PARTIAL BUDGETING ANALYSIS OF CONVENTIONAL PUMP OVER VERSUS PULSAIR CAP MANAGEMENT SYSTEM FOR A LARGE–SCALE CALIFORNIA WINERY

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ABSTRACT

The purpose of this project was to evaluate the financial feasibility of implementing an automated gas injection system from Pulsair as an alternative to the traditional pump over cap mixing technique that is used during the alcoholic fermentation stage of winemaking.

There were various costs involved in this project that were determined and explained through the use of the partial budgeting method. The costs that were thoroughly analyzed included equipment, labor, utility, and initial investment costs for the Pulsair system as well as the related pump over operation costs. After the two methods associated numbers were evaluated, they were then transferred into excel spread sheets where it was determined that the initial investment for the Pulsair system would be considerably higher. It was also concluded that even if the utility cost (the major cost factor in the difference of the systems) for the Pulsair system was multiplied 200 times, the total operating cost for the automated system would still be considerably less than the Pump Over method.

After further assessment of the figures, it has been concluded that it would be a feasible endeavor for wineries seeking expansion, as well as for future start-up wineries to implement the Pulsair system with expected profitability after the first year of operations.

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Chapter 1

Introduction

Wineries in California that operate on the larger scale are experiencing a loss in revenue due to increased overhead costs during the harvest season and the failure to research alternative production methods. Corsey (2006) highlights that recent trends in the wine industry point toward more mechanization in the vineyards and a concentrated push for automation in production facilities in countries such as France, Australia and the United States. As of now vineyard managers are benefiting by utilizing the most technologically sound mechanical harvesters on the market. In this situation, the replacement of manual labor by machines is mostly related to the vineyards themselves more than the production facility. Hiller (1987) explains the reasoning for the general conformist attitude by winemakers against automation in relation to wine production: the belief that fine wine can only be made through the utmost care and diligence of skilled winemakers and production assistants without the aid of mechanization. As of late, this claim appears to have limited validity.

Corsey (2006) also indicates that losing profit as a result of poor use of materials, equipment and the unnecessary allocation of resources such as electricity and labor, tends to lead toward a path of destruction in this ever-demanding fast-paced industry. This is why the utmost care and diligence must be taken during the alcoholic fermentation stage, a critical time in the winemaking process.

In winemaking, excellent “cap” management during alcoholic fermentation is essential for harnessing positive flavor, aroma and color compounds. The cap floats on top of the fermenting juice as a result of rising carbon dioxide and is a collection of skins, seeds and stems

that contain the necessary compounds for the wine making process. Therefore, it is absolutely essential for the winemaker to keep the cap saturated by mixing the contents of the tank if he or she aims to extract the necessary amount of color, tannoids and polyphenols from the must. Within the last ten years, new automated cap management technology has proven its worth in reducing overhead costs (Patterson, 2011). Although wine cap management systems from the Pulsair company may cost upwards of $100,000 to install into a production facility of 20 tanks, winemakers need to be educated on the capabilities of automation and explore this alternative to pump overs if they are interested in maintaining the quality of their wine while cutting costs.

Problem Statement

Is the implementation of an automated gas injection system for wine cap saturation a feasible and profitable endeavor for wineries producing 75,000 cases a year or more?

Hypothesis

The implementation of an inert gas injection system for cap mixing will decrease costs and increase profitability of large-scale wineries without negatively impacting the quality of the wine.

Objectives

1. To describe two wine cap management methods, pneumatage (Pulse Air system) and pump over, and related potential impacts on wine quality.

2. To evaluate the financial feasibility, initial investment and the costs of operation of implementing an automated gas injection system as an alternative to the traditional cap mixing techniques for hypothetical winery “X”.

3. To use the information generated from hypothetical winery "X" insofar as to assess the impact of a gas injection system on costs and future profitability for large-scale wineries more generally.

Significance

To be able to create higher profits while lowering overhead costs during harvest is the goal of any winemaker or owner of a winery. As Smyth and Russel (2009) make clear, winemakers are turning to researchers to develop ways to cut production costs through the use of more energy efficient machines that do not jeopardize quality. Due to poor limited previous research about mechanizing and automating the tank room or any other part of the production facility, wineries keep their laborers on the clock longer than may be necessary to accomplish the necessary tasks that are typical during a day of harvest. Marais (2003) explains that winemakers who are joining the support toward automation want to be sure that new production machines that will replace or aid in traditional mixing practices, will be as successful if not more at extracting the necessary and extremely important tannoid and phenol compounds from the skins, seeds and stems.

This research could be an important tool in aiding a winery of large scale and capacity in the direction of establishing a more successful cap management regimen. By automating certain tasks, labor costs could be drastically cut while producing the same amount, resulting in a more profitable and successful business that will have a secure future and be competitive in the wine industry. Essentially, labor during the harvest and crush season at a winery is at an all-time premium, so allocating labor else ware in the production facility can be made possible by

automating monotonous tasks such as pump overs which in time would justify the initial cost of the system.

