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Incorporating Lean Non-Value Added Variants into a Method of Determining Stakeholder Salience for First-Line Manager Decision Making

Bruce H. Bader
Indiana State University

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Bruce H. Bader

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Vita

Education:

PhD. Technology Management, Indiana State University, Terra Haute, IN (In process)

MBA, with emphasis in TQM, Northern Kentucky University, Highland Heights, KY 1993

B.S. in Chemical Engineering, Grove City College, Grove City, PA, 1972

Manufacturing Experience:

Continuous Improvement Manger, March 1999 to February 2016, Little Rapids Corp.

Manager of Quality Control and Process Improvements: January 1991 to March 1999, British Petroleum.

Process Engineering Supervisor: November 1982 to January 1991, Aristech Corp.

Area Supervisor: February 1981 to November 1981, United States Steel Corp.

Process Engineer, November 1976 to February 1981, PPG Industries Corp.

Teaching Experience:

Taught graduate level courses in "Operations Management," "Organizational Behavior," "Strategic Planning" and "Leadership", 2005 – 2013 at Lakeland College.

Presented "Happy First-line Managers; Resource Management for Strategic Planning", April 2016 at the NEW Continuous Improvement Consortium.

Presented "Keep on Truckin': Optimizing FMEA in a Challenging World", April 2012, Minnesota ASQ Professional Development Summit.

Some recent articles published:

"A study on production breaks in gynecological examination table cover paper rolls processed on a Schultz Rewinder" (December 2016) *Engineering Science and Technology, an International Journal,* DOI information: 10.1016/j.jestch.2016.10.009.

"Optimizing training competency and speed: FAST", (September 2016) *Quality Progress* p. 72.

"Solving the mystery of the missing fifth "S"" (January 2016) *The Journal for Quality and Participation*, Vol. 38, No. 4, p. 35 – 38.

COMMITTEE MEMBERS

Committee Chair: M. Affan Badar, Ph.D.

Chair, Dissertation Committee, Professor, Department of Applied Engineering and Technology Management

Indiana State University

Committee Member: Suhansa Rodchua, Ph.D.

Associate Professor, School of Technology Graduate Programs

University of Central Missouri

Committee Member: Alister McLeod, Ph.D.

Associate Professor, Department of Applied Engineering and Technology Management

Indiana State University

ABSTRACT

This research brings together two streams of thought for first-line manager decision-making. The first is the quality system model, in particular, Lean operations. The second is Stakeholder Theory. Both streams have been identified as ways to improve value of the organization. Previous studies disagree regarding whether Lean and Stakeholder theory can work together. The potential problem of having a poor balance of Stakeholders and Lean waste is that exclusive focus on one may result in less awareness of the other, in which case value can be lost by the organization.

This research investigates if both Lean waste and Stakeholder salience share a common language in the literature using data mining. This research surveys organizations that perceive themselves as Lean and have multiple diverse Stakeholders to determine whether Lean wastes and Stakeholder salience (priority) are considered the decision-making process. A Z-test compares proportions of Lean waste considered to proportions of Stakeholder salience. An ANOVA is done to see if organization type, position of a person within the organization, organization size, geographic location, or lean management maturity has an effect on the priority assigned to Stakeholder salience or Lean waste variants when making decisions. The final phase of this research is a proposed decision-making instrument that will weigh Stakeholder salience and Lean waste variants on an equitable level for First-line Managers' decision-making.

The major findings of this research are that Lean waste variants and Stakeholder salience are considered in decision-making but that Stakeholder salience is more important. This is

independent of various factors. Stakeholder mapping using salience values adjusted for Lean waste provides a visually enhanced balanced approach allowing the decision-makers to know the impact of both, facilitating more precise input to their decision-making process. More precision in the decision-making process can lead to results that create improved value for the organization.

PREFACE

"…do not merely look out for your own personal interests, but also for the interests of others" Paul of Tarsus' first century letter to the Christian in Philippi (Philippians 2:4 New American Standard Version). Organizations like societies can rise and fall depending upon the decisions made by the people within that organization. "If people were able, at the moment of decision, to see and feel the full weight of all the consequences linked to the choice at hand, then many of life's tragedies would be avoided." (Howard, 2007, p. 145). It is my sincere desire to help people make better decisions, by including looking out for the interests of others in the decision-making process. I particularly have empathy for first-line managers who are often in the difficult situation of trying to implement strategic plans with an apparent contrary workforce in a Lean environment. My goal for this research is to provide some measure of support and assistance to those unfortunate but brave men and women.

