their inability to align themselves with a different persona, the entrepreneur (Jain, George and Maltarich, 2009). One study shows that the individuals who align themselves toward a "hybrid" personality, self-identifying with both roles, academic and entrepreneur (Jain, George and Maltarich, 2009, p 922). This same study saw that overall university scientists "take active steps to preserve their academic role identify" (Jain, George and Maltarich, 2009, p 922).

Andrew J Nelson (2014) believes that there are a variety of individual factors which "correlate with entrepreneurship and commercialization behaviors" (p. 1144).

His research shows that organizational contexts can affect the behaviors of individuals and ultimately the roles they believe they assume. Lastly, Nelson found that academics are affected by their ability to interpret and act upon the entrepreneurial mission of a university. In other words, the mission of the university can affect their opinion of their own role. The more entrepreneurial the mission the more likely the academic to act in that manner, or assume that role (Nelson, 2014).

After reviewing the literature which applies to Role Identification it can be seen through critical analysis that researchers, students, scientists, etc. need to identify their role as an entrepreneur in order to gain a higher degree of success in commercialization. The more closely self-aligned an individual makes themselves with entrepreneurs the more often success can be observed. It can be inferred that universities play a large role in assisting in the identification of individuals' roles as they provide the environment and ecosystem, be it entrepreneurial or research based which fosters the role individuals, especially researchers, might more closely align themselves with.

University Support

Universities serve not only as the locus for innovation, but also as a support system for entrepreneurship. Institutions for Higher Education across the globe have instituted various policies which enable innovation and commercialization processes. Some institutions of higher education have implemented the use of incubators to induce the creation university based spinoffs. These incubators "promote and foster

the transformation of ideas, with highly innovative content emerging from University research" (Mazzi, Passeri & Bellandi, 2015, 173).

Other, more entrepreneurial, universities have implemented more rigorous spin-off programs. One university established a program which complements advanced research activities by giving the researchers or scientists resources necessary for commercialization, like funding (Hsiao and Brown, 2009). Universities are also forming "locus' of innovation" which serve as hubs for knowledge and management of commercialization as well as entrepreneurial activities. The loci of innovation can vary within each hub as to what specific practices or services they offer; however, they are managed by the universities (Hsiao and Brown, 2009, p. 148). Other universities have created their own venture capital funds (UVCs) which are used specifically to assist in the financing and funding of student or university started ventures (Widding, Mathisen & Madsen, 2009).

It can be seen through current literature that Institutions of Higher Education are swaying toward more entrepreneurial methods and missions. This results in an increase in support for ventures and innovations which are taking place at the university. Various universities are using different initiatives to increase the commercialization of innovation. One could test as to whether this increases instances of academic commercialization for technology or not.

Support Networks & Collaboration

Corporate entities and Institutions of Higher Education communicate to foster relationships for successful commercialization or venture attempts. There are a variety of strategies employed by corporate firms to help further their commercialization efforts. Corporate firms work with IHEs in order to foster innovation and boost sales through new products. Primary strategies include working with university-industry technology transfer (UTT) processes at universities (Johnson, 2011). Corporations will purchase research from universities which has a high level of promise to turn into a viable, revenue-generating product. Many times corporations will look for high-tech research with large scalability (Wouters, 2010). These offices help to foster the relationship between the two entities as well as collaboration. The university receives financial compensation as well as secondary press if the venture is successful. The corporate entity receives a mechanism through which they could boost their sales (Johnson, 2011).

In some instances, corporations will purchase startups very early in their lifecycle due to a promise of technology. These startups may be in a pre-revenue stage. Corporations will do this because small, early stage startups often have to navigate through "markets for technology", versus a product markets (Pries & Guild, 2007). There are large differences in "business activities of firms depending on whether they operate through product markets or markets for technology" (Pries &

Guild, 2007, p. 319). The markets for technology are usually lesser of a financial burden.

Through reviewing the literature regarding the relationship between corporations and Institutions for Higher Education, it can be seen that a fostering of a cooperative and collaborative is in the interest of both parties. Few studies have been conducted looking at the success of commercialization within markets for specific technology through these relationships, something which could be explored in further research.

The next section, methodology, will discuss some of the methods used to conduct the writing of the business plan used in this thesis. It will also compare alternative methods of business planning, including The Lean Startup Method by Eric Ries (2011) and a traditional business plan method. It will also compare and contrast some of the advantages and disadvantages of both.

Methodology

There is a vast variety of methods by which an entrepreneur can craft and plan their business. The traditional business planning method is just one of them. This is the method which is explained in this thesis, but for this section I am going to go into depth on the differences and similarities between the *Learn Startup* method and the traditional business plan. I will begin with a brief overview of the Lean Startup

method, and what it entails. I will include a brief overview about the traditional business planning method. Additionally, I am going to consider the strengths and weaknesses of business planning, and evaluate debates about its veracity.

Lean Startup Approach

The Learn Startup method was developed by Eric Ries in 2011; however, the principles used within the method have been utilized by entrepreneurs for years. The main idea behind the Learn Startup method is that the entrepreneur takes an iterative approach to their business (Ries, 2011). Instead of sitting and creating a plan to which the prospective entrepreneur would follow like a map, the Learn Startup method encourages the individual to simply go out and begin acting on their passion and business. In some ways it is like flying blind, but as the startup environment is constantly changing, it can be a very useful method.

The Lean Startup approach is based off of five principles which guide its methods. They are: Entrepreneurs are Everywhere, Entrepreneurship is Management, Validated Learning, Innovation Accounting, and Build-Measure-Learn (The Lean Startup Methodology, 2015). This section will detail what each principle means and how it feeds into the core philosophy of the Lean Startup approach. The Lean Startup method “isn't simply about spending less money” (The Lean Startup Methodology, 2015). It is about trying to frame the process and creating an iterative, almost scientific, approach to it.

The first two principles focus on the people within the startup company, and identifying if they are right. The first principle discusses how you do not need to be a starving entrepreneur, or working "in a garage, to be an entrepreneur" (The Lean Startup Methodology, 2015). Eric Ries compares corporate entrepreneurs, like the CTO of Proctor and Gamble to startup entrepreneurs (Eric Reis, 2011). Both face similar challenges, and both can use similar methods to overcome those challenges. The second principle looks at the management team around the venture, and evaluating their success needs to be altered to what general venture capitalists, or those individuals who hold them accountable have been attune to (Ries, 2011). Ries believes that many management teams within startup ventures "work at startup speed" (Ries, 2011). This makes them seem disorganized to venture capitalists, as a result they are replaced. According to Ries, the opposite is quite the fact, they are not disorganized, but playing outside of general management norms, which in a startup is necessary.

The second two principles, three and four, have more of a scientific focus. The first of which, Validated Learning, focuses on how to focus the startup. Most startups focus on revenue Reis (2009); however, believes that the business needs to focus on building sustainable business. The Lean Startup offers a variety of ways to do this, all blanketed under the *Validated Learning* principle. The fourth principle, *Innovation Accounting*, focuses on how to hold your startup accountable for a variety of metrics,

and how to identify those metrics. One important face which The Lean Startup Methodology (2015) points out, is how to prioritize work. The final principle, looks at building products. The theory examines how a startup could take an idea to a marketable, commercial product through an iterative process of build-measure-learn. The final piece to the fifth principle is identifying when and when not to "pivot" (The Lean Startup Methodology, 2015). The next section will overview some of the advantages and disadvantages of the Lean Startup method.

Advantages & Disadvantages

As with any process or method there are advantages and disadvantages; the Lean Startup method is no different. It has positives, but it also has negatives. Many of the positive aspects of the Lean Startup approach mirror from the method's principles, deeply rooted to believe that an entrepreneur should "find the customer first, then the product" (Jeremy Schoemaker, 2014) and that an entrepreneur needs to know how to pivot their business or product to tailor it toward the individual customer market. Many entrepreneurs end up failing or quitting because they fail to truly identify what the market needs. They might have a grand product or an amazing solution, but nobody will buy it due to the lack of market acceptance. The Lean Startup method takes a main focus at eliminating this burden. This is a fantastic way to build a business and as an entrepreneur rid yourself of some of the more *annoying* aspects of entrepreneurship, like falling "into the habit of falling in love with [your] product or idea" (Schoemaker, 2014). Running a lean startup is also a great way to save cash and

identify the best places for your cash to be spent, as taught by the principles in Lean Startup. Not every startup needs to be or should be lean however.

There are an equal number of critics of the Lean Startup method as there are supporters, and for valid reasons too. Many equivocate the Lean Startup Method as a solution to people who are looking to change their financial status, not necessarily change the world. If every company surveyed the market in the scientific manner lean teaches them to, many innovative products would not be around today. One example which Jeremy Schoemaker brought up was Google. If the founders of Google asked "anyone on the net if they thought there was a huge internet search problem" (2014), Jeremy is sure that most would have said no. Another example would be SpaceX. If the founders of SpaceX asked the market if there was a big problem with the commercial space industry most would have likely asked what the commercial space industry is. Other criticisms of the approach are less rooted in the method itself and more toward the credibility of the Eric Ries' career which has been "underwhelming, before writing the book" (Alan Gleeson, 2012).

There are many more positives and negatives to the lean Startup method, as many as there are supporters and critics; the above paragraphs only bring a few repeated literary points to light. As with any method with alternative approaches there will be critics, the Learn Startup approach is geared toward a specific audience. The

next section will discuss and overview the traditional business plan approach and the advantages and disadvantages to that method.

Traditional Business Plan Approach

In contrast, the traditional business planning route has the prospective entrepreneur craft an extensive plan outlining each section of their business in detail. This provides the individual with a set of near instructions on how to continue down the path they have already started venturing toward. This section will briefly overview what a traditional business plan is and some differences between various methods. The main example to look to for a traditional business plan is the bulk of this thesis, which includes a large business plan modeled after the 2015 version of *Successful Business Plans* by Rhonda Abrams.

Rhonda Abrams annually authors a book titled *Successful Business Plans* which overviews the various sections within a traditional business plan. Some individuals choose to omit sections, while others follow the publication more directly. Some believe that a traditional business plan is built with a specific goal in mind, one example would be a business plan "in the pursuit of investors" (Kathaleena Edmonds, 2015). The next section of the methodology will overview some of the advantages and disadvantages relating to a traditional business plan approach.

Advantages & Disadvantages

A traditional business plan is a bit more tasking then the Lean Startup approach. It requires hours of research, forecasting costs and revenues, as well as overthinking virtually every aspect of the business. There are however, many positives to writing a traditional business plan. Jan King (2016) believes that if you are looking to start a business that requires over $200,000 in startup capital, you will need a business plan. This is not to say that it is because the business is large, but because that it what bankers and investors will want. One of the advantages of writing a traditional business plan is attracting and *selling* your business idea to people who you are asking for money (Jake Welford, 2008). One of the positives is the after-effect and success of implementation of the business plan (Leigh Richards, 2011). Traditional business plans often have high levels of success when implemented, if done correctly.

Traditional business plans also have negatives, or disadvantages. One of the most infamous of them all, which comes first hand to me, is the pure length and detail required in writing one. Business plans take awhile and you have to know a good deal about your business, your market and general business concepts to write one. Another downside, as mentioned previously as a pro, is the implementation of the business plan. Often times business plans end up outdated as businesses evolve. As a result, the plan is "left to languish on a shelf or hard drive someplace" (Richards, 2011). This ends up resulting in wasted time and resources. Lastly, business plans are collaborative documents. They require different eyes reviewing, editing and writing the plan coherently. One person can write the plan, but one person does not always

have the expertise required to detail and analyze every part of the plan (Richard, 2011). In my case, I have had a variety of advisor's overview and guide me during the writing of my business plan.

As with the Lean Startup method, there are many advantages and disadvantages of writing a traditional business plan. Those discussed in this section are only a few of the most popular or relevant within the literature. The next section will compare the Lean Startup method directly to a traditional business planning method.

Comparison Between Methods

Criticisms of the traditional business plan method contrast those of the Lean Startup method in that they "do not prepare a business owner for everything" (Scott, 2010). Due to the constant change of the startup ecosystem, business plans cannot prepare the entrepreneur for what may change. Consequently, because these business plans are so complex, long and detailed, going back to edit and iterate the text is a dutiful task. This exact reason is why some entrepreneurs decide not to craft business plans and instead follow the easily iterative Lean Startup method.

Another contrast looks as the marketability and encouragement of the entrepreneur. A business plan tells you if your product or idea will work in the market. If your product does not work, then go back and rethink the market or an aspect of your company, do not change your product (Jan King, 2015). The Lean Startup

method is opposite in that it illustrates if the product will be accepted by the market, but in the case of failure encourages the entrepreneur to change the product, not the business.

Some skeptics of the Lean Startup method believe that its hype in academia is coming from the current popularity of other "lean" methods used elsewhere, like in supply chain management. K. Edmonds points out that academia has adjusted to the change of pace and popularity in traditional business plan practices by replacing with more popular methods, such as "lean, and crowdfunding strategies that emphasize trial and error" (2015).

Reasoning Behind Method Decision

There are a few reasons as to why I decided to choose a traditional business plan approach versus the Lean Startup approach for my thesis and business. First and foremost, I wanted an opportunity to exercise my research skills and my business knowledge. I felt as though a traditional business plan was better at doing this. Secondly, my academic experience here at Ohio University within entrepreneurship has been more focused on a traditional business plan versus a Lean Startup. There have been many times where my team and I have been face with challenges, even put in positions where pivoting was an option; however, we decided to push through instead of pivoting. This undoubtedly helped us craft the company into what it is.

Pushing through these challenges excited our passions even further and motivated us even more.

Additionally, I wanted to craft my business around my specific product. I did not want to develop a business for the sake of generating revenue, which is what the Lean Startup approach impressed upon me. However, there are a few lean techniques and principles which I have utilized and exercised throughout the actual creation of my business, namely crowdfunding. Vaylenx raised over $10,000 from crowdfunding alone. Crafting a business plan allowed me to break down and think about my business in a very logical and organized fashion. In my personal opinion, I think it really depends on what type of business one is trying to start as to which method to follow. Sometimes the best option might be a hybrid of the two.

Methods

In this section I will explain the process I went through while writing the business plan. A brief explanation of each section of the business plan will be included as well as a short biography of the steps I took.

Sections of Business Plan

Industrial Analysis

The industrial analysis will examine the current industry that the business aims to compete in. It will explore the industry health and growth in the past, present and potential future. Key players and majority market shareholders will be analyzed.

Competitive Analysis

The competitive analysis will consider the current players in the industry who pose the largest threat to the company. It will overview these specific businesses and their products and services. The final section of the business plan will look at potential disruption from the emergence of new technologies and will consider how the proposed company can compete.

Company Analysis

The company description will provide brief summary of the company including the mission statement; the company's core values and goals and its future strategy and development milestones.

Market Analysis

The market analysis section will study the product market, scrutinizing potential competitive products. This section will look at the product's competitiveness, not the company's competitiveness.