Chapter 2

Review of the Literature

Most wineries operate at such low margins that any mistake or loss of product during production can be detrimental to their profit, especially in small wineries (Patterson, 2001). A way wineries combat this is through the use of benchmarking. This is done by measuring their success with that of similar wineries that achieve high performance in the industry. They then use the information they gather to improve on various facets in their winery that they feel need the additional improvement (Galitski, 2005). Through the establishment of greater production efficiency, increased profit and an overall better product can be accomplished through automated systems. One example of this may be mechanization to replace current practices such as pump over and punch downs.

Limited labor availability, (a common occurrence at a winery), often implies that "corners are cut" and can result in poor wine production practices. This is where automated processes may improve upon the capabilities of manual labor. When there is "must" in a tank that is going through the alcoholic fermentation stage, it is mandatory that the cap be agitated and mixed into the juice three to seven times a day depending on which red varietal is being made. Must is simply the combination of grape juice and its associated skins, seeds and stems after it is transferred from the grape press into a fermentation vessel in the winery. The cap in a wine tank is the accumulation of the skins, seeds and stems that float on top of the juice as a result of the production of CO2 from yeast during fermentation (Phillips, 2008).

One winery owner Curtis Phillips (2008), turned to automation and the Pulsair system specifically for cap mixing techniques. One problem that he faces on a seasonal basis is the

unreliability of his laborers. The wine industry is not the place for everyone; it requires a person's utmost diligence, patience and extreme skill when producing and creating a good bottle of wine. Phillips believes that it takes about a year of constant supervision and direct help of a crew member until he or she is no longer a danger to themselves or the wine. With this type of constant support and training, production members truly gain great skill working with wine. The problem is that labor is expensive and is never guaranteed, because turnover is high.

Phillips says, "The problem is compounded by the fact that a lot of wineries tend to be small and employ smaller staffs. Four can do the work of five in a pinch: but what happens if your only cellar worker leaves? You work 17 hour days without a day off for months on end, that's what I know. I've been there. And when you're there, what sort of quality are you really producing?" Although it is extremely difficult to test the differences that arise from switching from the manual pump over to an automated system, one thing is certain. When switching from the manual method to a fully automated system, it allows the winery to employ the same amount of people, but they will not spend the same amounts of time on cap management. Essentially, labor originally dedicated to cap management can be either relieved of their job or, allocated elsewhere in the winery to complete other important tasks such as blending. This allows greater focus on quality care of the wine while still producing the same amount of product. Phillips (2008) believes switching to automation saved his winery from going under for these exact reasons. Many of the problems that are found in a bad bottle of wine usually arise from the alcoholic fermentation stage and incorrect or poor cap management. Thus, the main reasons for a winery to automate their cap management system are for decreased material costs, labor and better quality wine production (Phillips).

In Thailand, an emerging wine country, Siam Winery is already years ahead of the majority of wineries in the world when it comes to automating the winemaking process. Tim Patterson, a published author, journalist and winemaker, wrote an editorial column about advantages and disadvantages of automation in wineries. In the article, “Do we still need winemakers?” Patterson explains how Siam winery has automated everything in their winery; from automated fruit grader and sorters, to automatic crush and pressing cycles as well as automatic juice transfer to tanks and even down to automated alcoholic fermentation regimens and bottling. Essentially not one step of the winemaking process requires manual labor. Patterson claims their facility has been successful ever since it opened its doors is 1982 but only recently has the winery seen superlative success, being featured BBC Food and Drinks as well as being chosen to be served in Octobers APEC (Asian Pacific Economic Community) conference. Through the use of total automation implemented at their facility in 2007, Siam winery has climbed to unprecedented success. Patterson states, “If you're not sold, think about this: They knock out 20 million bottles per month.”

Not all wineries can automate, and it is essential to understand that automating does have its limitations. However, knowing the size of the winery and or business plan of the winery can aid in the decision of whether or not to automate certain winemaking procedures. For instance, a small- scale winery producing 500 cases with a price point of fifteen dollars, would not want to automate since one or two people could easily do the work. Another example would be a small-scale winery that produces 3000 cases a year with a price point of 120 dollars a bottle for white and 150 dollars for red. In this case, if they chose to automate, the ends would justify the means. This latter example describes the case of Arkenstone Winery in Napa Valley. Winemaker Sam Kaplan (2011) turned to automation in his production facility and he stated, “I can do pump

overs from my couch at home, watching TV with a nice cold beer in my hand." Patterson (2011) talks more about automation in relationship to size of winery as well as the exception, Arkenstone Winery. He said, " Suppliers I talked to agreed that automation is probably off the table for very small operations, unless they are also very high end: Arkenstone, for example, makes only a few thousand cases of its own wines--a $120-per-bottle Cabernet blend and a $45 Sauvignon Blanc. The target range for automation lies somewhere between 25,000 and 150,000 cases."