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Finally, I acknowledge God, the source of all wisdom. “If any of you lacks wisdom, let him ask of God, who gives to all generously without reproach” (James 1:5 New American Standard Version). The Biblical instruction to “not *merely* look out for your own personal interests, but also for the interests of others” (Philippians 2:4 New American Standard Version) and my years of experience were the propulsive mechanisms for this research.

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CHAPTER 1

INTRODUCTION

Overview

The objective of chapter one is to delineate an abbreviated background against which the research is assessed for suitability. Two of the current streams of thought contributing to quality management are Lean and Stakeholder Theory. First is the quality system model of Lean operations as expressed by "value-added" goals for operations management. The seven Lean variants first described by Womack, Jones and Roos (1990) are commonly accepted words for waste within the Lean community. Second is Stakeholder Theory as applied to strategic planning. The Stakeholder salience factors are limited to five commonly used factors that were studied by Agle, Mitchell and Sonnenfeld (1999) in their survey of chief executive officers. The five variants consist of power, interest/attitude (Gardner, Rachlin, & Sweeny, 1986), urgency, influence (Mitchell, Agle & Wood, 1997) and network (Rowley, 1997). Each source has been cited over 2000 times indicating their acceptance as meaningful factors. The essence of the research is defined as problem statements and research questions to address a statement of need. Assumptions and limitations are identified. Key terms are defined.

Background

Quality management systems strive, among other goals, to add value to processes that make up the overall system in which they function (Atkinson, Hamburg & Ittner, 1994; Imai,

1997; Liker, 2004; Oakland, 1993; Ohno, 1988; Westcott, 2014; Womack, Jones & Roos, 1990). Value, from a Lean system of quality management perspective, can be described as "…creating more value for customers with fewer resources," (Womack & Jones, 2003, p. 6). It can also be described as activities or materials for which the customer is willing to pay (Liker, 2004).

The effort to justify the use of Stakeholder Theory, as it became known, as a means of creating value for the organization as a whole has long been debated (Atkinson et al., 1994; Asif, Fisscher, de Bruijn & Pagell, 2010; Donaldson & Preston, 1995; Firestein, 2010; Jensen, 2000). As far back as Hill and Jones (1992) and Atkinson, Waterhouse and Wells (1997) attempts have been made to create a theory that allows for the organization to be the agent of many diverse Stakeholders while pursuing profit. Berman, Wicks, Kotha and Jones (1999) and Henisz, Dorobantu and Nartey (2011) demonstrated that both strategic variables and Stakeholder relationship variables will have direct effects on firm financial valuation.

Stakeholder Theory found its way into quality management literature as early as 1993 (Oakland, 1993). Westcott (2014) discusses the requirement of addressing Stakeholders in the body of knowledge for the Certified Manager of Quality and Organizational Excellence from the American Society for Quality. The Malcolm Baldrige National Quality Award (2015) and the Shingo Prize (2008) include Stakeholder consideration in their requirements. Hence, there is a body of evidence that quality management systems and Stakeholder Theory are related and both are used to address value to the organization. Value in quality management and Stakeholder theory can be viewed as improving financial performance by using fewer resources while still providing what Stakeholders desire. Atkinson et al. (1994) summarize the perspective well by saying that reliability and price constitute customer satisfaction. They continue to say that

"superior value began to emerge as the dominate strategy of successful companies…" (1994, p. 57).

Toyota, which has consistently provided both reliable products and financial performance, is one model of applying a quality management system to manufacturing. Russell and Taylor (2000) give some insight into the development of a quality management system at Toyota. They tell how Eiji Toyoda, President of Toyota after the Second World War, focused on adding value to the product by eliminating waste. An earlier auto manufacturer, Henry Ford, related waste to value of what is produced (2006/1926). Toyota and Ford Motor Company (in the early days) are considered by some to be examples of Lean manufacturing. Womack (Womack, Jones & Ross, 1990) is credited with heading the team that developed the word "Lean" in relation to manufacturing and management. Womack and Jones later (2003) relate their five principles of Lean quality management to value which they define as the total elimination of waste.

In order to address waste one must know what it is. While Womack and Jones (2003) go into great detail as to what constitutes waste from the Lean perspective, other authors have tried to simplify the description of waste. Westcott (2014, p. 366-369) developed succinct one word descriptions of the seven types of waste: "overproduction, delay, transportation, processing, inventory, motion, and defects." For the purpose of this research value-added is defined as those activities which work counter to waste as defined by Westcott's seven words. An eighth waste, underutilized employee creativity, is put forth by Liker (2004) and is embraced by others but is not be part of this research.