Marketing and Sales Plan

The marketing plan will screen for marketing efforts conducted in the past or presently being conducted by competitive firms. This section will also look into proposed marketing efforts to be conducted by the business laid out in the plan. This section will include some forecasted sales as well.

Operational Plan

The operational plan will look at the strategic and tactical goals of the company and how it hopes to achieve them. It will also shed light on the proposed and potential production and distribution strategy and methodology of the business.

Exit Strategy Plan

The exit strategy will outline a variety of exit strategies, canvass for the best proposed strategy and compare against current exit activity going on within the industry amongst rival firms.

Strategic Positioning Plan

The strategic positioning plan will describe the different advantages of the company, operational, proprietary and other such advantages which set it apart from other firms in the industry.

Management Plan

The management plan will summarize the organizational structure of the business. It will also go into depth on the team which is helping to start the company.

Technology Description

The technological description will give a more in-depth description of the product and a glimpse into the technical specifications and development process. It will also look at all required research and development, the milestones and associated potential challenges that the proposed business may face during the development process.

Pro Forma Financials

The pro forma financials will forecast the budget, provide a balance sheet, income statement and cash flow forecast for five future years.

Financial Plan

The financial plan will explain possible funding plans, and describe the funding strategy for the venture. Lastly, this section will look at long term methods for raising capital for future projects or products.

Process

This paragraph will list out the steps I took and what I did to write the business plan. First was the Global Health Case Competition. In 2014 my team and I competed

in the Ohio University Global Health challenge that focused on developing an innovative approach to combatting mosquito borne disease in Guyana. After winning the challenge we began developing our company Vaylenx. In July we travelled to Guyana to meet with high-ranking government officials to discuss the feasibility and implementation of our product. After traveling to Guyana we recognized that economically depressed and mosquito spread disease ridden countries were in desperate need of our product. Since then we've organized a strong research team and are working on garnering funding and setting up the necessary experiments.

After the trip to Guyana and having identified a very valuable aspect of our plan, the nanoparticles, my team and I decided to create a business. From there we contacted a law firm to arrange the legalization of the business. Once the business was created we separated and set out on two different coherent paths. One path was to try and gather some funding, the other was to gather a research team.

With regards to funding, we contact TechGROWTH Ohio. After speaking with John Glazer we were invited to become a client of theirs. We would work with Lee Groeschl and John Glazer over the next few weeks to try and figure out strategies of raising capital. Lee came up with the idea of crowdfunding. We raised over $10,000 from crowdfunding alone. We set up meetings with investors, angle networks, and other potential capital generating organizations. We were invited to the MIT Lemelson Investors Challenge which promoted the idea of business competitions. After

competing in the MIT challenge we met with Paul Benedict to compete in the Texas Christian University (TCU) Values and Ventures competition. On April 7th we travel to TCU to compete.

The other path, gathering a team of researchers, was much more difficult. I met with various professors at Ohio University to try and see if anyone could introduce me to someone with the expertise we needed. Finally, I was pointed in the direction of Dr. William Romoser an entomologist. He met with me and pointed me in the direction of even more researchers, Dr. Roger Nasci, Mike Cooper of the Ohio Mosquito Control Association (OMCA), and more. None of these individuals could help us explicitly. We began cold calling researchers and professors at other universities or labs. Eventually we met back with Dr. Romoser who pointed us to Dr. Marco Neira. After one Skype session Dr. Neira was on board. From that point we have begun working out the legalities of the partnership.

During all of this I continuously wrote the business plan. The graphic below illustrates the steps in writing the business plan. Each section was written after doing research, either primary or secondary, pertaining to that particular section. For example, in the marketing and sales plan I would research what previous companies had done, but I would also call to get quotes for specific services

The next section of the document includes the business plan. This is a separate document used as the basis for the research of this thesis. As explained in the previous section, I will be exemplifying a traditional business plan example. The citation of outside documents is synonymous to that of traditional business plans. Additionally, the writing style and format of the business plan is different then that from above. The style follows guidelines of traditional business plan literature. Lastly, this section includes its own references in the footnote style, the full list appears at the end of the section.

Business Plan

Company Description

Vaylenx LLC is an Ohio based company offering innovative and proactive vector control products and services to a global community plagued with vector borne diseases. Vaylenx LLC. operates under the name Vaylenx.

The company was founded in 2015 and operates out of Athens, Ohio with research facilities in Florida and branches in global strategic locations. The pilot international branch is located in Georgetown Guyana.

Mission Statement

To create and distribute innovation and proactive methods to prevent vector borne diseases using environmentally friendly solutions.

Vaylenx LLC is a global company creating and distributing innovative and proactive methods to prevent vector borne diseases using environmentally friendly solutions. The products Vaylenx offers are only matched with its customer service. Vaylenx takes all customers to heart as valued shareholders of the firm following through with every engagement and sale. The firm is a partner to foremost the environment and the community. Employees and customers enjoy an unparalleled level of transparency and involvement with one another.

Services

Vaylenx is a product based company offering a variety of vector control solutions. Currently, only one such method is planned for commercial release with other solutions in an R&D pipeline. The inaugural method is using carbon nanoparticle pellets, CNP-1© to proactively control the mosquito population in tropical and sub-tropical areas whilst not harming the surrounding environment or biology.

The technological aspect of the product is in process of continuing research and development. Currently, Vaylenx LLC. has completed the initial stages of research to prove product validity. Vaylenx will create revenue through the sale of a carbon nanoparticle solution used to alleviate vectors. The technology has preexisting developmental applications; however, non pertaining to vector control.

Vaylenx will create revenue through the sale of CNP-1© used to kill mosquitoes. The proposed revenue model plans for two revenue streams. The first being revenue generated from the sale of CNP-1© to world governments within areas afflicted by vector borne disease. Initially, beginning with distribution to the government of Guyana due to our preexisting relationship with their government.

Initially, beginning with distribution to the government of Guyana; however, ultimately spreading to a global market. Within Guyana, the Ministry of Natural Resources would purchase the product directly from Vaylenx and distribute it throughout their Geological and Mining Commission to individual mining teams.

These mining teams would be able to use CNP-1© in the standing water that collects on the mining sites. This would reduce the level of mosquitoes within the small geographic area of the miners and result in fewer disease outbreaks ultimately increasing efficiency within both the mining commission and for the individual miners.

The second method is privatized licensing to biomedical, or agricultural firms, including large medical companies with interest in tropical disease alleviation, like DuPont Chemical and Bayer AG. Recent acquisition and licensing activity present within their public information show promise toward partnership or purchase. Preliminary talks with companies which focus in larvicides, namely Clarke Mosquito Control and ADAPCO Mosquito Control Solutions, have begun. After presenting at the Ohio Mosquito Control Association (OMCA), Clarke Mosquito Control and ADAPCO approached us with interest in potential research and application. Clarke is currently interested in discussing product commercialization possibilities, while the Vaylenx team has reached out to ADAPCO for researching opportunities.

Other products include a method for control and reduction of Quagga Mussels within the Great Lakes regions of the United States. This would be a novel technology developed through Vaylenx LLC. The last proposed product is a low-cost malaria detector which, similar to a diabetes test, can detect the presence of malaria with

simply a droplet of blood. This technology would come through the acquisition of Disease Diagnostic Group, a Cleveland based start up firm.

Vaylenx has been well received by interested key stakeholders. The Center for Disease Control, U.S. Department of Agriculture, and the Ohio Mosquito Control Association have assisted us in research and expertise as well as promised us field testing facilities along the Great Lakes in Ohio. The Ministry of Natural Resources of Guyana, Ministry of Health of Guyana, and the Office of the Secretary to the President of Guyana have promised us field testing space within the Hinterlands, as well as access to miners and mining companies.

Development to Date

Current company development can be segregated into three sections: R&D, finance and team formation. The company has made significant strides in each of these areas as of its inception.

Within R&D, Vaylenx has developed a scientific advisory board which will be governed by leading experts in the field who will help guide the research of the pilot product. The original study which shows product feasibility has been licensed to Vaylenx for further research. Currently the firm is searching for a lead researcher to lead R&D efforts hands-on.

Vaylenx has secured some funding with promised investments for the future, this information is illustrated in further detail in the following section. The firm has looked at additional sources of capital, including incubators and business plan competitions. Accumulated funds will be leveraged toward access of further funding and investment. The legal team has also provided the leadership of Vaylenx with a variety of angle investors of a high net worth.

Vaylenx has created a team of full time, committed individuals including the CEO, Noah Rosenblatt and two additional members; Katherine Clausen and Morgan Stanley. A fourth individual, Savannah Heller works on the firm's digital presence and design. The company is in its infancy currently. The team has created a scientific advisory board of 6 members with expertise in a variety of sciences to assist in the research. Lastly, Vaylenx has secured the interest of Dr. Marco Neira an expert researcher in Quito, Ecuador who says he can assist in piloting the research and development. Contracting negotiations are currently underway.

Legal Status and Ownership

Vaylenx LLC. was established in the state of Delaware as of September18,2015. The location of the registered office is 1209 Orange Street Wilmington, 19801. The company was established through the legal entity of Benesch Friedlander Law located in Cleveland, Ohio. The company is set up as a single person Limited Liability Corporation (LLC). Noah Rosenblatt is the sole shareholder of Vaylenx LLC. There

are 50 million authorized stock shares; however, currently there are no issued shares, common or preferred. Noah Rosenblatt owns one hundred percent of the firm.

The company has trademarked the name of Vaylenx for marketing and advertising purposes. The company has also proposed patenting the pilot product. Two patents will be filed, one for design and one for manufacturing. The patents will be filed in all locations of distribution as well as competitive innovative geographic locations, namely India and China. The patent will initially be undertaken as a provisional patent giving Vaylenx a 12-month period to raise capital for patenting funding.

Current funding as come from personal investment of Noah Rosenblatt totaling approximately $1,000 USD. Crowdfunding has brought in an additional $10,200. The Honors Tutorial College of Ohio University has also donated $1,600 in kind. Therefore, the total liquid cash for Vaylenx LLC. totals $12,800. Tim Holt has pledged a financial commitment of an unknown amount. TechGROWTH Ohio has also proposed a financial commitment of what is believed to be approximately $50,000.

Total funding sought is approximately $2 million USD to fund initial research and development as well as business administrative and setup costs.

Industry Analysis

Overview

The industry NACIS is *32532 Pesticide Manufacturing* in the US. The industry can be broken down by NAICS code into three other sub-industries, Enzyme Manufacturers (32532.02), Insecticide Manufactures (32532.04) and Pesticide & Miscellaneous Agricultural Chemical Manufacturer (32532.06) [25]. The industry itself is segmented into the downstream, distribution and upstream production of pesticides. Additionally, there are a variety of pesticides which segment the industry even further. These segmentations will be discussed in detail in section 2 (a), but include herbicides, fungicides, insecticides and an other category. Vaylenx, as a business, focuses on both the downstream distribution and the upstream manufacturing of the product. Vaylenx operates within the vector control insecticides market specifically relating to mosquitos. In terms of innovation, Vaylenx has a novel idea to which current patent literature does not explore. Therefore, the innovation within this specific business plan would be implemented through the Pesticide Manufacturing industry.

This industry analysis will explore the size and growth of the industry in which Vaylenx will operate within. It will also discuss the maturity of the industry, technological change, a brief overview of financial characteristics, regulatory issues and barriers and sensitivity to economic cycles. By the end of the document Vaylenx will indirectly identify its position within the industry in order to more directly identify the strategic position within the market overviewed in the market analysis.

Size and Growth of the Industry

The Pesticide Manufacturing industry is growing; this is good news for Vaylenx. According to IBISWorld the averaged annual growth from 2005 to 2015 is 3.16% while the annual growth from 2015-2020 is around 1.95% per year[2]. Although the proposed average annual future growth is lesser then the past annual growth, the past annual growth averages ten years' worth of data versus five, ultimately skewing the numbers. Between 2010 and 2015 the growth rate was considerably higher (13.24%) then between 2005 and 2010 in which the industry saw a decline in growth (-5.23%). This was due to the recessions effects on imports and exports within the global economy ultimately effecting the downstream nature of the industry. Additionally, the current outlook of the industry according to IBISWorld for the 2016 year shows a -15.2% growth rate[2]. This number skews the future predictions and the averaged annual growth rate for the next five years. If 2016 is eliminated and the time span from 2017 to 2021 is averaged, it shows positive growth of approximately 5.38% which is higher then the previous ten years.

The total revenue of the entire Pesticide Manufacturing industry equals $21.5 billion annually, as of 2015[2]. Revenue is expected to drop in 2016 as stated previously; however, it is expected to climb .9% in 2017 and increase to $23.6 billion as of 2021. The profit margin is approximately 8.3% of the total revenue. Between 2015-2021 it is reported to increase to 12.2% of total revenue totaling $2.6 billion[2]. This is good for Vaylenx, because it is a high industry profit margin relative to all industries at 7%

margin[2]. Profit for the industry is proposed to increase throughout the future years as prices for oil decrease driving costs of exports down and an increase in demand for exported goods from this industry.

The industry as a whole has been recovering from the recession over the past several years and has shown an increase in activity as well as growth in revenue. This is good for Vaylenx as it provides apt timing for market entry as the Pesticide Manufacturing industry is steadily growing. Although the growth has not been large, it is steadily increasing. The increase in trade volumes will boost operations and revenue for Vaylenx within the industry. The largest barriers to growth include external and internal competition. Trade imports and exports are decreasing in scale on a short run time horizon, but increasing in scale on a long run time horizon as newer trade routes are established. In the short run major industry players are consolidating with smaller companies to establish a monopoly over existing trade routes internationally. As a result, future research lends itself to believe that smaller companies will attempt to retrieve market share by establishing trade routes through developing markets, i.e. Asia[2]. Monopolization within the industry proposes one of the largest barriers to growth as 66.2% of the industry is controlled by five companies; Bayer AG (21.6%), Dow Chemical (16.6%), Syngenta AG (11.6%), Monsanto Co. (10.3%) and DuPont (6.1%). The competition will be elaborated on in a further section of the business plan.

The recession caused a large deficit in revenue, profit and sales within the Pesticide Manufacturing industry. Revenue fell 11.3% in 2010 alone[2], years after the recession began. The decline in revenue from the recession was "caused by decreasing farm incomes and increased offshoring to low-income countries to reduce costs"[26]. The offshoring of production labor provoked an increase in globalization within the industry and has now resulted in increased revenue in the long run from established lines of exportation. Technological advantages and innovation within the industry has also caused a surge in revenue as many pesticides have begun employing hydrocarbons. Hydrocarbons are an energy intensive activity therefore, falling oil prices decreases production costs and increases revenue in the downstream[2].