Richard Parks the inventor of the Pulsair system (personal communication) indicates that the automated cap management systems are durable and have a long functional lifetime of around 15 years. Patterson would agree that automation in general works and can be profitable over time for the right winery. Patterson went as far to say that, "As with any capital investment, the potential payoff comes over time: buy once, use indefinitely." Essentially, this means, " buy once, never will there be excess labor costs incurred. "

Some methods of cap management include pumping over, "Pigeage" or punch down, "pnuematage" or gas bubble method, the "delestage" method termed rack and return and rotary fermentors. This project focuses on the two most commonly used techniques; pump over and punch downs and are compared to the output of the pnuematage gas bubble method. This project focuses on the traditional pump over method along with the proposed automated alternative from Pulsair, pnuematage.

The pump over cap mixing technique is more of a stand by method to the punch down. Winemakers argue that the act of the wine coming into direct contact with oxygen helps to extract the more fine tannins from the must during fermentation. This is especially true with

varietals such as Syrah since it is one that significantly benefits from being in contact with more air (Phillips). In a pump over, the juice is drained from the bottom of a tank then through the use of a must pump and a network of transfer lines (hoses), the wine is then pumped directly over the top of the tank and on through an irrigator that evenly disperses the wine over the cap. There are disadvantages to this system that relate directly to a winery's overhead cost. To set up a pump over the laborer needs a pump, typically centrifugal or progressive cavity pumps which use considerable amounts of energy, to hoses that are expensive and break regularly and finally, a laborer to run the process. The largest disadvantages of the process is the amount or time of labor used and the fact that when you are forcefully transferring wine through hoses and pumps, you are essentially liquefying and destroying the must, one of the essential elements to making a good bottle of wine (Phillips).

Lastly, the pneumatage method utilizes metal plates that are installed directly to the bottom of the inside of the tank. Through the use of an inert gas such as CO2 and nitrogen that is released into the tank, large bubbles form under the plates until they get large enough at which point they slowly release and rise to the surface. Once the bubbles are large enough to overcome the surface tension of the wine, they rise up through the cap. This process breaks the cap and pulls the must that comprises the cap down the sides of the tank and mixes it completely into the wine (Snedden).

The Feasibility Study

To administer a feasibility study for a winery, the analyst must first identify the problem or problems that warrant such a study. According to the Business Dictionary a

feasibility study is, “An analysis and evaluation of a proposed project to determine if it (1) is technically feasible, (2) is feasible within the estimated cost, and (3) will be profitable.” Essentially, since making a profit is the number one goal, the study must be built around that by the use of objectives and goals that will create an opportunity to increase profit. Making a profit is not necessarily one of the objectives, but it is an implicit goal in which the objectives of the study aim to meet. Although there has been little information about starting a winery or expanding the operations of an existing winery, the basic truths for administering a feasibility study, such as determining all operating costs for example, still apply.

Before compiling a precise list of objectives the analyst must fully understand what they are trying to achieve through the use of for example, a new business plan or implementing a new machine such as Pulsair’s system into an existing business. It is essential to understand how the winery works as well as what the winemakers plan is for the wine. Hiller (1987) highlights, the winemaker is ultimately the final decision maker when it comes to production techniques.

A feasibility study must specify the size, scale and capacity of the winery simply because of the extreme differences in costs and operations based on production volume. Bret Larreau of Key Technology says in reference to the wine industry, “it's a fragmented industry with tens of thousands of wineries, massive scale differences and a majority close to garage size (Patterson, 2011)." A key outcome of the system among quality assurance which is guaranteed by the system, is that the Pulsair system must be equally as good at, if not better, than pump over at reducing the amount of labor and time allocated toward cap management. The pneumatge gas injection system from Pulsair, according to the system user manual, attaches directly to any alcoholic fermentation vessel that utilizes a two inch butterfly valve, so it is assumed that it is necessary to determine how many and what types of vessels the winery has (Parks, 2006).

Phillips says, “This type of system can be retrofitted to existing fermenters and has the advantage of scaling well in fermenters (Phillips).” Finally, one of the main components of the study and quite possibly the most important, is determining whether or not the initial cost, installation and annual maintenance of the automated system is a justifiable and profitable endeavor for large scale wineries as an alternative to traditional pump over’s.

Key Factors of the Study

Patterson (2011), after interviewing two winemakers who have both employed the Pulsair system said they, “both are convinced the system will surely pay for itself in decreased labor and energy costs and consistent wine quality.” To analyze the profitability of implementing the Pulsair system, a key factor to the study will be to determine how many years the system is guaranteed for and annualize the cost of materials over the successful life of the system.

After obtaining the necessary calculated information, the researcher will then input the data collected into a partial budgeting template created in excel and compare the results to asses for future profitability of hypothetical winery “X.”

The success of the Siam winery was built around the reliability and durability of the machines that automate the winemaking processes. Siam winery was able to gain quick success after the launch of the system because ample research was done and every input had a calculated output that was determined through tests such as partial budgeting. Clearly for Siam, the positive aspects of automating proved to be a profitable venture for their winery and were achieved by thorough assessment, carefully analyzed factors and accurate cross comparison research. A benefit to detriments method of comparing the two cap management methods will also be used in

this study to determine if the probability of automating through the use of the Pulsair system is profitable and plausible.

