Enterprise Resilience of Maritime Container Ports to Pandemic and Other Emergent Conditions

(Technical Paper)

An Exploratory Analysis of the Phylloxera Crisis of the 1800's and the Implications on the Current Virginia Wine Industry

(STS Paper)

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

Introduction

Thomas Jefferson planted European grape at his estate, Monticello in 1770, but little did he know that he would struggle his whole life to cultivate French wine in Virginia. (Holloway, 1997). Virginia has had a long history of frustrating wine production, from the first settlers that discovered the native American grape produced wine that "tended to smell and taste rank-something like wet fur" (Lukacs, 1996), to post-Revolutionary War farmers that struggled against the harsh winters, mold, and a pest native to eastern United States called phylloxera. Phylloxera destroyed vineyards and spread outside of the eastern United States in the late 1800s, wreaking havoc on the international wine industry (Lund, 2017, pg.1). Virginia is now home to 312 wineries (Mariani, 2019), with wine tourism a driving factor in the Virginia economy, and has experienced 39% growth from 2010 to 2017 (Reed, 2017). This STS proposal aims to explain how scientific exploration, specifically when it comes to phylloxera infestations, explain current Virginia wine economy and, shed light on how to combat new phylloxera infestations.

Virginia wine industry has created thousands of jobs, and is predicted to continue growing (Staff, 2017). With this growth, Virginia has the potential to export wines, impacting the state's transportation services, specifically at the Port of Virginia. As the port prepares their 2065 Master Plan they will have to consider the industry trends in Virginia, including the wine industry. The port also has plans to become the deepest port on the east coast (Ashe, 2019), therefore their processes and future plans must be explored for potential inefficiencies. This capstone proposal aims to suggest potential new technology the port should explore and implement in order to increase their capacity and prepare for the future and the changing economic landscape of Virginia. This prospectus will explore the phylloxera infestation of the 1800's in order to understand how scientists worked together to find a solution, understand the

lasting impact of it on Virginia, and potential opportunities for increased exports of Wine through the Port of Virginia.

Enterprise Risk and Resilience of Container Freight Operations: Port of Virginia and Commonwealth Center

The Port of Virginia is an economic driver that employ's "9.4% of the state's resident workforce" (Port of Virginia). As a result of Americans continuing to consume and import more, the Port of Virginia has started the process of deepening their harbor to be able to fit the newest container vessels currently navigating the Panama Canal (Ashe, 2019). This strategic $320 million investment makes the Port of Virginia the only east coast port with the ability to handle such large containers, subsequently promising years of economic benefits (Ashe, 2019). During this capstone, a group of undergraduate systems engineering students, Robert Donnan, Courtnay Edwards, Arjun Iyer, Tan Karamete, Peter Myers, Robert Prater and Simone Olson, will explore the potential opportunities that the port could implement in conjunction with the expansion project. These opportunities could be in a variety of areas such as information technology, energy, environment and marketing solutions. This project will be completed at the end of April, and will produce a paper to be published by Institute of Electrical and Electronics Engineers Press and a presentation to systems engineering professors and students at Systems and Information Design Symposium. These opportunities will be found through research with resources provided by the Port of Virginia, and information online in the form of environmental impact statements, case studies, new articles and more.

One of the most promising opportunities is the creation of a crane manufacturing plant in Virginia. Cranes are an essential part of the port operations, but are also a significant cost

requiring years of planning to replace them. The current cranes "are capable of handily transferring cargo to and from ships with a width of 22 to 24 containers" (Seeger, 2019). As the port attracts new ships, the current capability of the cranes will not be enough for the new super ships. The port will need more cranes to handle increased traffic, which means potentially sourcing cranes within the United States. The potential for an American crane factory means creating US jobs, shorter travel distance for US customers, and the ability to use US grants to buy cranes. This project will require a thorough understanding of the crane industry, the potential barriers to entry in the US market, the environmental concerns and cost analysis of this new plant.

Looking into new technologies, another opportunity the port can implement is to move to electric gantry cranes. Rather than powering cranes on diesel, the new electric cranes significantly "reduce energy and maintenance costs" (Lane, n.d.). These electric cranes allow the port to offset their emissions caused by older machinery and boats, while increasing their sustainability efforts and boosting their public image. All of these solutions aim to create jobs in Virginia either by increasing the capacity and demand of the port or by creating a new manufacturing facility.