Year	Revenue $ Million	Growth %
2016	18,262.7	-15.2
2017	18,422.3	0.9
2018	19,182.0	4.1
2019	20,556.2	7.2
2020	21,974.0	6.9
2021	23,687.8	7.8

Maturity

The Pesticide Manufacturing industry is mature in its lifecycle. Maturity is measured by the value added to the overall economy over a ten-year period. This overall value

added is expected to increase at 6.3%[26], this is more than the overall GDP of the US economy, 2.2%[28]. This shows that the industry is growing and contributing to the economy of the US. One large reason for the mature nature of the industry is the consolidation, as mentioned previously. Many of the large players are purchasing smaller companies and consolidating throughout the industry[27]. However, growth is promoted through innovation caused by public opinion on the use of certain chemicals. This leads companies to niche differentiate themselves causing a slight growth in smaller businesses. It also lends itself to increased R&D expenditures toward innovation, where Vaylenx finds a strategic edge. Oil prices have also increased growth and slowed maturity as new markets become more available[2].

Startup trends and activity shows that as of the second quarter for 2014 there were 24 startups[25]. The average sales for these startups were just over $8 million with a combined total of a 2.17% market share[25]. With 24 firms starting operation in 2015, over 19% of the industry is comprised of startups[25]. This is positive for Vaylenx showing that despite consolidation startup firms are able to survive and grow. When looking at the Pesticide Manufacturing industry as a whole the number of enterprises has seen a decrease from 2012 to 2015Q2[25]. In 2011 there 207 reported companies, while by 2015 there were only 179[2]. This shows the consolidation. Additionally, according to BizMiner the average cessation rate is approximately 16%[25] which means that the majority of the companies are being bought out versus ceasing operations due to financial reasons. In terms of sales, small businesses, which includes startup firms,

have the lowest numbers in terms of revenue; however, they have increased 12.2% annualized since 2012[25].

	Q3 2013	Q4 2013	Q1 2014	Q2 2014
Establishments	42,708	42,735	43,099	43,425
Local Government	828	824	833	832
State Government	451	450	450	453
Federal Government	202	189	180	180
Total	44,189	44,198	44,562	44,890

***Source**: Bls.gov. Industries at a Glance: Support Activities for Transportation: NAICS 48. Bls.gov,. (2015). Industries at a Glance: Support Activities for Transportation: NAICS 488. Retrieved 8 March 2015, from http://www.bls.gov/iag/tgs/iag488.htm*

Technological Change

The Pesticide Manufacturing industry has a high level of technological change[2]. There are a few leading reasons as to why technology has been changing so rapidly within the industry. This includes high R&D costs, risk and level of innovation. Additionally, the technological change has been spurred and influenced around a few specific areas of innovation relating to public opinion on specific treatments and evolution of pests.

The Pesticide Industry has very high R&D costs which is caused by the high level of research occurring within the industry. Companies are constantly needing to develop new products as well as update previous products. Some strategic alliances within the industry is driven by these high R&D costs. Companies see it as less risky and less capital-intensive to partner with other companies, spreading costs and risk amongst multiple entities[2]. Other companies are purchasing startup companies which drive innovation within the industry. Larger enterprises find is easier to purchase the technological innovation off a startup, developing the technology, versus trying to invent a novel product on their own. Many startups cease business through acquisition versus bankruptcy[25].

Startup firms are popping up within the industry focusing on two areas, innovation relating to the evolution of pests or innovation spurring from formation of alternative products as public opinion changes. Pests are living organisms and as a result they evolve. Many of the pests which pesticides treat evolve rapidly, similar to the drug market with diseases. This causes a constant battle for inventive and original products to attack pests differently. Vaylenx falls into this niche within the industry as the company is attempting to attack the mosquito in a new, novel method as many mosquito populations have become immune to some of the current methods.

Additionally, public opinion has caused innovation. One such is example is Genetically Modified (GM) crops and pesticides. The more GMs are being brought

into a brighter light, people are disapproving[28]. This causes firms to go back and reinvent products they had previously been employing. They are creating entirely new product lines in order to attack the same issues. Startup firms are also finding niches within this area of the industry. Vaylenx has an opportunity to grow off of this issue as our product is environmentally friendly.

Regulation

The Pesticide Manufacturing industry, as imagined, has a very high level of regulation. This level of regulation is only increasing as new products and pesticides are being developed[2]. Regulation in the Pesticide Manufacturing industry effects not only the development of the products, but also the sale and application. The main regulatory issues for a company operating within the Pesticide Manufacturing industry inside of the US are those pertaining to the Environmental Protection Agency (EPA) and those guided due to jurisdiction policies.

The Environmental Protection Agency is "is responsible for regulating the production and use of pesticides in the United States under the Federal Insecticide, Fungicide and Rodenticide Act. This act grants the EPA authority to register and assess the risks of all agricultural chemicals. The EPA assesses the ecological effects of a pesticide's use and evaluates its toxicity residues"[26]. If a product is not cleared by the EPA for use, then it is not allowed to be sold or manufactured within the United States. Other countries have similar agencies to control the creation, distribution and allocation of

potentially harmful substances. One famous pesticide which potentially caused the major regulations there are now is DDT. DDT was a vector control pesticide which was employed since 1874; however, studies done in the mid 1970s showed malign side-effects on humans and biotic life[29]. This caused the EPA and other state agencies to spring into action.

The second most impactful regulatory issue surrounding the industry is that of jurisdiction. Pesticide manufacturing is subject to "regulations in the jurisdictions in which they operate"[26]. Not only do each of the fifty states within the United States have their own regulatory and jurisdictional policies, but so do foreign countries. A product, like Vaylenx would be employed throughout the planet, focusing mostly within tropical and sub-tropical areas. With this in mind American manufacturing of the pesticide would need to be cleared through the EPA, licensed for testing, and preliminary use and manufacturing within the US; as well as other countries which may be considered applicable and viable markets.

Most EPA regulations are concerned with pesticides for agricultural means as these most directly effect humans; however, strict regulations for pesticides which have the potential to come in contact with humans are subject to scrutiny as well. Vaylenx has proposed a product designed to be used within water sources, both open and closed. These water sources could be seen by the EPA as having the possibility to come in contact with humans.

The benefit to the EPA is that through the banning of certain pesticides, herbicides and fungicides, innovative entrepreneurs and researchers have created environmentally friendly alternatives. Vaylenx's pilot product has been proven to be environmentally friendly to surrounding aquatic life as of preliminary lab testing. Due to the publics concern with pesticides which are not environmentally friendly, the demand for more environmentally friendly solutions has been increased. This means there is more capital to be acquired for startups and more eager researchers. One push has been to look into bacterial pesticides.

Financial Characteristics

Capital intensity for the Pesticide Manufacturing industry is high[26]. The high capital intensity is attributed to the high level of research and development in the industry[2]. R&D in the industry is pushed by two factors, mentioned previously; increasing reliance and push for new technology and innovative products, and increase resistance to current methods. Reiterating, the high level of capital intensity and large R&D costs are one of the highest driving factors for partnering, merging and acquisition activity within the industry[2]. In 2015 purchases accounted for the largest expense in firms operating within the Pesticide Manufacturing industry at 52.0%[26]. This is lower then the average industry costs within the sector; however, R&D costs are over 5% higher on average[2]. Additionally, according to IBISWorld report on the industry, in 2015 for every $1 spent on labor, $1.09 is spent on research and development[2].

The average annual revenue for the Pesticide Manufacturing industry was just under $100 million, at $99,526,066 Q4 2015. This number was created through dividing total industry revenue by the number of firms as provided by IBISWorld. When examining a micro-finance report regarding solely startup firms, average revenue has decreased from 2010 to 2015 from $9.4 million per firm to $6.3 million[30]. On the other hand, net profit as a percentage of total revenue has increased since 2011 from 21.75% to 24.87%[30]. One fact that could attribute to the lower revenue would be the increased number of startup firms. According to BizMiner there are 13 startup firms as of Q2 2015 whereas there were 8 in 2010[29].

The Cost of Sales for the Pesticide Manufacturing industry averaged over 13 startups firms for Q2 2015 was $2,888,687[30]. This means that 45.33% of the total revenue was spent incurring costs or production or sales. This is relatively low, by industry standards. The after tax-net profit for Q2 2014 was 24.87%[30]. This number was figured after calculating costs for all the other expenses including, salaries, rent, taxes, etc. The EBITDA was nearly 26% of total revenue, or $1,868,594[30]. The profit margins for the industry are relatively high, by industry standards.

Gross profit, in terms of revenue of the industry for the thirteen startup firms has continued to remain steady over the past year, slightly increasing since 2013. Overall profitability of the industry for startup forms is rather high.

Profitability						
	2010	*2011*	*2012*	*2013*	*2014*	*Q2 2015*
Gross Profit: Revenue	59.63	54.28	49.52	49.46	54.67	54.67
EBITDA: Revenue	27.73	24.72	18.09	19.08	25.48	26.41
Return on Revenue	26.94	21.75	16.7	18.11	23.54	24.86

The Pesticide Manufacturing industry's current ratio for Q2 2015 was 2.40[31] which was relatively average over the past 5 years, increasing slightly. This means that the majority of companies in the industry have the ability to pay off current liabilities with their cash on hand and liquid assets. Additionally, the Days Payable ratio was 27.45 for Q2 2015[31] which means it took only 27 days (rounded) for the company to pay the payment toward its payable liability. This is good news, meaning companies have rather liquid assets and cash on hand is rather flexible. This also means companies are not leveraging debt as much to afford changes in organization or new ventures. Vaylenx will be able to benefit from this because it shows that most companies are financing operations without the use of debt. Vaylenx wants to minimize debt and debt usage as much as possible to ensure long term longevity.

The cost of sales for accounts payable which measures the number of times payables turn over in the course of the year (high measures indicate cash flow concerns) is relatively low. The average for Q2 2015 is 13.30. This number is however slightly higher than the 2013 cost of sales for accounts payable at 12.05[31]. This means that companies have very little issues with cash flow and receiving cash from accounts. Vaylenx will benefit here because it shows a lack of difficulty in receiving payments and payments on time and ultimately will allow for quick and stable growth as a startup. Please see the appendix for more detailed financial information.

Sensitivity to Economic Cycles

The Pesticide Manufacturing industry is somewhat sensitive to economic cycles. It is largely sensitive to big changes in economic activity, such as the 2008 recession. This is because much of the revenue from the Pesticide Manufacturing industry comes directly from the farming industry, 63.2%[26]. The farming industry is rather stable year over year, with an annual increase in recent years of approximately 20% annually[2]. Large changes which effect the farming industry often will resonate in the Pesticide Manufacturing industry as well.

The Pesticide Manufacturing industry's second largest demand market is exports, which serves all international trade for product demand within the industry. This market sector is very sensitive to economic cycles as multiple economies can be effected from a single event creating a domino effect. The exchange rate of the dollar

to other currencies can also have an effect on international trade and product demand, either increasing or decreasing it. Although growth can be largely attributed to the increase in the farming industry, which is not directly a revenue source for Vaylenx, the increase in downstream trade revenue is an area where Vaylenx can benefit.

In 2008 the US economy crashed and went into a recession as a result many industries were hit with ill-luck and poor performance as they struggled to stay afloat in a rather stagnant economy. The Pesticide Manufacturing industry was no exception. During this period the reduction in activity for farming and agricultural industries, and consumer spending led to a decrease in demand and the industry plunged. Between 2008 and 2009 the revenue for the Pesticide Manufacturing industry decreased a staggering 15.1%[26]. The industry had a strong recovery in 2012 with an increase in revenue of 27.3%[26] the largest increase in year over year revenue since the recession. It was not until 2013 that the industry surpassed the prerecession levels of revenue[26].

The industry has experienced increased levels of competition as a result of the positive growth. Reiterating the face that big players within the Pesticide Manufacturing have put pressure on the smaller players through acquisitions, consolidation and expansion of products and services[26]. This information will be expanded upon within the competitive analysis. Vaylenx can still operate on a competitive level; this will be expanded on in the competitive analysis.

Globalization

Globalization within the industry is medium however it is steadily increasing[26]. The industry market share is controlled by a majority of large international or multinational corporations; however, the smaller players do not have an international reach. Globalization levels are increasing as a result of two occurrences. The first being that caused by the heavy market saturation which has pushed smaller companies to look elsewhere for business. Secondly, as a result of the recession, international trade has increased resulting in new foreign opportunities for both large and small companies.

Population within foreign countries continues to rise increasing agricultural demand as well pushing the demand within the pesticide industry[26]. This demand is not entirely relevant to Vaylenx as the pilot product is not an agricultural fertilizer or assistant; however, mosquitos do breed in stagnant water which can be found around many farms. As a result, this could potentially open up new commercial opportunities.

This level of globalization but steadily increasing trend toward foreign operations provides an opportunity to Vaylenx. Vaylenx will be able to enter the industry at an appropriate time in order to scale up for global operations just as the industry trend is growing toward global operations. A niche for Vaylenx could be to be to scale operations to a larger magnitude or dual US-foreign ownership to inchoate foreign services into operations as a Unique Selling Point (USP).

Market Description

Vaylenx LLC operates within the Biochemical market within bio-pesticides of invertebrate larvicides, *see figure 1*. Competition within this market will be addressed in the following section. From here Vaylenx will continue to grow within the Bio-pesticide market as we want to stay true to our values and mission of being environmentally friendly, to which chemical pesticides traditionally do not factor in the environment[8]. There are other types of bio-pesticides outside of biochemical, including microbial and semiochemical[9] (*figure* 1). Vaylenx would move from biochemical into microbial as it less chemically focused and therefore considered more environmentally friendly then semiochemical. From there Vaylenx would want to move into diagnosis of vector borne diseases acquiring diagnostic tools such as the hand-held malaria detector from Disease Diagnostic Group[10]. The target markets of Vaylenx can be broken down by geographic region, demographic description and psychographic description.

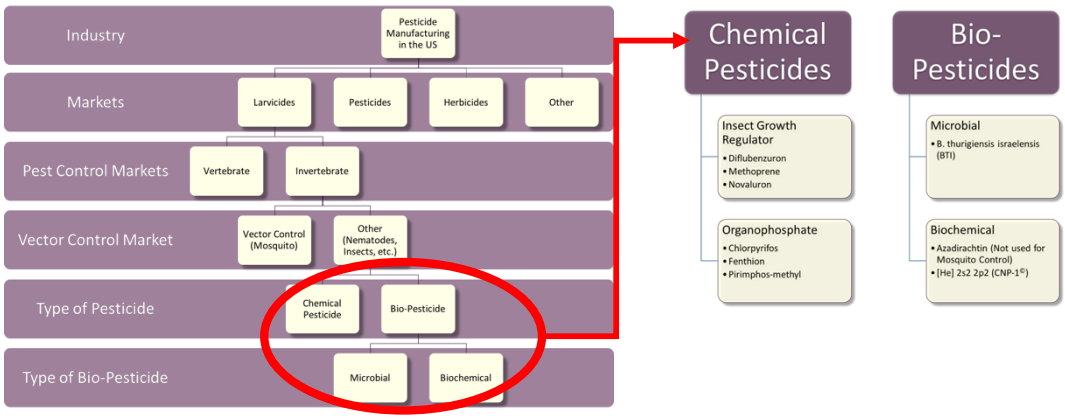


Figure 1

Target Customers

The initial target customers by geographic region would be the government of Guyana, due to the preexisting relationship with Heads of State and persons of influence. Future distribution would mirror Guyana and target customers would be global governments within tropical and sub-tropical areas, spreading throughout South America from Guyana. The current plan is to market to Brazil following successful implementation in Guyana as it has the largest market of consumers within S. America[11].