The feasibility study provides relevant information to the necessary people heading a winery as to educate or make them aware of the opportunities that are available and can make their winery run at a higher capacity, while producing the same, if not more product and ultimately create an increase in net profit. Galitski says, “Not all industrial facilities have the staff or the opportunity to perform a detailed audit of their operations. The lack of knowledge of cost saving opportunities provides an important barrier to improving the efficiency of operations of a business.” Essentially, this study will take into account the various factors that comprise both the pump over and Pulsair system then, their qualities will be cross compared to determine a length of time before hypothetical winery “X” could potentially make profit.

Chapter 3

METHODOLOGY

Procedures for Data Collection

Before deciding whether or not to implement a new process or equipment into a winery, there are several factors that need to be evaluated. It will be essential for the researcher to locate a winery in San Luis Obispo County that is of equal production size as the proposed hypothetical winery expansion "X" to determine pump over regimen quantities, amount of labor needed to perform tasks, as well as the allotted pump over times and equipment needed with their associated costs. These numbers will correlate with the numbers regarding the traditional pump over method shown in the partial budgeting form located in the appendix. The next and possibly most important step for the researcher will be to obtain a 20 tank price quote for hypothetical winery expansion "X" from the sales department of Pulsair Systems. This quote must include the initial price of the system (parts and materials), price of installation, and costs of labor required to operate the system. These steps must happen before any further research and data is collected because it is the foundation of the general analysis.

Since one of the main goals of this study is to provide any winery in search of greater success the necessary information and technology options to do so, a partial budget will be an essential tool for comparing the monetary advantages and disadvantages of the proposed system related to the traditional pump over method. Once the winery has been located, it will be necessary to examine their specific tactics and production methods including all materials and equipment they use for cap mixing. Essentially, it is important to know variables such as the related costs of their equipment such as pumps and hosing as well as the amount of laborers

needed to complete a pump over regimen for 20 tanks. More importantly, the researcher must calculate the time their laborers spend each working day using the setup and how often they must replace equipment or more professionally known as annualized costs. Essentially, this will exemplify the potential benefits and increase of profit for future harvests in terms of profitability, sales, growth, return on investment and overall value of the winery as a result of implementing the Pulsair pneumatage gas injection system.

After assessing various financial benefits of using the system, it is then imperative that the researcher educate himself on the workability, competence and efficiency of the machine as well as the necessary raw materials the winery would need to run the system (Dellenbach). To illustrate these potential benefits the Pulsair system has over pump over, a partial budgeting form as well as two excel spread sheets containing related costs of pump overs and the Pulsair system will be developed. Tigner (2006) indicates the essential purpose of a partial budget as, "A partial budget helps farm owners/managers evaluate the financial effect of incremental changes. A partial budget only includes resources that will be changed. It does not consider the resources in the business that are left unchanged. Only the change under consideration is evaluated for its ability to increase or decrease income for a business."

In this study the incremental change is the Pulsair system. Tigner (2006) would stress that the general process of mixing the cap would not change, however the way in which the necessary and desired results from mixing the cap would consequently be acquired utilizing a different technique or incremental change to the overall process, while still maintaining the quality and integrity of the wine. By cross analyzing the selected production methods for the criteria stated above, the partial budgeting technique will determine if it is financially a sensible decision to implement the Pulsair system. Through an analysis of the partial budget form

presented, the researcher will determine if the potential success of a winery can be directly correlated to implementing a gas injection system into their production regimen. Parks (2006) would agree that this widely used business tactic will show the importance of doing in depth research on a product before making an impulse business decision that may hinder net profit and in this case halt the success of any winery.

It will be essential for the researcher to calculate the actual costs or initial investment of both techniques. This will also include calculating the operating costs as well as the annualized costs for each component that comprise the two techniques, pump over and Pulsair cap mixing. The annualized cost formula used for this project can be found in the appendix. For the conventional pump over, it will be imperative for the researcher to correlate and calculate labor and equipment costs such as pumps and hosing with the San Luis Obispo County winery. In addition to acquiring labor and equipment costs, utilities such as electricity should be obtain by multiplying the kilowatts per hour consumed by the pumps by $0.12 to determine how much energy is drawn by the pumps (PG&E). After reading the pump specifications for a progressive cavity pump, it is understood that the pump draws 264 amps of electricity per hour. To convert amps into kilowatts, the researcher will multiply 264 amps drawn times 220 volts (standard winery electrical current) divided by 1000, divided by 3 (twenty minute pump over regimen) then multiplied by the PG&E constant of $0.12 per Kw hour. For labor, it will be essential to obtain the average hourly wage of a cellar hand in California wineries and multiply that number by the total amount of hours that four cellar hands take to complete all the necessary pump overs for a three month crush season. After consulting the local winery, it is determined that all cellar hands for the particular winery receive $11.00 per hour with time and a half taking affect after

eight hours. After calculating the actual costs, labor and utilities costs, a bottom line number can be generated and correlate with the operations of the local winery.