An Exploratory Analysis of the Phylloxera Crisis of the 1800's and the Implications on the Current Virginia Wine Industry

During the colonial times of Virginia, silk and wine seemed like the promise of wealth for the English settlers (Pinney, 1989, pg. 14). Having seen native grapes growing in the wild, the English expected America to be the perfect habitat to cultivate grapes to make wine. They quickly realized that the natural grape did not produce the same quality wine as the European

grapes (Holloway, 1997). This problem persisted even into Thomas Jefferson's era with the "successful cultivation of *Vitis vinifera*, the classic European wine species, virtually impossible, until modern methods were developed to control black rot and such destructive pests as phylloxera" (Monticello Org, n.d.). Little did early Americans know that the native grapes, part of the *Vitis aestivalis* species, spent centuries growing resistant to phylloxera. The phylloxera feed on the structural roots of the *Vitis vinifera*, which "provide entry to soil-borne fungi and bacteria, resulting in progressively more severe root damage, yield loss and eventual vine death" (Lund, 2017, pg.2). In the mid 1800's, as world travel became more common, the American grown grapes were sent over to Europe causing the introduction of phylloxera to the vast vineyards in France. This introduction resulted in a fast deterioration of the French wine economy, and the solution would take years to find (Lund, 2017, pg. 2). At first the French farmers tried to use pesticides to kill the phylloxera, but it was not until an American entomologist, Charles V. Riley, communicated with French scientists to help solve the phylloxera crisis. Riley "confirmed that the American and European phylloxera were identical and that the species originated in America" (Sorensen, pg. 1), and argued that "the American vines would be permanently adapted to resist the depredations of the bug because the two had coevolved" (Gale, 2011, pg. 66). He also figured out the "ultimate solution for phylloxera was grafting" (Carton, 2008, pg. 144) the European vine to the resistant American vine.

Riley's scientific observations and analysis saved the French wine industry, and allowed eastern states, like Virginia to produce French grapes. Using the actor network theory, this research paper will explore the relationship between the phylloxera, French and American framers, phylloxera and the scientists that generated a solution. Actor network theory "attempts to 'open the black box' of science and technology by tracing the complex relationships that exist

between governments, technologies, knowledge, text, money and people" (Cressman, 2018, pg. 2). The paper will use historical case studies, and primary documents to create a network of the wine industry during the mid 1880s. This network will visualize the connections between the human actors (Riley, the farmers and French scientists) and non-human actors (the phylloxera).

The criticism of Actor Network Theory is that it struggles to understand the sociotechnical elements of the networks (Cressman, 2018, pg. 10). Therefore, this analysis might struggle to incorporate the complex social environment and biases of the French wine industry during the 1800s. Actor Network Theory can be a vast analysis, and with such a historic event it might be hard to limit and control the number actors. This type of analysis is important because the scientific solution of grafting the vines completely altered the wine industry. It is also important to draw the connections from this analysis to present day. There was never a complete irradiation of phylloxera, instead just a proposed solution. Phylloxera outbreaks can still be seen on the West Coast with farmers using new techniques to protect their vines (Skinkis, pg. 2). As travel between countries is easier than ever thanks to boats, cars and airplanes, the phylloxera could be transported everywhere. Using actor network theory will give insight into how the phylloxera problems were solved, and how the network has changed to possible combat any 21st century issues with phylloxera.

Research Question and Methods

How did scientific analysis play a role in solving the phylloxera infestation of the wine industry during the mid 1800s, and what is its lasting effect on the Virginia Wine industry?

To answer this question will involve an exploratory analysis of the history of wine in the mid 1800s, specifically looking at the scientific methods of Charles V. Riley and French

researchers to combat phylloxera. This analysis can provide insights on the current wine industry, specifically, the impact of phylloxera on Virginia wine production given that "not until the 1960s did anyone succeed in growing European grapes in the Eastern United States" (Lukas). This exploration will be aided by the use of actor network theory, which will draw connections between key actors, and explore the relationships that were created in order to fight the phylloxera. The analysis will require historical case studies and primary sources such as letters, books and scientific documents in order to understand the network. Currently, grafting "remains the method of choice for protecting grape vines" (Gadye, 2015), but as science continues to evolve, this analysis can help to understand new ways to combat different pests.

Conclusion

The phylloxera infestation during the 1800s caused intense damage to French wine production, but it also enabled eastern states, like Virginia, to start producing European wine. Through producing wine Virginia has been able to create a booming industry. This growth will have an impact on the Port of Virginias, which is currently looking for opportunities to grow and innovate. This STS paper aims to explore and explain the relationships between scientists, farmers, vineyards, and phylloxera during the 1880s. The paper also aims to understand the connections between the current Virginia wine industry and the scientific solution to phylloxera. The results of this analysis should be a deeper understanding of how science and communication play a role in viticulture, as well as a network that describes these relationships. The technical paper and project aim to explore opportunities where the Port of Virginia can innovate and increase efficiencies to because one of the leading ports in the United States. Both these projects have deadlines in the Spring of 2020 and will result in scholarly papers.

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