One example of distribution due to the current distribution strategy would be through Guyana's Ministry of Natural Resources who would purchase the product directly from Vaylenx and distribute it throughout their Geological and Mining Commission to individual mining teams. These mining teams would be able to use CNP-1© in the standing water that collects on the mining sites. This would reduce the level of mosquitoes within the small geographic area of the miners and result in fewer disease outbreaks ultimately increasing efficiency within both the mining commission and for the individual miners. Additionally, some countries, like Guyana, would be able to distribute CNP-1© throughout public water canal systems.

Market Size

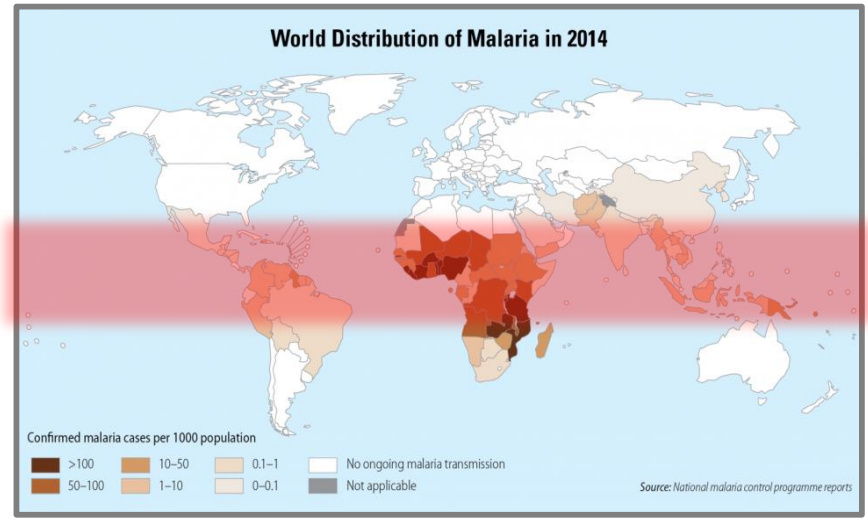


Figure 2

The market as mentioned previously, is large. There are over 112 countries that are affected by vector borne disease, *refer to figure 2*. This means that in terms of customers there are 112 governments by which Vaylenx could sell CNP-1©. However, the market must be broken down into individual market segments. Market segments for Vaylenx are first broken down by geographic area. This is because the CNP-1© is a larvicide whose demand is driven by the population of specific mosquito species. Any geographic area that is afflicted by vector-borne diseases would be considered a potential market. The majority of these markets are within tropical and sub-tropical climates *see figure* 2. Within these climates there are three species of mosquitos which transmit diseases; *Anopheles Gambiae, Culex, Aedes Aegypti*. The location of these mosquitos is the geographic area and target market location.

The market can be broken down by country basis and then by consumer basis. There are 112[1] countries that are afflicted by Malaria alone. The majority of these countries

are also affected by other vector borne diseases, including, but not limited to, Zika Virus, Chikungunya, Dengue Fever, Yellow Fever and Japanese Encephalitis. The demand for the product would be driven by the spread of these diseases. For example, Zika Virus although always having existed, has recently spread to other parts of the world including Brazil and even the US[2].

Please view the customer profiles for corporate target customers broken down by psychographic and demographic descriptors. The sample companies are fictitious examples.

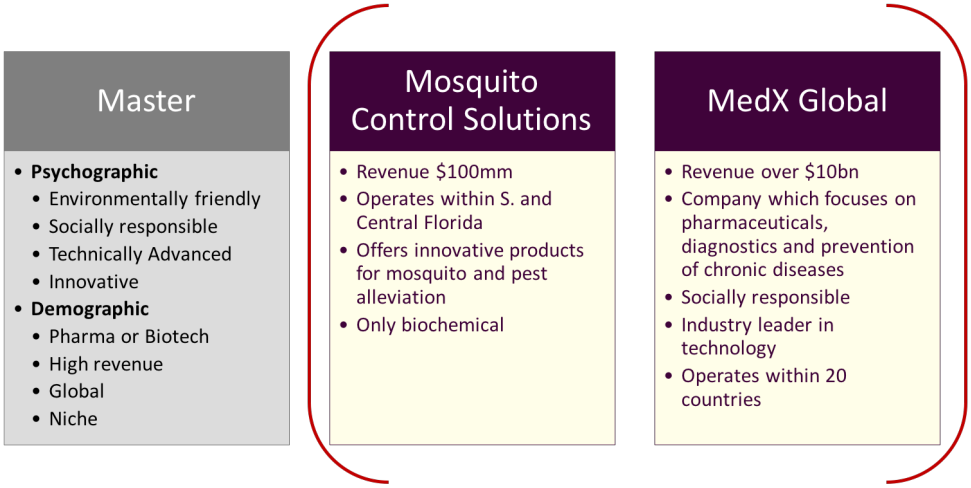


Figure 3

Market Trends

Many overall trends were identified within the industry analysis. The majority of the trends that currently exist are resultant of the spread of varying vector borne diseases. The market increases as the number of infection incidents increases as well. Currently Malaria demands the largest market, as more people are affected by Malaria each year then any other vector borne disease[3]. Until recently, Malaria was unparalleled in dollars spent to try and prevent, diagnose or treat those affected. Zika Virus has recently taken the spotlight.

Zika Virus is a vector borne disease that has been around for sometime; however, it has just recently commanded the attention of the mainstream media[4]. In 2015, it spread to Brazil and since then has grown rapidly in the number of those infected[4]. It has grown so much that President Obama has issued a $1.8 billion initiative to search for prevention, treatment and diagnostic measures against the virus[5,6]. The spread of Zika has increased the market size and the demand for the products which Vaylenx would offer, specifically CNP-1© utilizing nanoparticles as a preventative measure against mosquitos.

Strategic Opportunities

Vaylenx has three strategic opportunities which will expedite and increase sales through marketing initiatives. The product is a novel product within a relatively

unexplored area of research, the product is environmentally friendly and the product is cheap to produce, ultimately cutting down the strategic price point.

The pilot product, CNP-1© uses technology which is relatively new within its respective field of research. The application of the technology to vector control is unheard of and opens up a plethora of new research opportunities for additional applications and solutions. This is known as various experts in the field, including Brian Byrd of Western Carolina University and Roger Nasci of the CDC have both stated so to Vaylenx leadership. It is believed that CNP-1© uses a novel mode of action. This means that it affects the vector in a way never seen before meaning it can beat out existing solutions as diseases and vectors have yet to adapt against it.

Initial tests show the product being environmentally friendly as Zebra Fish are able to survive in a saturated aquatic solution and even eat the affected vector larvae without any ill-effect. This is a strategic positon as much of the global population is becoming increasingly environmentally focused as the era of DDT like pesticides moves to the wayside[7]. Lastly, the materials required to product the product as well as the processes by which to do so are relatively cheap. Some materials can be found as the bi-products of other industrial processes. Others are cheap in mass quantities. This allows Vaylenx to enter the market at a competitive and strategic price point maximizing market capitalization.

Competition

Description of Competition

The competition within the specific market to which Vaylenx operates exists in both large firms and small businesses. The market is very niche. There are four sectors of

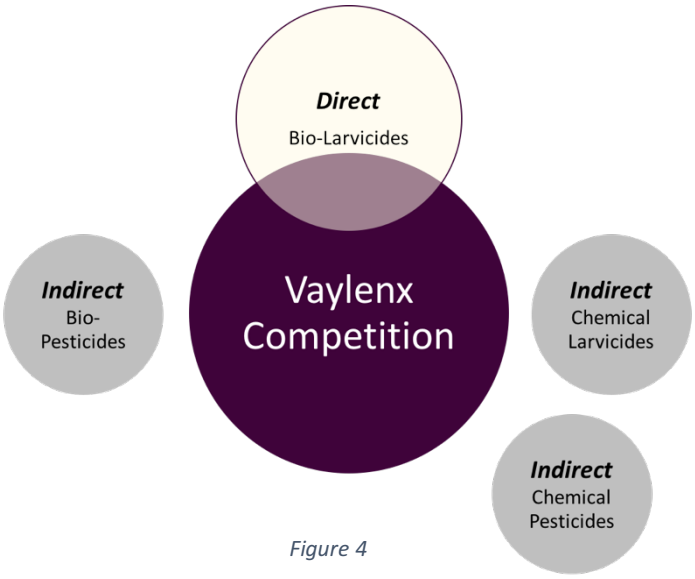


Figure 4

competition, one of which is direct and three of which are indirect. The four sectors are competing larvicides, competing pesticides, competing bio-larvicides and competing bio-pesticides. Competing bio-larvicides are the only direct competitors, while the other three remain threatening, are indirect competitors. Other potential indirect competitors include firms which could be considered to be customers as well. These firms usually have a variety of vector control solutions, some of which could be considered competitive to Vaylenx. For example, Bayer AG owns the rights to a product called Starycide, a larvicide which a very targeted MoA and low

environmental effects; however, it is a chemical larvicide and focused on knapsack breeding areas[12].

Market Share Distribution

The market share distribution can be divided into two areas, one is larvicide use by country, the other is overall industry market share. The market share distribution per country changes. For Guyana, the main larvicides for vector control of mosquitos are permethrin, lambda-cyhalothrin, malathion, and temephos[13]. However, there is no measurement of the sales of these different products, as many are brought in via NGOs. Below is a list of compounds which the WHO uses for larval source management (LSM) in the countries in which they operate.

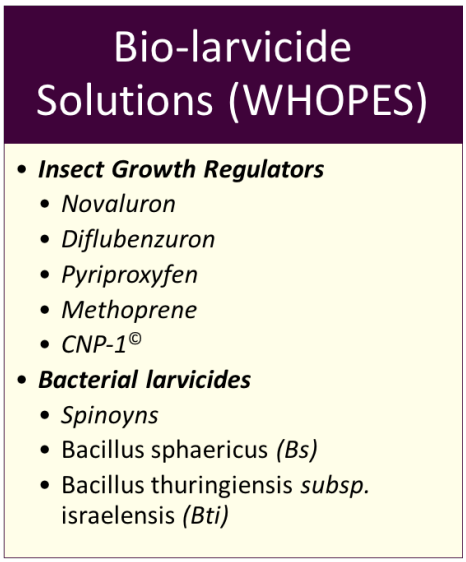


Figure 5
Source [14]

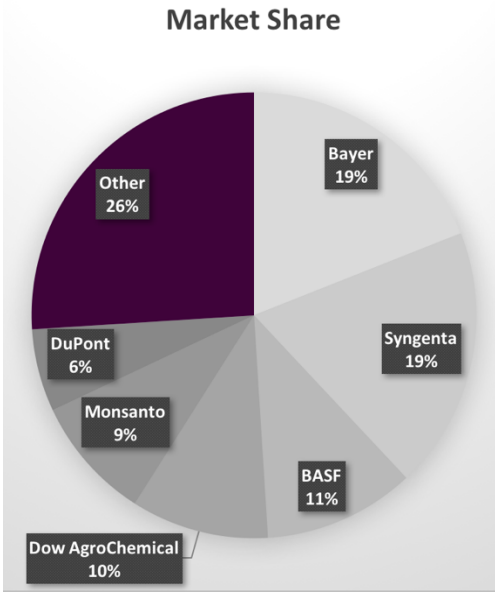


Figure 6

The industry as a whole is segmented into seven segments. 74% is controlled by six companies, *see figure 6*, and 26% is controlled by smaller enterprises. This 26% is where Vaylenx would enter and attempt to gain market share. According to IBISWorld, "demand has really picked up and the industry has nearly doubled its revenue, which has reignited interest in pesticide manufacturing. Consequently, new small companies have set up shop since 2010 and have taken away some market share from major players"[15]. As mentioned in the *industry analysis*, many larger players are acquiring smaller companies to decrease consolidation and increase market share.

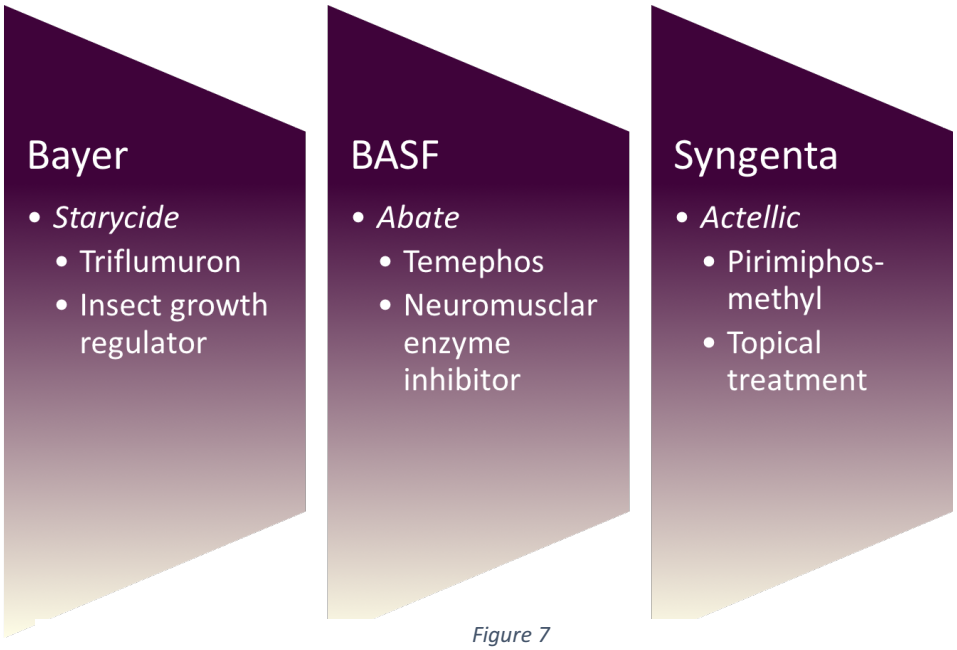


Figure 7

The heavy-hitters in the industry have larvicides currently being used *see figure 7*. As mentioned Bayer has Starycide[12]; however, BASF uses a product called Abate®[16], a neurotransmitter that has currently been under suspect for toxicity[17]. Current trials compare Abate®, also called Temephos, against Methoprene an insect growth

regulator and another competitive product. Syngenta uses Actellic, a product which was originally used to treat other insects; however, has shown short term effectiveness against Anopheles vectors[18]. Actellic is a topical treatment versus traditional larvicide[18]. The other three products are larvicides.

Barriers to Entry checklist	
Competition	Low
Concentration	Medium
Life Cycle Stage	Mature
Capital Intensity	High
Technology Change	High
Regulation & Policy	Heavy
Industry Assistance	Medium

SOURCE: WWW.IBISWORLD.COM

Figure 8

Barriers to Entry

The barriers to entry are high[15]. The current market is very fluid, in terms of acquisitions and mergers. Meanwhile, the companies that control the majority market share are considered heavyweights within industry, some within global business overall. They have high spheres of influence and very large cash reserves; their costs are often lower. Most players within the market have patented products, although some are generic. The two highest barrier to entry are the high levels of capital intensity and technological change. High levels of technological change result in increasing levels of R&D and higher capital requirements. These barriers push out low lever competitors through consolidation mostly. High levels of regulation, as mentioned in the *industrial analysis* also push out smaller players. Keys to success include niche product differentiation and strategic market positioning.