To compile an accurate partial budget, the researcher must acquire and calculate the same information that was calculated for the conventional pump over. Being that the Pulsair system is the incremental change, it is important that the numbers in the Pulsair price quote are entered into an excel spreadsheet accurately. After consulting the quote, it is determined that the hypothetical winery expansion "X" must invest $98,029 to the Pulsair Company for parts and materials. This includes a main control system priced at $16,779 as well as tank kits for twenty tanks priced at $81,250. After a personal communication by the owner and inventor of the Pulsair system, Richard Parks claims it will cost $1,800 per tank for installation. By multiplying this number by twenty, a total installation cost for hypothetical winery "X" would be $36,000. Being that the system is completely automated in that, a winemaker can literally set it and forget it, labor costs results in zero hours needed by laborers to operate the system. Electrical utility should also be calculated for an accurate representation of Pulsair's operating costs. To determine the amount of electrical draw from the main control system, the system specifications must be analyzed. After reading the system specifications, it is understood that they systems main control unit draws five amps of power over the course of an hour of continuous run time to mix twenty tanks (Parks, 4). PG&E meters read in kilowatt hours so the five amps must be converted to kilowatts, divided by three (20 min regimens) and then multiplied by $0.12. It will then be essential for the researcher to generate annualized costs for the parts, materials and installation. All numbers will then be inputted into excel and added to develop a bottom line cost of operations by utilizing the Pulsair system as an alternative to pump over.

Procedure for Data Analysis

After the appropriate information has been obtained it can then be inputted into a partial budget form and a benefit and detriment chart can be generated. The study will look at the amount of money spent on energy used by the two methods, and these will be the first overhead annual costs incurred that will be analyzed. This will visually show the researcher the related monetary differences between pumps used for pump over's and the Pulsair main control unit all relating to energy usage. The study also aims to illustrate the detriment of PG&E expenditures that wineries do and could potentially pay for pump usage by comparing the two systems energy consumption numbers. This procedure will allow for a more precise cost benefit analysis of the machine. In addition, the data collected in reference to the yearly net amount of money spent on materials and equipment by the winery not benefitting from an automated mixing system, will be compared to the price of installation for the Pulse Air system; this will exemplify the amount of money that can be saved and reallocated by considering the system.

To understand the pulse air system and all the inner workings behind it, Richard Parks (2006) and his detailed schematics will provide the basis for all technical answers to questions on workability, competence and efficiency of the machine. Parks (2006) provides a breakdown of what the capabilities of the machine are and what necessary materials and requirements a winery needs in order to successfully install the system. This information will also be analyzed and the appropriate materials, requirements and associated costs will be used to illustrate the costs and benefits of the system compared to pump over and punch downs. This examination will also give an extensive and detailed understanding for wineries and those unfamiliar with the pneumatage wine making process as well as offer an overview of options and benefits associated with it provided by the benefit and detriment chart.

Through the analysis of research done by multiple credible sources as well as the collection of the factual data and cross referencing of the selected mixing practices from this study, the researcher will illustrate all the production requirements and factors that revolve around the three processes as well as illustrate which system is clearly more efficient and cost effective ultimately exemplifying the possible benefits of automation.

Assumptions

In determining the feasibility of the Pulsair pneumatage system, there are a few main assumptions that must be addressed. First, one must assume that the data collected from the local San Luis Obispo Winery, are true and accurate numbers and information that reflects the operations of a large scale winery. This feasibility study examines the practicality of implementing a new automated production machine so assuming that all prices of the machine and its components are representative of an actual 20 tank quote from Pulsair Mixing Systems. Also it is necessary to assume that a market for the product has already been established and there is a demand for the system and that there are no related injuries or deaths as a result of the Pulse Air system that could potentially bottom out the market for the product. The researcher also assumes that all research done in relation to the pump over method, is the means for assessing and portraying the potential benefits that wineries can gain by implementing the Pulsair system. Finally, assume that the step by step analysis will provide an awareness of an alternative method and a means by which wineries can expand and become enriched by this study.

Limitations

The information obtained through this study will benefit winery officials and winemakers who wish to further develop their business tactics as well as educate themselves about alternative

efficient cost effective production methods. However there is little publicly available information about pricing in relation to the pulse air system, the numbers are based on quotes that come from the sales team associated with the Pulsair Company. Therefore the reader is limited to the pricing information that is related to the quotes obtained through the company which are established in this dissertation.