Competitive Positions

Vaylenx's CNP-1© solution is very competitive within the market. All of the larger firms, Syngenta, Bayer, BASF, etc. have products which either have environmentally hazardous effects or short term effectiveness. Starycide is the most competitive of the large firm competition. Abate's® toxicity has been argued, as seen by the studies comparing it to Methoprene[17]. Actellic has short term effects and is used only as a tropical spray[19].

Some smaller firms, like Clarke or ADAPCO wholesale different vector control solutions. This provides viable competition, as they have a wide range or products both chemical larvicidal and bio-larvicidal. Vaylenx however has en edge in that CNP-1© is being produced in-house, similar to the methods of the larger firms. None of the products found on the product listings of Clarke and ADAPCO are chemical duplicates of CNP-1©. Temephos, Methoprene and Permethrin are the most competitive solutions as they are widely used, long lasting, and with the exception of Temephos, show few adverse effects for the environment.

CNP-1© is not only environmentally friendly, but also long lasting. Its novel Mode of Action brings a new method to killing vectors at key water sources to which they are not yet adapted to.

Strategic Position

Technical Advantages

Vaylenx has a product which sits in a market that is very niche *see figure 1*, compared to some of the larger corporations controlling the market. Many of these larger companies use chemical larvicides, if they use larvicides at all. Vaylenx is also focused on mosquito vector control, whereas some firms, Bayer AG for example, are focused on pesticides related more toward agricultural production.

Vaylenx's pilot product CNP-1© applies a new technology, nanoparticles, to a mature industry in a solution never applied nor created before. This area of science and pesticide manufacturing applied toward vector control has never been explored before. This gives Vaylenx a strategic edge in that the product will take a longer lag of time to become outdated, in both product manufacturing and evolutionary science aspects. This makes the product attractive to both customer markets, governments and privatized licensing to the aforementioned large corporations.

Vaylenx has very strategically chosen to implement solutions in Guyana first. As mentioned before, there are a lot of existing relationships with individuals of influence within Guyana who have promised us testing facilities, pilot implementation and more. The strategic reason for choosing Guyana is that the regulatory requirements are lax in comparison to other geographic regions, like Brazil or the US. Implementation in Guyana will allow for iterative redesign of CNP-1© without major regulatory roadblocks.

Operational Advantages

Vaylenx has strategic advantage operationally as well. The core leadership team is young, energetic, inspired and passionate. The team has travelled to Guyana, and spoke with several high-ranking ministers and public officials. They have endorsed our research efforts and offered further support in our endeavors. Ministers and advisors close to the President of Guyana are looking forward to aiding us in future testing and have provided us physical testing ground in Georgetown, Guyana as well as within their Hinterlands and mining regions, where malaria and chikungunya run rampant.

Additionally, Vaylenx utilizes a research advisory board consisting of six members of the scientific community: Dr. Frank Horodyski an Ohio University (OU) professor emeritus who specializes in Polypeptides research. Dr. Bonita Biegalke an Ohio University professor who focuses in Virology and virus pathology. Dr. Nathan Weyand an OU professor conducting research in microbiology and immunobiology. Dr. Bill Romoser professor emeritus from OU specializing in entomology. Dr. Roger Nasci Chief of the Arboviral Diseases Branch in the Division of Vector-Borne Diseases, Centers for Disease Control and Prevention, and Dr. Sabyasachi Sarkar professor at Indian Technical Institute working with nanoparticle research.

Our team is in the contractual stage of partnering with Dr. Marco Neira and the Centre for Infectious and Chronic Disease Research lab in Ecuador. Dr. Neira is a leading

world expert in mosquito entomology, specifically focusing on vector borne disease in Ecuador. Dr. Neira was the understudy of Dr. Bill Romoser. Additionally, he has a team of lab assistants who specialize in the synthesis of nanoparticles. Dr. Neira has agreed to partner with us and provide us with facilities and researchers once we have secured the necessary funding.

Dr. William Romoser is the Chairman of Vaylenx's Research Advisory Board. He has extensive expertise in entomology, specifically with mosquitos, with over 52 years of experience. Dr. Romoser has held a various position throughout the scientific community centered around vector borne diseases. He has worked with the U.S. Army division of Virology through the early 2000s. He was the previous Director for the Tropical Disease Institute serving from 1989-1998. He was president of the Ohio Mosquito Control Association from 1995-1996 and has served on their Board of Directors until 2005. His research interests include Medical Entomology; Mosquito-borne diseases; Morphogenesis, pathogenesis, & dissemination of arboviruses in mosquitoes; Histology, ultrastructure, and alimentary physiology of medically important arthropods; Insect metamorphosis; Mosquito pupal behavior; Third World Development Issues. Dr. Romoser is one of the leading experts in entomological research concerned with vector borne disease in tropical locations.

The team has also reached out to the Ohio Department of Health, the Ohio Mosquito Control Association and Ohio University's Tropical Disease Institute. All three of

these institutions/associations have pledged to assist the team with their research in either resources or expertise. With the right funding and the right team of highly qualified researchers, our innovative team has the potential help make incredible headways in the fight against malaria and other vector borne disease like malaria and the Zika virus.

Vaylenx has been well received by interested key stakeholders. The Center for Disease Control, U.S. Department of Agriculture, and the Ohio Mosquito Control Association have assisted us in research and expertise as well as promised us field testing facilities along the Great Lakes in Ohio. The Ministry of Natural Resources of Guyana, Ministry of Health of Guyana, and the Office of the Secretary to the President of Guyana have promised us field testing space within the Hinterlands, as well as access to miners and mining companies.

Proprietary Advantages

Vaylenx has considerable strategic advantage with intellectual property. CNP-1© is proposed to be a novel solution combining the new study of carbon nanoparticle technology with the age old problem of vector control. The MoA of CNP-1© if proven to be novel will provide a substantial edge against competition and within the market as a solution with a variety of patent possibilities. This includes design patents, manufacturing/chemical patents and distribution method patents, i.e. polymerization of CNP-1©.

The brand of Vaylenx as well as CNP-1© is a strategic advantage as well. Vaylenx has already begun social media marketing to increase brand awareness with socially aware and conscious customers. This combined with the increased environmentally minded paradigm of the millennial generation can help increase the brand awareness of Vaylenx gaining potential customers for future products geared toward individual consumers.

Sales and Marketing

Sales Overview

Vaylenx will create revenue through the sale of CNP-1© used to kill mosquitoes. The proposed revenue model plans for two revenue streams. The first being revenue generated from the sale of CNP-1© to world governments within areas afflicted by vector borne disease. Initially, beginning with distribution to the government of Guyana due to our preexisting relationship with their government.

The second method is privatized licensing to biomedical, or agricultural firms, including large medical companies with interest in tropical disease alleviation, like DuPont Chemical and Bayer AG. Recent acquisition and licensing activity present within their public information show promise toward partnership or purchase. Preliminary talks with companies which focus in larvicides, namely Clarke Mosquito Control and ADAPCO Mosquito Control Solutions, have begun. After presenting at

the Ohio Mosquito Control Association (OMCA), Clarke Mosquito Control and ADAPCO approached us with interest in potential research and application. Clarke is currently interested in discussing product commercialization possibilities, while the Vaylenx team has reached out to ADAPCO for researching opportunities. These larger firms have the means to mass produce CNP-1© as well as the distribution channels to serve a larger consumer demand market.

Strategy

Our sales strategy would first begin with essential partnerships with companies and organizations that have strong ties within mosquito infested areas around the globe. Salesmen would concentrate on targeted marketing toward potential licensing opportunities with 3rd part firms. Salesmen would also work on forging international relationships with national governments of foreign bodies or NGOs. The information gathered here will be added to the internal reference network for Vaylenx for future use.

The sales strategy for selling licensing opportunities to 3rd party firms would take two form; guerilla marketing and trade/association appearances. Salesmen will focus on selling licensing opportunities at the trade shows or within the specific associations Vaylenx is a member of (OMCA, AMCA, etc.). The position will be salaried position with a commission 5% of the sale. Since Vaylenx is selling licensing opportunities the sale price is variable. Vaylenx will demand a flat fee for purchasing licensing rights as

well as a royalty fee. The salesman will only receive 5% commission for the flat fee charged to the consumer. The guerilla marketing will include cold calling, emailing and other short marketing initiatives. The salesmen who are working trade show booth will also be responsible for other sales efforts during the time that they are not away on travel. Vaylenx will initially attend 10 trade shows per year, see *marketing strategy* section.

The sales strategy for selling to governments and NGOs will be slightly more difficult. These sales will be secured through referrals and sustained relationships with influential people of power within specific geographic locales. These relationships will be managed by the salesmen as well. Salesmen will receive a 5% commission of the initial order with a 1% commission of every repeat order for a sale made within this demand market as well. The salesmen will have to make forge the relationships as well as maintain them.

Current estimates show that year 1 annual commissions for two salesmen is approximately $99,000; see the table below.

Commission					
1 license @ 5%	1 order @ 5%	Salesmen	Repeat order @ 1%	Salesmen	
$50,000	$4,500	2	$20,000	2	

		$9,000		$40,000	
Total Commission					**$99,000**

Sales Projections

Vaylenx's sales revolve around our product's sustainability. Since the nanoparticles, over time, become exceedingly diluted, they will need to be reintroduced intermittently thus establishing a consistent customer base. The current research demonstrates an active life of approximately 6-months with maximum potency showing a significant decrease at the 3-month mark. The material cost to produce one unit of CNP-1© is estimated $0.01 per unit. One unit is equal to 3g of CNP-1©. However, when packaging and polymerization costs are added in, the total unit cost is $.16. This shows a need for continuous reintroduction of CNP-1© into the environment which means repeat customers and repeat purchases.

At a cost of $.16 per liter of water to produce CNP-1© the selling price is inflated to $3.00. The selling price for licensing agreements is $150,000 per licensing deal with a 25% royalty fee for any CNP-1© sold. CNP-1© will be sold in batches of 1kg, 5kg and 10kg. According to the sales projections below, Vaylenx will generate approximately $575,000 in revenue by the end of year one.

Year 1

Item	Unit Price	Unit Volume	Sales
CNP-1©	$3.00	133,002	*$399,006*
Vaylenx Licensing	$150,000	1.0	*$150,000*
Licensing Royalty	$3.00	33,250	*$24,938*
Royalty fee: 25%			***$573,944***

Marketing

Marketing Strategy

Vaylenx's primary marketing strategy is separated into three areas. Networking, trade shows, and guerilla tactics as these are the easiest methods of access to the customer base. Networking is relatively low cost, as some services can be used for free initially. These services include mass email services and social media networking services. The expensive aspects of network marketing will be the costs of memberships to associations related to mosquito control and abatement. This will be overviewed in more detail in the *licensing* section.

The second method of marketing will be related to attending trade shows. Trade shows will allow Vaylenx market penetration for direct licensing and partnering opportunities. Trade shows are relatively expensive due to the cost of travel, lodging and registration. A mock budget which has Vaylenx attending 10 trade shows with two employees for an average of four days a year would estimate costs to be around $33,000. This is expensive for a startup, but has a high propensity to pay off. An

additional $1500 for paper materials, promotional items, and misc. costs is built in for a grand total of $34,500 a year for trade show marketing costs.

Guerrilla marketing is the final tier of the marketing strategy. This will include miscellaneous marketing effort that are specifically targeted at gaining additional customers. The main focus will be digitally with website traffic, SEO optimization, and advertising digitally. The costs for this are estimated at approximately $10,000 a year. This includes a contracted web manager who will also work on SEO optimization. Other tactics include billboard and signage; however, this would be used down the road during the pre-revenue stage but post startup. The annual cost for five billboards is $60,000.

Finally, during the post revenue stage of Vaylenx, marketing and PR consultants will be hired to optimize all guerilla and networking marketing efforts. The costs for these firms approximately $150,000 annually. This cost would be added to the cost for trade show marketing efforts. The next section details marketing efforts for the two different revenue segments, government contracting and licensing.

Government Contracting

The customers of world governments will be identified strategically through an internal reference network via the inaugural introduction into Guyana. Non-government organizations can also be leveraged for future customers, as they work

closely with world governments. A second possible target government would be that of Ecuador, as our research partner, Dr. Neira has his lab based in Ecuador with good connections to political officials. Brazil is the ultimate goal in terms of governmental customers for South America as they have the largest GDP and population of potentially at-risk citizens. Vaylenx's internal reference network will be used as the primary method for securing governmental contracts.

The costs for this would include website management, IT services (which will be detailed later) and simple web marketing. There are additional associations relating to NGOs that Vaylenx could opt into at a later date as well. The majority of marketing costs are going to be focused around securing licensing or partnering opportunities.

Licensing

With regards to privatized licensing, trade shows and association memberships will be the main source of licensing opportunities. Memberships to the American Mosquito Control Association (AMCA), the Northeastern Mosquito Control Association (NMCA), the Ohio Mosquito Control Association (OMCA) and the Florida Mosquito Control Association (FMCA) will be sought after first. Corporate memberships to these associations costs approx. $1000. These memberships come with booth space at annual meetings, discount on advertising, free advertising in select publications and subscription to scientific-type publications[20]. Additional costs include the web marketing and print marketing during trade show marketing efforts. Initially to

minimize marketing costs memberships to only the OMCA and AMCA will be purchased and on an individual versus corporate level. This decreases the costs from $1000 per membership to averaged $110 per membership. Costs will be outlined in detail in the financials.

Pros and Cons of Licensing

With a licensing agreement with a larger firm like ADAPCO or Clarke, Vaylenx can open its distribution network and widens its marketing strategy. The licensing and partnering with ADAPCO or Clarke will allow for revenue as the sale of CNP-1© grows and repeats due to the necessary 3-month replenishment. Licensing will allow for distribution agreements through 3rd party firms to carry the product; however, there are no networks in which Vaylenx can tap into. Please see Figure 9.