Chapter 4

DEVELOPMENT OF THE STUDY

In developing the partial budget to achieve the study objectives, the first factor assessed was the creation of a hypothetical start up winery that can also be used as an expansion to an existing winery. It was then necessary for the researcher to consider the amount of tanks the facility would have, as it is one of the base factors for determining the initial investment cost for hypothetical winery "X". Additionally, extensive research about Pulsair Systems, especially for wine cap management applications, was essential for understanding the information that aided in the request for a 20 tank pricing quote. The price quote obtained through Pulsair's sales team was an accurate and realistic quote representative for 20 stainless steel, closed top fermentation vessels. The facility will operate with two rows of ten tanks with a gap of fifteen feet in the middle and each tank two feet apart from each other.

Analysis

In the first section of the partial budget form, the researcher analyzed multiple operating and investment costs regarding the traditional pump over technique. After evaluating operational technique as well as operation prices for a similar size local winery in San Luis Obispo, to that of hypothetical winery "X", multiple factors on the partial budget could be determined. It was concluded that hypothetical winery "X" would need to invest in four progressive cavity pumps made for wine (four pumps per five tanks) as well as 120 feet of food grade insulated hosing. In addition to equipment, information regarding number of pump overs per day as well as length (time) of pump overs was obtained from the local winery and applied to the annualized cost formula and calculations are found in the appendix. Below illustrates the

total investment cost of each system and allows for conclusions to be drawn regarding system implementation cost.

Table 1. Total Investment Costs for the Pumpover and Pneumatage Systems

Total Investment Costs For Both Systems (Cost of Equipment and Installation, Not Annualized)	
Pump Over Method	
- Pumps	$ 25,200
- Hosing	$ 403
Total	**$ 25,603**
Pulsair Pneumatage System	
- PPC 3120 Main Control System	$ 16,779
- Tank Kits (20 Tanks)	$ 81,250
- Installation	$ 36,000
Total	**$ 134,049**

In Table 1 (above) there are initial investment cost amounts that correlate directly with each method. The pump costs were calculated to be $25,200 and the related information as well as annualized cost information is in the Appendix (Table 1). The same was calculated for the hosing needed to complete the pump over system and the calculations can also be found in the Appendix (Table 2). The corresponding calculations for the equipment and installation needed to construct the system are found in the appendix (Table 3 and 4).

The researcher has highlighted (in red) the Pulsair system initial investment cost. It has been concluded that clearly the Pulsair system will initially cost hypothetical winery "X" more if they decided to automate rather than choosing the traditional pump over method. However, other calculations and costs had to be analyzed to make accurate conclusions to determine if automating would be profitable.

Table 2. Annualized Costs for Both Systems

Annualized Costs Of Both Systems **Total Annualized Cost:** Conventional Pump Over Method vs. Pulsair Pneumatage System		
Costs	**Conventional**	**Pulsair**
Labor	$ 44,352	$ 1,848
Cost of Operations (Utilities)	$ 25,090.56	$ 285.12
Annualized Equipment Cost	$ 5,187	$ 7,659
Total	**$ 74,630**	**$ 9,792**

Table 2 (above) shows the breakdown of annualized costs that are associated with the two systems. The annualized cost highlighted (in red) above is reflective of what hypothetical winery "X" would pay annually if they were to choose the traditional pump over method. The interest rates applied to the annualized cost formula (found in the appendix) was obtained from Bank of America rates reflective of the loans needed to pay for initial investment costs. Labor costs were annualized based on the twelve hour day work schedule of a cellar hand and are far more substantial in the conventional method. From table two (above) one can easily conclude the annual costs for the conventional method would be considerably higher than those of the Pulsair

system. More importantly however, the researcher has determined that even if the utility cost of operations for the Pulsair system was multiplied two hundred times, the annual cost of operations for the Pulsair system would still be less than the Pump Over method.

From the tables shown above as well as table three, the researcher was able to draw final conclusions about the two systems potential for being profitable and will be further explained in chapter five. It is apparent that the overall initial investment for hypothetical winery "X" to implement the Pulsair system is significantly greater than the initial investment to use the pump over method. However after further research , it has been determined that the overall annual costs to run the Pulsair system in winery "X's" operations would cost considerably less and therefore justifying the initial investment. Further factors were analyzed in the study and contributed to the establishment of initial investment and annualized costs listed above.

A factor of great importance in which the partial budget form contains is the amount of hours and overall cost of labor for an entire crush season. Hypothetical Winery "X" would have to employ four cellar hands that would make $11.00 an hour and work six days per week. Exact step by step calculations can be found in the appendix however; the research has concluded that four cellar hands that log 1,152 hours of work during a three month crush season will cost the winery $44,352. Utilities, i.e. electricity consumed by the pumps, were also taken into consideration. After consulting PG&E, the researcher was able to equate number of kilowatt hours used by the pumps, to the price per kilowatt hour provided by PG&E ($0.12 kwh) (PG&E). Utilities that would be consumed to run pump overs would cost hypothetical winery "X" $25,090.56 for a three month crush season. Annualized costs were determined using a formula from Monke and Pearson (1989).