Potential partnership opportunities will be leveraged as well. If a larger firm, like Clarke were to be interested in partnering with Vaylenx the material and production overhead could be lessened for Vaylenx, but the distribution network widened as Clarke serves a large market. Clarke and ADAPCO serve a

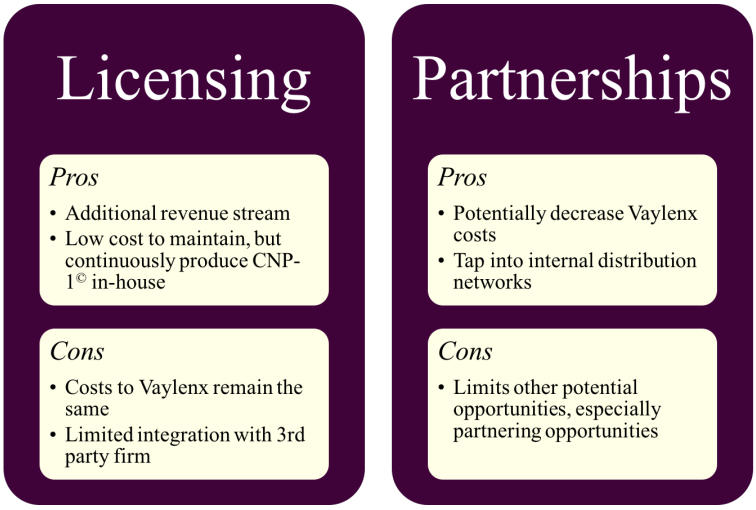


Figure 9

variety of markets and consumers from individuals to large organizations and NGO's. Vaylenx can tap into these networks through a partnership opportunity, see figure 9.

Marketing Longevity and Milestones

Vaylenx has a 3-tiered method for marketing costs. This structure breaks down the marketing costs into startup marketing costs, pre-revenue marketing costs and post revenue marketing costs. Costs increase as the budget for Vaylenx and the appropriate marketable domains increase as well.

The startup marketing total is just under $38,000. This includes the costs for trade show visits, ten per year, as well as individual memberships to mosquito associations. Web maintenance and design is also factored into this figure. The startup marketing budget is the lowest as the company has very little capital during this stage. Thrifty marketing efforts will be used during this time to try and keep the cost as low as possible.

The pre-revenue stage includes everything in the startup marketing stage as well as an in-house graphic designer and web manager in order to keep costs as low as possible.

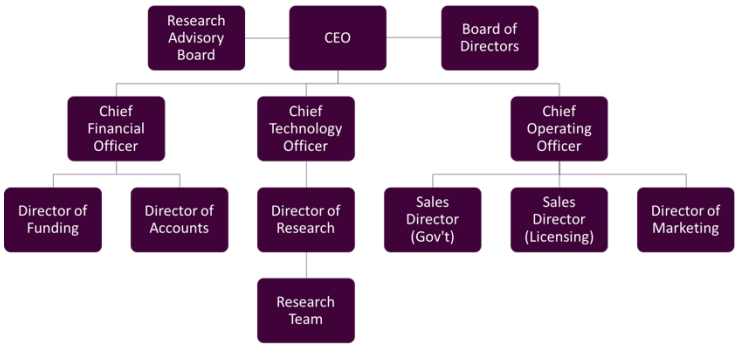
The post-revenue stage includes everything form the previous two stages as well as PR and advertising consultation, full time staff and additional trade association memberships. This budget is larger due to the increased budget stemming from

revenue coming in through Vaylenx. This budget is expected to be increased as seen fit during growth of the company. Please see the table below for exact numerical breakdown.

Startup Marketing Total	*$37,365.10*
Pre-Revenue Total	*$89,735.10*
Post Revenue Total	*$302,735.10*

Management and Organization

Vaylenx leadership team has been identified in prior sections. Noah Rosenblatt, CEO, Kate Clausen, CTO, Morgan Stanley, COO and David Bartizal as the CFO. The scientific advisory board sits with the leadership team; however, not as a corporate board of directors. The board of directors will be identified at a later date. Dr. Marco



Neira is to be the head of Research and Development for the firm. All business operations inwardly, including sales will fall under the COO. Dr. Neira, and all R&D

will fall under the CTO. The COO and CTO will report to the CEO. The CEO will be responsible for all outwardly facing initiatives and operations. Please see figure 10.

Dr. Sabyasachi Sarkar
Indian Institute of Engineering and Science Technology

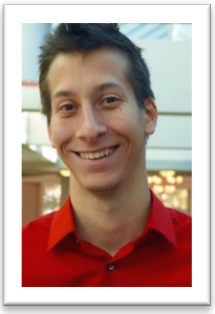
Dr. Bonita Biegalke
Ohio University

Dr. Frank Horodyski
Ohio University

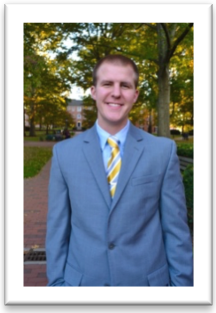
Dr. Bill Romoser
20 years vector control experience

Dr. Nathan Weyand
Ohio University

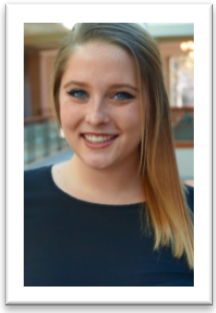
Dr. Roger Nasci
Former director of Abroviral diseases for CDC



Noah Rosenblatt
CEO



David Bartizal
CFO



Morgan Stanley
COO

Kate Clausen
CCO

The four founders are uniquely qualified through a variety of experiences. Noah Rosenblatt has considerable entrepreneurial experiences having started various other businesses. He holds an honors degree in entrepreneurship and management from Ohio University. Kate Clausen holds an honors degree in communications from Ohio University and has had experience in managing others which allows her to oversee the technology team effectively. Morgan Stanley has considerable political experience having worked on Capitol Hill previously. Her family is connected into the political

ecosphere and she holds an undergraduate degree from Ohio University in political science and is pursuing her master's degree in the same field. David Bartizal has worked for fortune 500 firms in their finance and accounting departments. He holds a dual accounting and finance degree from Ohio University.

Pre-Revenue Organizational Structure

The organizational structure above is specifically for Vaylenx during the first few years of its pre-revenue life, specifically relating to the startup phase. The positions listed in *figure 10* are necessary for the company to function. The following section will overview each position above, with the exception of the CEO, COO, CTO, CFO, Board of Directors and Research Advisory Board.

The CFO will be responsible for all financial functions and reporting them to the CEO. Under the CFO is the Director of Funding and the Director of Accounts. The Director of Accounts is responsible for all accounting information and processes, including payroll, taxes, revenue accounting, costs, etc. The Director of Funding is responsible for finding funding for Vaylenx during the early years of its growth and managing that funding. This position includes working with angle investors of venture capitalists (VCs) and negotiating their equity stake per investment.

The Chief Technology Officer is responsible for all R&D and product development. The Director of Research for Vaylenx is Dr. Marco Neira, he is responsible for

managing the research team, updating the CTO on research and development of continuing or new products, as well as reporting funding necessities to the Director of Funding. Under him is the Research Team. The Research Team is solely responsible for conducting the research.

The Chief Operating Officer oversees all business operations relating to the front-end offices and reports updates to the CEO. The two Sales Directors will work independently of one another. One will work on securing licensing agreements and sales with prospective customers. The other will work with securing orders for larger clients, such as governments, like Guyana. Each Sales Director will be compensated for their work, on a commission and salaried basis, as overviewed in the previous section. The Director of Marketing will oversee and engage in all marketing efforts and initiatives during the pre-revenue startup phase of Vaylenx's life.

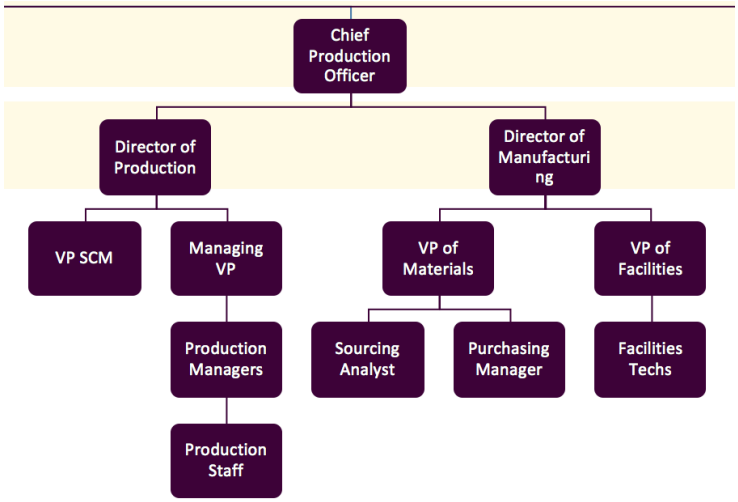


Figure 11

The production and manufacturing team has not been included as the following organizational structure is only for the startup phase of Vaylenx, which includes all pre-revenue activities. Since

there is no revenue being generated, there is no need for a production of manufacturing facility, nor team. If Vaylenx grows independently, meaning the firm is not acquired by a larger firm, then a production facility and team will be added to the organization structure. Please see *figure 11* to overview the production staff.

The Director of Production will oversee production and supply chain (VP of SCM). The Managing VP will oversee the production Managers, who as identified in the manufacturing section of the operations plan, is a member of the production staff or team. The Director of Manufacturing will oversee the sourcing of materials as well as the facilities management for the production staff. The VP of Materials will oversee the purchasing and sourcing of the materials required for production including the equipment. The Sourcing Analyst will analyze where to best find the resources necessary for production and if production could better be suited in a different geographic region. The Purchasing Manager would manage all of the purchasing agreements and report to the Director of Accounts all of the purchases made for production, including resources and equipment.

Future Post-Revenue Organizational Structure

As Vaylenx expands in growth the organization structure will change. Below are snapshots of each business department and theorized positons within them; however, these positons cannot be stated as permeant as growth might dictate the necessity of new positions or reason to eliminate others.

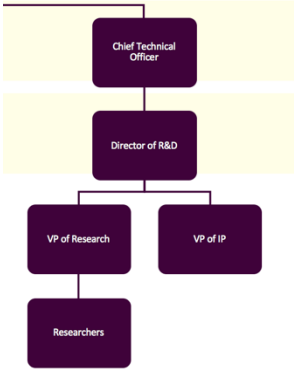


Figure 12: CTO

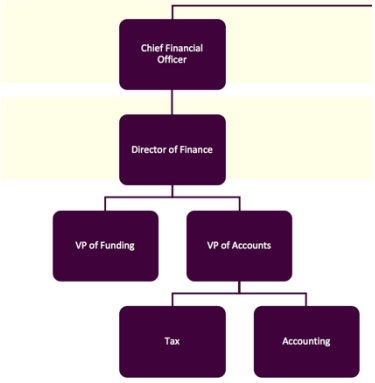


Figure 13: CFO

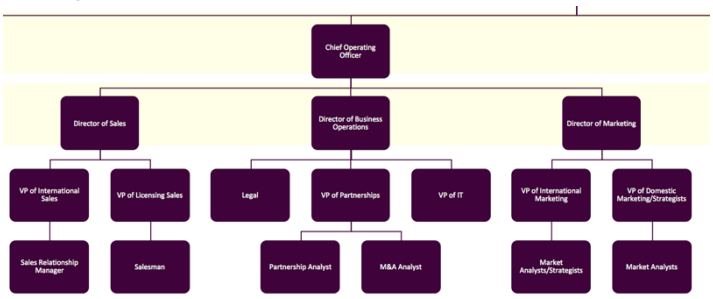


Figure 14: COO

There are five vertical positions based off the aforementioned organizational structure and figures 10-14. Each positions is paid more then the positon below it, ranging from $10,000 more to $20,000 more. This information is not relevant to a pre-revenue Vaylenx, as most individuals would have an equity share, which is to be discussed in a later section. This information pertains to a post-revenue Vaylenx that is growing according to the figures above.

Levels of Compensation

Level 5 is the lowest level of the compensation levels. The base salary for this positon is $42,000. Anything lower then level 5 is considered an un-salaried, hourly position. These positions are not included above, but include support positions and unskilled positions, such as janitors.

Level 4 is the second lowest positon of the compensation levels. The base salary for this position is $52,000. This will certainly increase as more individuals are hired throughout Vaylenx; however, this pertains to the aforementioned organizational structure of a post-revenue Vaylenx. These positions include the analyst and manager positions.

Level 3 is a middle tier position of compensation. These positions are paid a base of $72,000 a year. These positions include the VP positions. These positions require individuals to have advanced backgrounds, most likely a graduate level education degree or subsequent experience working in their field.

Level 2 is the second highest position of compensation. These positions are usually either veterans of Vaylenx or, more than likely, veterans of their specific field. These positions are paid $92,000 annually for the work, as this position requires more time and management skills to properly get the job completed.

Level 1 is the highest level of compensation. This includes the C-level executives of Vaylenx. These executives are paid $102,000 for their work, as they have either been founders, veterans or put into their positon by the board of directors of heavy investors.

The Board of Directors and the Research Board of Advisors are compensated; however, it is on an individual basis. These negotiations are discussed between the Chief Executives of Vaylenx and the individual board member in question. Any individual on the board in the beginning, or startup phase of Vaylenx will be compensated through equity stake, not annual compensation. This is subject to change as Vaylenx begins turning revenue.

Pre-Revenue Commissions

Vaylenx will distribute commissions to the pre-revenue members of its team through an equity stake in the company. Founders hold majority share, including all-undistributed equity share. Each Board member, of each board, is awarded an initial half percent equity, with a negotiable increase. Each member of the team that is not a founder is awarded a quarter percent equity, with convertible equity to stock options, when applicable. If converted to stock, the team member has the option to purchase preferred stock, versus common stock.

Operations

Manufacturing

Manufacturing of CNP-1© costs $.16 per unit as specified in a prior section. The components to manufacture the product include wood wool, acetone, nitric acid and

distilled water. Manufacturing would take place initially in Athens, Ohio see the *location* section of the operations plan.

The initial manufacturing operations setup would not be automated; however, this will change to automated manufacturing as operations grow requiring more production. The steps required to manufacture CNP-1© would require at least three technicians to create the particles for CNP-1©. If the particles were polymerized for a more optimal distribution, then a fourth technician would be required for this. Technicians would be paid $42,000 annually[22]. One of the three technician would be paid $52,000 annually and serve as the manager of the team. This team would be scaled up in order to satisfy continuing demand.

Manufacturing would require resources listed above as well as equipment required for manufacturing. These include, Soxhlet extractors, hot-column extractors, bowl burners, filter papers, tubing, a burner, and a washer.

In the beginning a Soxhlet extractor would be used (1.5L), but when operations increase CNP-1© will need be produced using hot-column extractors, as they are able to purify the solution in larger quantities. A Soxhlet extractor for 1.5L volume costs approximately $1500. A hot-column extractor would up that cost to $25,000[23].

The other resources required would cost together a maximum of $30,000 during the startup phase of Vaylenx. Reiterating that the cost for resources and equipment would

increase as production and demand increased with Vaylenx's growth. See the table below.

ITEM	COST
15L Acetone	$277.80
20L Nitric Acid	$176.00
1.5L Soxhlet Extractor	$1,448.88
Hot-Column Extractor	$23,995.00
Filter Paper (100) Grade 4	$28.00
Earthen (Clay) Bowl (1000pc)	$1,000.00
Industrial Dishwasher	$3,100.00
Merker-Fisher Burner	$72.00
Startup	***$5,648.88***
Larger Growth	***$28,195.00***

Information Technology

This section will overview the necessary IT resources and equipment necessary for Vaylenx to operate as a business. Vaylenx will require computers and software systems, including intuit accounting systems, company phone systems, and closed network software systems.