The second section of the partial budget form is devoted solely to the initial costs of implementing the Pulsair system as well as what can be expected in reference to future operation costs of the system. After communication with Richard Parks, the owner and inventor of Pulsair, the researcher was able to acquire a twenty tank price quote from the company. To implement a Pulsair 20 tank wine cap management system, hypothetical winery "X" must invest in a main control system priced at $16,779 as well as a 20 tank installation kit priced at $81,250. The system does not install itself so after consulting the price quote it is understood that it will take $1,800 to install the system to each tank for a grand total of $36,000. These three numbers summed together equates to $134,049 for the total initial investment cost. The understanding behind a completely automated system is that no labor is required except for the initial programming of the various and desired cap saturation length and quantities. However, in the case of hypothetical winery "X," 168 was added to labor costs for a three month crush season. At $11.00 per hour this equated to $1,848. Other than calculating annualized costs of the systems parts/ materials and installation, (which are found in the appendix) electrical draw from the Pulsair system was also examined. The main control unit for the Pulsair system draws 5 amps of power per hour of continuous cycle. After converting amps to kilowatts and applying it to the PG&E constant of $0.12 per kwh, the calculations conclude the system will draw 2,373 kw over the course of a 3 month crush season. This number reflects the $285.12 annual utility cost hypothetical winery "X" can expect by implementing the Pulsair system as an alternative to pump overs. All resulting calculations are found in the appendix.

Chapter 5

SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

Summary and Conclusion

The analysis of the partial budget proved certain parts of the hypothesis to be correct. The original hypothesis stated that the implementation of a gas injection system for wine cap saturation could be a feasible and profitable endeavor for wineries producing 75,000 cases a year or more. To create an accurate partial budget that would assess the possibility for future net profit gains for any large scale winery, all initial investment, labor, utility and annualized costs were considered.

The analysis of the partial budget has proven that the initial investment to implement the Pulsair system as an alternative to the traditional pump over technique, would cost hypothetical winery "X" $64,093.20 more than the initial investment of the equipment and parts if they decided to utilize pump overs in their operations. However, if winery "X" took out a loan from Bank of America with an interest rate of 10% and annualized their payments over the 15 year successful life expectancy of the system, their annual costs for operations on an annual basis would be considerably less than the annual costs of applying the pump over method to their winery operations. For the Pulsair system, winery "X" would pay $7,659 per year to run the system with annual utilities averaging at $285; this is a total annual operations cost of $7,944. If winery "X" took out a loan from the same bank an annualized their costs for the parts and equipment needed to run pump overs in their operations, they would pay $5,187 annually. Although this number is less than that of the Pulsair system, hypothetical winery "X" must consider their annual utility cost to run all four pumps. If winery "X" decided to neglect the

opportunity to automate, they would pay $25,090.56 annually to PG&E just to run their pumps. This equates to a $30,277.56 annual cost for operations that does not included how much they would have to pay cellar hands to complete the pump overs.

Recommendations

With a considerably less annual cost of operations through the use of implementing the system from Pulsair, the project of starting hypothetical winery “X” is a feasible and profitable endeavor so long as the monetary means to cover the initial investment is available. With that said, the long term investment for the Pulsair system is recommended venture to start-up wineries as well as wineries looking to expand their operations. To expand this study of automation, other various factors such as winemaker competence of the system and holding capacity of the fermentation vessels, that could affect the profitability of the operation should be researched and evaluated. Strategy and specific winery operations are beneficial and key factors to success of the automated system and should be of great interest to future Pulsair clients when deciding if automation is the best approach to winemaking.

References Cited

Anon. “Smaller wineries in NZ go high-tech.” Issue 336 (1991): 51. *Australian Grapegrower & Winemaker.* Web. 11 May 2010.

Corsey, L. 2006. “Putting the chill on increasing winery energy costs.” *Australian and New Zealand Wine Industry Journal. 21(April): 56-60.*

Dellenbach, P. 1977. “Progress in production equipment and wine cellars.” *Vignes et Vins.* 258(April): 39-41

Egretier, JM. 2002. “Process and equipment for breaking up the cap of marc in a vat.” *French Patent Application.* (April)

Galitsky, Christina. 2005. “BEST Winery Guidebook: Benchmarking and Energy and Water Savings Tool for the Wine Industry.” *International Energy Studies.* (May): 10-15.

Goode, Jamie. 2007. “Tannins in Wine.” *Harpers Wine and Spirit Weekly.* (May 18): 44-45.

Hiller, M. 1987. “New thoughts on winemaking in Germany.” *Grapepress.* 52(April): 28-30.

Marais, J. 2003. “Effect of different wine-making techniques on the composition and quality of Pinotage wine. II. Juice/skin mixing practices.” *South African Journal of Enology and Viticulture.* 24(May): 76-79.

Monke, E. A. and S. R. Pearson. 1989. The Policy Analysis Matrix for Agricultural Development. Ithica: Cornell University Press.

Parks, Richard. 2006. “Systems and Methods for Mixing Fluids and other Materials.”*Google Scholar.*(April): 1-10.

Patterson, Tim. "Do We Still Need Winemakers?" Wines & Vines - The Voice of the Wine Industry. 2 Feb. 2011. Web. 06 Mar. 2011.

Phillips, G. 2008. “Automated cap management: how to manage red wine fermentation for quality using punch-down, pump-over and submerged cap systems.” *Australian & New Zealand Grapegrower & Winemaker.* 530(May): 54-59.

M. Smyth and J. Russell. 2009. “‘From graft to bottle’—Analysis of energy use in viticulture and wine production and the potential for solar renewable technologies.” *Renewable and Sustainable Energy Reviews.* 13(April): 85-98.

Snedden, J. “The next step forward in red wine static fermentation technology.” Issue 442 (2000): 28. *Australian Grapegrower & Winemaker.* Web. 11 May 2010.

Tigner, R. 2006. “Partial Budgeting: A Tool to Analyze Farm Business Changes.” *Ag Decision Maker.* (May): 5-8.

APPENDIX

Appendix Table 1: Annual Cost of Pumps ($/Year/Per Pump)

Annual Cost of Pumps ($/Year/Per Pump)			
Initial Investment	25,200	Interest Rate	0.08%
Salvage Value	0	Useful life	5
IC – PVSV	25,200	(1+i)^n * i	0.00080321
		(1+i)^n – 1	0.00400641
PVSV	0		0.20048026
Annual cost:	**$ 5,052.00**		

Appendix Table 2: Annual Cost of Insulated Hosing

Annual Cost of Insulated Hosing ($/Year)			
Initial Investment	403	Interest Rate	0.05%
Salvage Value	0	Useful life	3
IC - PVSV	403	(1+i)^n * i	0.00050075
		(1+i)^n - 1	0.00150075
PVSV	0		0.33366672
Annual cost	**$ 135.00**		

Appendix Table 3: Annual Cost of Pulsair System (Parts and Materials)

Annual Cost of Pulsair System (Parts and Materials)			
Initial Investment	$ 98,029	Interest Rate	0.10%
Salvage Value	20000	Useful life	15
IC - PVSV	78,029	(1+i)^n * i	0.00101511
		(1+i)^n - 1	0.01510546
PVSV	20,000		0.06720124
Annual cost:	**$ 5,244**		

Appendix Table 4: Annual Cost of Pulsair System Installation

Annual Cost of Pulsair System Installation			
Initial Investment	$ 36,000	Interest Rate	0.08%
Salvage Value	0	Useful life	15
IC - PVSV	36,000	(1+i)^n * i	0.00080965
		(1+i)^n - 1	0.01206743
PVSV	0		0.06709413
Annual cost:	**$ 2,415.00**		

Appendix Sample 1. Pump Utility Calculations

Pump Utility Consumption Calculation = Progressive Cavity, Phase 1, 220 volt, 264 amp draw.

1 Pump:

264 Amp x 220 Volt / 1000 = 58.08 Kw per hour
58.08 / 3 (3 x 20 = 60 min) = 19.36 Kw per 20 min
19.36 Kw x 6 Pump Over (Per Day Per One Tank) = 116.16 Kw per day per one tank
116.16 Kw x 5 Tanks (1 pump per five tanks of 20) = 580.8 Kw per day per five tanks
580.8 Kw x 30 days = 17,424 Kw per month per five tanks
17,424 Kw x $ 0.12 (PG&E) = $ 2,090.88 per month per 5 tanks
$ 2,090.88 x 4 (4 sets of 5 tanks) = $ 8,363.52 per month for all 20 tanks
$ 8,363.52 x 3 Months = **$ 25,090.56** Total utility charge to run pumps for a 3 month crush season.

Appendix Sample 2. Pump Over Method – Labor Calculations

Labor Calculation = Pump Over Method

1 Worker:

8 hours x $11.00/Hr. = $88 (Per 8 hours of work)
(After 8 hours, time and a half applies)
12 Hrs. – 8 Hrs. = 4 Hrs. x $16.50 = $66
$88 + $66 = $154 (per 12 hour working day)
$154 x 6 (days per week) = $924 (per week)
$924 x 4 (weeks in a month) = $3,696 (Per month of work)
$3,696 x 3 (month crush season) = $11,088

- Each harvest worker earns $11,088 for a three month crush season

$11,088 x 4 (employees) = **$44,352** Total labor cost for hypothetical winery "X".

Appendix Sample 3. Pulsair System Utility Consumption Calculations

Pulsair System= 5 amp draw

One Pneumatage Main Control System: PPC-3120-080-400

5 Amp x 220 Volt /1000 = 1.1 Kw per hour
1.1 Kw x 24 Hrs = 26.4 Kw per day
26.4 Kw x 30 days (1 month) = 792 Kw per month
792 Kw x 3 Months = 2,376 Kw used during crush season
2,376 Kw x $ 0.12 (PG&E) = $285.12 Total utility consumption cost for the Pulsair system for a 3 month crush season.

Appendix Sample 4. Kilowatt Conversion Formula

Conversion Formula Used to Convert Amperage to Kilowatt Power
Kw= Amp x Volt / 1000