Vaylenx will utilize AT&T small business phone systems during early stages of growth (less than 25 employees), and upgrade to Cisco systems once growth surpasses

25 employees. Initial servers and computers again are based off a ten-person business, with room to grow. All computing services and equipment is from Dell. Dell sells an Inspiron 20 3000 all-in-one workstation, which is ideal for Vaylenx, as well as a server to create and unify a closed network for Vaylenx employees.

Intuit will be used for the financial control systems including a payroll and accounting system until Vaylenx is larger then 25 employees. Intuit QuickBooks offers an easy and cheap solution for accounting software, while Intuit Payroll offers the same for payroll management. Each software system requires a monthly subscription; in this case the medium level package is used. For Intuit Payroll there is an addition $2 fee per employee per month.

IT services will also be utilized for maximum efficiency of Vaylenx. CGB Tech LLC can install all IT service components for Vaylenx including upkeep of software and hardware. They will offer onsite business service which includes installations, network setup and administration, upgrades and repairs for $95 an hour. Additionally, they offer commercial offsite administration which includes managing part of Vaylenx's technological services.

Intellectual Property

Vaylenx has considerable strategic advantage with intellectual property. Vaylenx has two patentable inventions, the first is CNP-1© as a novel solution combining the new

study of nanoparticle technology with the age old problem of vector control. The Mode of Action of CNP-1©, if proven to be novel, will provide a substantial advantage against competition. There are various additional IP possibilities stemming from CNP-1© including design patents, manufacturing/chemical patents and distribution method patents, i.e. polymerization of CNP-1©. The second main patent would be filed for the nanoparticle synthesis machine utilizing renewable resources for over a 98% yield of nanoparticles, decreasing variable costs for production. Patent services will be outsourced to legal firms, like Benesch-Friedlander, which have already pledged support to Vaylenx in patent filing.

The brand of Vaylenx as well as CNP-1© is a strategic advantage as well. Vaylenx has already begun social media marketing to increase brand awareness with socially conscious customers. This combined with the environmentally-minded millennial generation can help increase the brand awareness of Vaylenx, gaining potential customers for future products geared toward individual consumers.

There will be an individual in charge of IP for Vaylenx. This individual will oversee the IP team and all IP operations as this is essential to the success of Vaylenx. This includes the legal aspects of Vaylenx, like IP litigation. Vaylenx will derive success through trade secrets and novel, patentable research initiatives. This team will ensure the success of patenting, provisional patents, trademarking, copyrighting, patent litigation and other patent services. Most of these services will be outsourced to law

firms or patent litigation firms, like Benesch-Friedlander, in the beginning of Vaylenx. This team will oversee those relationships as well.

Location

The global HQ of Vaylenx will be Athens, Ohio until otherwise deemed necessary to move. Two additional locations would include other more urban areas of Ohio as well as locations in Florida as potential research partners exist in Florida. Vaylenx is against moving outside of the country for operations.

Vaylenx will have a strategically placed manufacturing plants. The first will be close to the HQ in Athens Ohio as real estate is cheap. As the size of Vaylenx and the demand grows an additional manufacturing plant will be opened in Florida as Florida poses the best location for exporting the product internationally.

The initial lab space required for future R&D will be located at the Innovation Center at Ohio University in Athens. This provides ample room for sustained future R&D in the beginning. Vaylenx will continue to contract with Marco Neira in Ecuador for latter stage experimentation and development. More information regarding future technology and the subsequent plan can be found in the *Technology Plan* of this document.

Resource Supply

The supply of the resources necessary for the production of CNP-1© would come from two recyclable sources. The first being chemical warehouses, like GFS Chemical, for the chemicals required for synthesis of CNP-1©. These chemicals can be purchased in 20L for $277. The chemicals are reusable and recyclable for continued use. As production necessity increases chemicals can be purchased in quantities of 12,000L for $8000 and reused with a 98%+ yield through a distillation process. This essentially drops the year-over-year variable cost for the chemicals for CNP-1© to zero.

The second being natural occurring recycled products. This is where we would receive the wood wool from. Wood is a precious resource; however, there are many companies which recycle and repurpose wood as a carbon source. Vaylenx would serve as a downstream customer of recycled wood, specifically wood wool. Wood can come from old shipping crates, retired dockyards and farms, lawn care byproducts, even rotted wood.

Additionally, if wood wool cannot be found from a recycled company resource then it can be purchased. American Excelsior Company manufactures and distributes excelsior (wood wool). Small amounts can be purchased in bundles of approximately 1lb. for $13 not including shipping.

One important fact to note is that the variable resources for Vaylenx are recyclable therefore the cost is only incurred once every few years. This is built into the financials by showing a 98% yield on variable recourses and a 2% total spend year

over year on variable costs to replenish the maximum variable resources each year.

Vaylenx would serve as a downstream customer of recycled carbon. Vaylenx can get carbon material from realistically any carbon source. If carbon materials cannot be gathered through recycling methods then they can be purchased at $15 yard/3, one cubic yard is approximately 581kg of carbon material. 23mg of carbon material yields 3mg of CNP-1©; therefore, 23kg of carbon material would yield 3kg of CNP-1©.

Global Operations

Vaylenx has commercial operations outside of the United States both research and development and sales. In terms of R&D, partnership with Marco Neira lab, The Center for Infectious and Chronic Disease Research (CICDR) in Quito Ecuador is the foremost location and located outside of the US. Commercial sales operations will be dependent on the location of the sale, as per the sales strategy and proposed revenue streams, international governments provide an entire consumer demand base.

One example of this however, would be the relationship and sale to Guyana. A sales relationship manager, please see the *Management and Organization* section, will manage this one geographic region, or country. The relationship manager would oversee the entire relationship with the customer; the country. He or she will see the sale from end to finish as well as overseeing any complaints or customer service solicitations. The sales relationship manager will live within that specific location he or she is tasked with selling to, in this example, Guyana.

During growth of Vaylenx, if necessary physical locations are required within locales outside of the US for sales, then this will be arranged on a territory basis. The terrorizes will be arranged by continent first, then if necessary by region. An example would be South America, and then regionally as Northern S. America, Eastern S. America, etc. Locations for R&D would be dependent on research partners, some locations would be located outside of the US and Ecuador, if pertaining to a specific ecological ecosystem, for example Africa.

Manufacturing centers are to remain in the US. Manufacturing in another country will only be necessary if from a cost-benefit perspective of shipping and sales it is more ideal to manufacture. For example, if there is a large quantity of products are sold to Eastern Africa and it is less expensive to manufacture in India and have CNP-1© shipped to Africa from India versus from the US, then manufacturing in India will be considered.

International shipping to customers will be through aircraft or maritime freight methods. Aircraft shipping will only be used if emergency or expedited shipping is required, otherwise maritime shipping methods will be employed as it is less expensive. All shipments will be marked fragile and places in 40-foot shipping containers for final delivery at site determined by the customer. Vaylenx does not offer a return policy, as CNP-1© is non-recoupable. However, if the product is

defective, then Vaylenx will assume that cost, unless it is a defect caused by the customer's misuse. Tariffs and import/export laws will be dealt with by the sales relationship manager on an individual customer basis.

Technology Plan

The following section will overview CNP-1©, how the technology works, in simple terms and what the future plan is for technology development within Vaylenx. Additionally, a brief background about the discovery of the technology will be given.

Background

The technology was discovered by Kate Clausen during a research review for a case competition regarding Malaria and global health at Ohio University. She was able to see the possibility for the use of the nanoparticles for vector control. The original study found was done by Dr. Sarkar of the University of Benegal. After speaking with Dr. Sarkar as a team he told us that he was not pursuing the application of the technology for vector control any further and gave us a written statement allowing us to pursue his efforts. From here on out we coined the solution CNP-1© and began to form Vaylenx around the technology.

How-It-Works

CNP-1© is a unique solution. The process by which it is created cannot be discussed in this section, as that is a trade secret. What can be discussed are a few of the hypothesizes for what exactly the solution does to the mosquito larvae.

Hypothesis One

The first hypothesis looks at hormone disruption caused by CNP-1©. There is a hypothesis that the CNP-1© solution mimics a hormone found in the mosquito larvae and blocks the mosquito from getting that hormone, as the organism is under the belief that it already has received the appropriate quantities.

Hypothesis Two

The second hypothesis theorizes that CNP-1© affects the breathing apparatus' within the mosquito larvae. The molecules are "nano", or small, and are able to infiltrate and clog up the fine breathing tubes which the larvae use to get oxygen while submerged in water.

Hypothesis Three

The third hypothesis discusses the possibility of CNP-1© mimicking a chemical used to shed the lining of the mosquito stomach during the change in its lifecycle. This would confuse the organism into thinking it has shed its stomach lining when it has not. Ultimately the organism would starve itself.

All three of these hypothesis' are considered valid until the research on CNP-1© is complete. Information which is known and can be shared is that so far there is no harm to the outside environment when tested against certain species of fish. CNP-1© takes 25 days to kill the mosquito, or before effects are seen and remains effective for approximately 3 months. The mosquito is put in a form of "suspended" animation which disallows the mosquito to move from its next stage in its lifecycle. Lastly, the level of mortality, or eradication, depends on the concentration of certain chemicals found in CNP-1©.

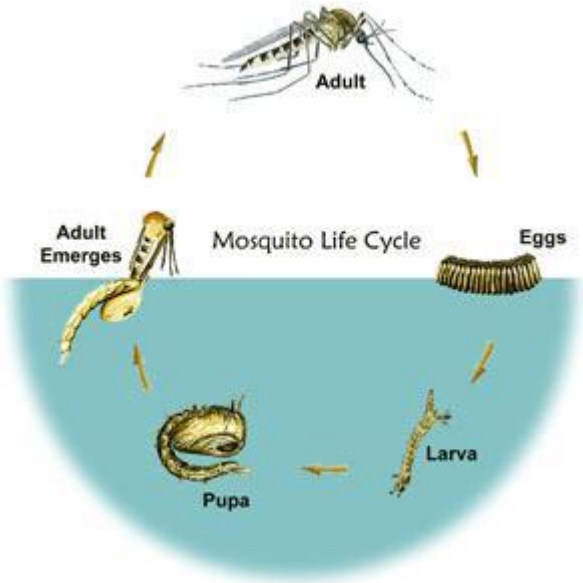


Figure 15[24]

As specified before, there is a specialized research team dedicated to researching these select hypothesis'. Please see the figure below for exact steps in the research phases.

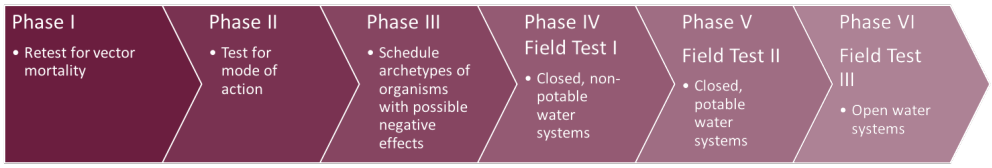


Figure 16

Beyond the first three phases, which were discussed earlier, are three additional field testing phases. This is necessary to test the effectives of CNP-1© within different ecosystems that mosquitos breed in; closed, non-potable, closed potable and open water. Phases IV, V & VI are all in accordance with the varying levels of toxicity screenings required for application. For example, testing in closed non-potable systems requires to only test toxicity against specific organisms. In potable closed systems Vaylenx needs to test for toxicity in humans. For open water systems, a large number of organisms need to be tested against. Varying levels of permissions through organizations like the FDA are required at the last stages of testing as well.

Future Plan

For future development Vaylenx plans to continue down a similar R&D plan as with CNP-1©. The same team working with Dr. Marco Neira will be utilized in development of future solutions. Any research and development concerned with the development of chemical or biological solutions will be studied down in Quito, Ecuador. Solutions that are more mechanical in nature, such as diagnostic devices, will have separate R&D teams utilized. The majority of research will be sub-contracted out

to other firms, like Dr. Neira's lab until Vaylenx has the appropriate capital required to move R&D in-house.

Step by Step Process

Exit Strategy

The founders of Vaylenx have two ideal options for an exit. The first being a future purchase from a larger bio-tech, pharma or vector control firm. The second being a buyout from a similar firm. A purchase would be the most ideal option as it would most likely result in the majority of Vaylenx employees staying with core Vaylenx business operations, including the founders, ideally. A purchase would also ensure that CNP-1© remains a viable product to at-risk areas. If a company merged with Vaylenx, negotiations would be attempted to ensure that the product remains on shelves, the employees remain with the Vaylenx team. A purchase would hold promise for mass-production or expedited production of Vaylenx products along with a larger distribution network.

If Vaylenx were to be bought similar negotiations would occur. Vaylenx would be purchased on the basis of lessening completion and business operations cease after acquisition. On the other hand, in a traditional acquisition of Vaylenx, business operations could continue, just without core members of the team. The purchaser would have the rights to change Vaylenx and its products however deemed fit. Purchasing price would be determined at the time of acquisition inquiry and based off professional valuation from both sides of the negations.

The ultimate goal would be for Vaylenx to exit the market pre-revenue as to lessen incurred expenses of production and manufacturing. The company would sell as a packing including, trade secrets, intellectual property, employees, current assets, current cash, brand, and customer base. The most valuable of these being the IP of CNP-1© and other potential products. Many similar firms within the bio-tech, pharma, and pesticide spaces have been acquired pre-revenue. See the table below.

Year	Company	Market	Activity	Price	Revenue
2009	Algeta	Biotech & Pharma	Acquired by Bayer	$2.9bn	$20m
2014	Idenix Pharma	Biotech & Pharma	Acquired by Merck & Co.	$3.85bn	

2014	Cubist Pharma	Biotech & Pharma	Acquired by Merck & Co.	$8.4bn	$926m
2014	OncoEthix	Biotech	Acquired by Merck & Co.	$375m	
2011	Divergence Inc.	Pesticide Biotech	Acquired by Monsanto	$71m	$30m Pre-Revenue

Financials

The following section will overview the financials of the business including three year pro forma financial statements.

Vaylenx's 3 year pro forma financials start out at the first year before generating revenue and include the next two years of revenue generation. First year revenue is zero, as Vaylenx has yet to begin commercial operations. However, according to the

$1,500	Personal Investment
$4,000	Alt. Funding
$11,800	Raised Capital
$5,000	TCU
$50,000	TechGROWTH (Potential)

income statement, by year 2 Vaylenx's profit margin is 4% higher than industry standards in year 2. Vaylenx is generating $573,944 in revenue by year 2.

See sales projection estimates in the tables below for direct sales. With conservative demand estimates, sales projections show revenue within the first year of operation in table 2. Month 1-5 sales estimates are included in the figure below. The month over month growth multiplier is deterred from averaging startup firms' annual growth over the previous 5 years and dividing it by a factor of 12 to get a month over month percentage growth rate. This is easily attainable as it is lower then most countries' GDP, like Guyana.

	Month 1	**Month 2**	**Month 3**	**Month 4**	**Month 5**
Starting Units	10,000	10,185	10,374	10,566	10,761
Month over Month Average Growth	*1.815%*				
Revenue	$30,000	$30,555	$31,121	$31,697	$32,284

Year 1			
Item	**Unit Price**	**Unit Volume**	**Sales**
CNP-1©	$3.00	133,002	*$399,006*
Vaylenx Licensing	$150,000	1.0	*$150,000*
Licensing Royalty	$3.00	33,250	*$24,938*

Royalty fee: 25%	***$573,944***

Vaylenx's unit sales, as reflected in the financial statements, are in gram units; however, sales volumes are itemized differently. The volumes will be sold in units of 1kg, 5kg and 10kg volumes – this is the equivalent of 1000, 5000 and 10,000 units.

Needs Assessment

Vaylenx needs $62,440 to begin operations. With current cash at $12,300 we assume funding for 2016 at cash at $75,00. This number also includes the TechGROWTH potential funding. The company is on the right capital financing path to raise the required capital to begin research and commercial operations. Capital needs for Vaylenx will increase as production increases throughout years 2 and 3 of revenue generation. Given the low cost of manufacturing and the low cost of labor through our lab partner in Ecuador, projections show that Vaylenx can be cash flow positive within the first year of operation.

Variable costs for year 1 are significantly less as the required resources are less then what is needed for full scale production. The costs for full scale production are reflected by the cost of goods sold in years 2 and 3. Due to the reusability and recycling of the variable resources, the variable cost per unit is less then $.01 if packaging and polymerization costs are excluded. The main factor in the cost of goods

sold, or variable costs, are the packaging and polymerization costs. The variable cost per unit is $.15/g/unit of packaging and polymerization costs. Total unit cost is $.16/g/unit. One kilogram to manufacture would cost $161 and 10kg would cost $1610, enough to treat 3.33 million liters of water.

Vaylenx LLC

Projected Income Statement
December 31, 2X16,2X17,2X18

	2X16	2X17	2X18
Revenue: Direct Sales	$ -	$399,006	$497,230
Revenue: Licensing	-	174,938	353,178
Gross Revenue	$ -	$573,944	$850,408
Growth			
Cost of Goods Sold	7,891	84,283	84,283
Gross Profit	$ (7,891)	$489,660	$766,125
Margin:		85%	90%
Operating Expenses			
Labor Lab	29,000	72,000	130,000
Management Wages	-	80,000	120,000
Sales Staff	-	60,500	73,646
Equipment	-	5,733	28,279
Office	1,688	5,237	8,697
IP costs	5,000	70,000	-
Legal	7,500	9,000	10,800
Charitable Contributions	-	28,697	42,520
Marketing	12,475	67,845	67,845
Total Operating Expenses	$55,663	$399,012	$481,787
SG&A % of Sales		70%	57%
Total Operating Income before Taxes	(63,554)	90,648	284,337
NOL(Net operating Loss) Tax Benefit	-	(63,554)	
Taxable Income 25%-2017, 39%-2018	(63,554)	27,094	284,337
Income Tax Expense	-	6,773	110,892

Net Income	$(63,554)	$20,320	$173,446
Profit Margin		4%	20%

Vaylenx LLC
Projected Cash Flow
December 31, 2X16,2X17,2X18

	2X16	2X17	2X18
Operating Activities			
Cash Received From Customers	$ -	$573,944	$850,408
Cash Paid to Suppliers	(7,891)	(84,283)	(84,283)
Cash Paid for S&A	(55,663)	(164,352)	(278,825)
Net Cash received by Operating Activities	$(63,554)	$325,308	$487,300
Investing Activities			
Purchase of Equipment	-	(5,733)	(28,279)
Total cash used by investing Activities	$ -	$(5,733)	$(28,279)
Financing Activities			
New Borrowings	75,000	-	-
Issuance of Common Stock	-	-	-
Cash received from financing activities	$75,000		
Cash Received	11,446	319,575	459,021
Beginning Cash	17,300	28,746	348,321
Ending Cash	$28,746	$348,321	$807,342

Vaylenx LLC
Projected Balance Sheet
December 31, 2X16,2X17,2X18

ASSETS	20X6	20X7	20X8
Cash	$28,746	$348,321	$892,383
Account Receivable	-	-	-
Supplies(filter paper, Bowls)	-	1,112	1,112
Inventory	1,617	2,015	2,511
Prepaid Expenses	12,000	12,000	12,000
NOL Benefit	63,554		
Current Assets	$42,363	$363,448	$908,006
PP&E			
Soxhlet Extractor/Dishwasher/Burner	-	4,621	4,621
Hot-Column Extractor	-	-	28,279
Accum Dep	-	(360)	(2,560)
Net PP&E		4,261	30,340
Patent	-	70,000	70,000
Amortization	-	(3,500)	(7,000)
TOTAL ASSETS	$42,363	$429,948	$971,006
LIABILITIES & EQUITY			
Account Payable	3,750	4,500	5,400
Total Liabilities	$3,750	$4,500	$5,400
EQUITY			
Common Stock	$38,613	$425,448	$965,606
TOTAL LIABILITIES & EQUITY	$42,363	$429,948	$971,006

The above three pages include the financial statements of Vaylenx for the first three years. These are estimate numbers, but do represent positive growth. Vaylenx can be cash-flow positive within the first year at estimated borrowing of $75,000.

Key metrics to notice are the positive cash flows, the sheer volume of revenue numbers within the first three years characterized by non-exponential growth. The growth numbers are very conservative; however, still show positive growth powered by a few key clients, and some licensing opportunities. Primary direct sales for years 1-3 would mostly be for demonstration purposes and field testing on national sites. Additionally, costs of patents are included in year 2; however, the patents will be purchased before first revenue (year 2).

The following section contains the references used in the business plan section. After the references section a discussion section is placed, overviewing and analyzing the results.

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Discussion

While conducting the business plan section of the thesis I was able to combine my knowledge of commercialization processes for startup ventures in academia with that of my intent to form a business. There are four themes that can be taken from the literature review and mapped with the writing of the business plan. These four themes assisted in writing the plan and were constantly coming back into focus during the process. The four themes are *realized innovation, market for ideas, support networks and university support*. It is without doubt that these four themes are what my thesis can contribute to the field in terms of an experiential research process for the commercialization of startup ventures within academia.

Realized Innovation

Realized innovation deals with the ability of individuals, firms or organizations to recognize that usefulness and potential of an idea (Keinz & Prugl, 2010). This concept can be traced back to the advent of the business value proposition and product; back in 2014 when I first identified the potential for the nanoparticles. As mentioned in the methodology section, nanoparticles were only one facet of the original plan used in the Ohio University Global Health Competition.

I realized that there was a potential innovative product and began conducting research to affirm my assumption. During the summer of 2015 I spoke with angel investors, accelerators and other startup venture experts to see if these nanoparticles could turn into a potential venture. I received positive feedback from the majority of individuals I spoke with. I even traveled down to Guyana with my team to speak to key governmental stakeholders who also supported the product. By September 2015 I established Vaylenx as a legal business entity. If I had not realized that this was an innovative product, then there would never be a company.

Market for Ideas

The second theme, *market for ideas*, is perfectly applicable toward the creation of Vaylenx and writing of the business plan. The concept behind the market for ideas is that an entrepreneur considers a problem based approach versus a solution based approach during the ideation phase. The Vaylenx team had a bit of an advantage here

in that the problem was previously identified by Ohio University during the Global Health Case Competition. The problem of malaria was identified as a problem worth finding a solution for before the team of Vaylenx had realized the potential for the innovation. The university assisted in this regard by setting the stage and providing an ample opportunity for Vaylenx to go through the ideation stage while focusing on a specific problem. This leads into the next theme of *University Support*.

University Support

Ohio University supported the Vaylenx team both directly and indirectly. Studies show that universities which support their prospective entrepreneurs have a better success ratio of the commercialization of new ventures. Ohio University supported Vaylenx, as mentioned in the previous paragraph, with the competition which ultimately brought the innovation to light. The university also supported the team through collaborative mentorship between the students and professors. While writing the business plan an advisor constantly oversaw the authoring section, by section. This helped the company identify where the holes in the plan were, where and when the company needed to pivot and future opportunities. In the creation of a business plan the university support was instrumental.

Support Networks

The university also had ties with organizations outside of academia which provided support for Vaylenx and to me during the writing of the business plan. This

brings me to my last theme, *support networks*. Ohio University has many support networks; however, the most support for Vaylenx came from TechGROWTH Ohio (TGO). Without the expertise offered here the main funding initiatives, legalities, contracting and research team generation or creation would not be possible. While writing the business plan there were certain aspects that needed clarification from which the university personnel could not assist, mainly hands on legal and funding assistance. TGO was able to provide the necessary expertise through its personnel which assisted me during the authoring of the business plan and the simultaneous creation of Vaylenx.

Vaylenx is such a large concept for a business, one that is atypical of the current norm, that writing a business plan and creating the company could not be done alone, let alone by students. Lacking many of the resources, knowledge and expertise necessary to start any company the combined assistance of the university, their support networks and the innate recognition of the potential by the entrepreneurs is really what led to the success of Vaylenx.

Conclusion

Summary

In brief the outcome of the work conducted throughout this thesis has led to two results. The first is the generation of a business plan which is being followed and

enacted in reality. The second are the contributions to the field of research specifically technology commercialization processes within academia.

In summary, I wrote a systematic literature review which reflected on the various articles written concerning technology commercialization of startup ventures within academia. This systematic literature review overviewed various themes observed throughout the literature. I took a systematic approach to the literature by organizing the various articles in the beginning and then mapping them according to themes. A thematic map was created to map and interconnect the themes found throughout the literature.

A methodology was written following the literature review. The methodology was separated into two parts; the methodology and the methods. The methodology overviewed two different approaches in business planning; the Lean Startup approach and a traditional business plan approach. Advantages and disadvantages of both were then identified. Form the two approaches were compared and a reasoning as to why the business plan approach was chosen was provided. The methods section the process undertaken to write the business plan and the various sections of the business plan.

The following section was the business plan. The business plan was separated into ten sections; these sections are listed in the methods section as previously stated. The business was written under the guidance of Dr. Luke Pittaway, the thesis advisor.

The plan was written and enacted congruently; therefore, the business plan was reiterated and amended as areas of new information were discovered.

Following the business plan, the is the discussion which reviewed what was learned throughout the process of writing the business plan and conducting the research. Challenges of conducting the research and writing the plan were also discussed as well as what was taken from the research in the literature review to assist in the authoring of the business plan.

The last section of the thesis was the conclusion which overviews all the work done throughout the thesis. The conclusion discusses the contributions to the field as well as the potential implications. Finally, the conclusion reviews possible limitations of the research and concludes with final remarks.

Contributions

The contribution of this work to the field of the commercialization of technology startups in academic ecosystems is that the support of the university assists in the success of the business planning and commercialization processes. As mentioned in the discussions section, there are four themes from the literature review which carry over into the personal experience during authoring the business plan. These themes carry over into the congruent development of the business as well. A university that displays an entrepreneurial ecosystem, like Ohio University, the host

university, supports the writing of a business plan for a technology business. Additionally, the networked support the university provides to outside parties assists in the success as well.

Additionally, on a more applied side, this business has the potential to change the world. The contribution to the environmental, humanitarian and the business disciplines is quite obvious and has been a motivating force in my efforts. A successful product and business with this concept could help save lives and change the world for the better with a transformative ecologically benign larvicide to help alleviate and slow down the spread of vector borne illnesses.

This project can contribute to my discipline as well through shared knowledge. I learned a lot through writing this business plan, and although it will not be readily available to those whom it could have the largest impact on, my knowledge and shared experiences will be. I can take the experience of success or failure in enacting the business plan into a real business and the knowledge from doing so and share it with my peers or potential coworkers as the business develops. I believe that this is an incredibly valuable aspect of the project and contributes to my discipline of entrepreneurship and business equally. I became fascinated in both due to my father sharing his experiences of entrepreneurship with me, which has inspired me to take this career path myself.

The potential changes in the academic ecosystem as well as the applied potential of the business illustrate how contributive this thesis is. The business plan has the propensity to become a real business and change the world; however, for now it is simply changing my world which will one day hopefully be able to shape, influence or change another individual's world too.

Implications

There are a variety of implications to the field from the conclusions drawn out in this study. The implications vary from applied implications to the business in the study, to academic implications for university's which teach or promote entrepreneurship.

One implication is that this process provides a real opportunity for the business outlined in the plan to become a reality. The plan written follows an iterative process which has allowed for an up to date strategic plan. The plan has also been reviewed by experts in the field, be them academics or consultants. These revisions were promoted by the support of the university. If it were not for the support of the university the business plan would not be as finalized or legitimate as it is.

Another implication are the pedagogical methods surrounding the business plan process. As the methodology stated, there are many approaches to writing a business plan; however, the success of the business in this plan shows that a traditional

iterative method can be taught and employed successful. This success validates the practice of teaching a traditional business planning method, like at Ohio University.

A third potential implication is the possibility of altering university support in universities lacking an entrepreneurial ecosystem or one promoting of entrepreneurship. To promote entrepreneurial endeavors of students some universities might start to direct their environment toward entrepreneurship. As states in the literature review, entrepreneurial universities are becoming more popular for a variety of reasons, beneficial to the student and university alike. This might come in the form of securing relationships with outside organizations, like how Ohio University partners with TechGROWTH Ohio. It might also mean the implementation of more entrepreneurial academic programs and classes.

There are many challenges when building a business from the ground up; however, governments can assist in this growth. Governments can assist in the growth of new ventures, specifically technology ventures from the academic atmosphere. Governments do this through applying new policy and support of organizations which encourage technology startups. TechGROWTH Ohio, which provided assistance during the writing of the business plan in this thesis, is a joint partnership between the State of Ohio and Ohio University. Governments can also provide funding opportunities in the form of grants geared toward startup firms. A lot of government grants exist, but more exist to support scientific research versus commercialization.

The networked support from the university to third-party firms provides students with grant opportunities, as well as professional support.

This study has implications in the academic ecosystem, as well as the applied entrepreneurial space. These are some of the implications of this study. The next section will discuss the limitations of the study.

Limitations

While conducting this research, both writing the business plan and the additional sections of the thesis, there were limitations. These limitations could affect the outcome of the work, skew results, and limit contributions.

One of the largest limitations of this research and business plan is that it is concerned with a large scale business. In other words, the startup envisioned is not a small vision. This changes the business planning as well as the research process. For example, with this startup there is more of a focus on future management organization versus current management organization the future version is what is necessary for successful operation of such a large scale company.

Another limitation is that the business is very heavily research focused. This limits the business plan in that the first years of activity are focused on research and development versus revenue generation. Additionally, some of the research conducted

for the literature review was focused on technology startup firms explicitly. This limits the scope of applicability of the research to the field to only technology companies.

Lastly, there is a limitation with the method. For this thesis a traditional business plan approach was taken, but as overviewed in the methodology there is an alternative approach. In fact, there are many alternative approaches. This limits the scope of applicability as the conclusions and analysis of this thesis is focused only on startup entrepreneurs who write a traditional business plan.

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