It must be kept in mind that in Lean quality management systems the focus on value-added operations leads to limited resources or not having excess resources. Art Byrne, the CEO who dramatically changed Wiremold in the 1990's, explains that in a non-Lean system if one out of 10 machines is not operational, it is not a problem because nine others are in operation. In a Lean system the entire line is inoperable because the tenth machine adds value and is not redundant to the other nine (Emiliani, 2007). Because overproduction is considered waste, removing buffers from processes is part of Lean value-added activity (Liker, 2004). By their very nature buffers allow for extra resources to address problems or troubles. In some organizations the word "Lean" is wrongly associated with elimination of resources without any consideration of value-added components (Womack & Jones, 2003).

The people in organizations are regularly faced with the need to make decisions. The first to propose a comprehensive system to include Stakeholders' demands in the organization's decision-making process was Freeman (1984). The process of including Stakeholders in decision-making has led to the development of Stakeholder maps or models (Bryson, 2003; Carrington & Combe, 2013; Cater, 1998; Elias & Cavana, 2000; Freeman, 1984; Hill & Jones, 1992; Mitchell et.al, 1997; Phillips, 2005; Rowley, 1997; Susniene & Vanagas, 2015;). These maps are to be used to aid decision makers who want to create value while meeting the varying needs of Stakeholders. Jensen (2000, p.3) said, "We cannot create value without good relations with customers, employees, financial backers, suppliers, regulators, communities, and the rest."

This decision making has not always been easy. Halal (2001, p. 35) points out in his survey of 540 managers that 86% claim that their company "strives to cooperate with important stakeholders", yet only 54% had a way to measure their service to stakeholders. If there is confusion among managers regarding how to serve the demands of different stakeholders, then

clear and actionable direction is likely not given; or, if it is given, people working at the primary operational level may have completely different perceptions of the action required and, hence, may make decisions based on low priority goals (Pederson, 2010). A model for organizations to use in order to optimize stakeholder value-added operating decisions does not exist.

There is some debate about whether Stakeholders and Lean quality systems conflict or cooperate in the decision-making process. Berman et al. (1999) make an assertion that Stakeholder relations will affect managers' decisions on the distribution of resources which in turn affects financial performance as measured by return on assets. Zaki's study (2007) shows Lean and agility (or satisfying Stakeholders) are two different concepts. While he does not see them as conflicting, he also does not see them as cooperating. Susniene and Vanagas (2015) demonstrate that financial performance can be affected by conflict over scarce resources among Stakeholders. On the other side of the debate, Asif et al. (2010) make the case that continuous improvement systems and Stakeholder recognition can be integrated to work alongside of each other. Oakland (1993) goes so far as to give a method for value-added computation in relationship to multiple Stakeholders.

In addition, recognizing the dynamics of all of inter-relationships between the organization and each Stakeholder can cause problems (Preble, 2005). Kivits (2011) discuss how managers must understand that inter-relationships among Stakeholders as well as their influences are in flux and then plan accordingly to work on satisfying their changing demands.

An organization may recognize the need for a balanced approach to making decisions regarding Stakeholders and yet not have the tools to accomplish this (Asif et al., 2010). A manager who identifies one or maybe two Stakeholders may find only short-term success, as

defined by value creation, but not in the long run (Harrison, Bosse & Phillps, 2010; Halal, 2001). By recognizing the needs of the many Stakeholders, the organization has a greater probability of recognizing significant issues (O'Dowd & Roche, 2009) and avoiding problems with marketplace reputation (Blanchard, 2012).

Purpose

Statement of Problem

The problem for this study is the lack of an integrated day-to-day decision-making model for first-line managers that takes into consideration the effects of common Stakeholder salience factors and Lean waste management within organizations that perceive themselves as Lean and have multiple diverse Stakeholders.

The potential problem of not integrating the two is that exclusive focus on waste reduction may alienate Stakeholders and exclusive focus on Stakeholder satisfaction may reduce awareness of waste. In either case an unbalanced approach to Lean waste or Stakeholder salience creates confusion for the decision-makers. Knowing the impact of both facilitates more precise input to their decision-making process. More precision in the decision-making process can lead to results that create better value for the organization.

Statement of the Research Questions and Hypotheses

1. Do Lean and Stakeholder theory share a common language?
2. Are the seven types of waste identified by Womack, Jones and Roos (1990) which are associated with Lean (Lean waste variants) found in decision-making models or methods used by organizations that perceive themselves as Lean and have multiple diverse Stakeholders?

3. Is the degree of inclusion of both Lean waste variants and Stakeholder salience criteria dependent on type of organization, organization size, position of the respondent within the organization, location of the organization or length of time since introduction of Lean management to the organization?
4. Is there an over-all difference between the prominence of Lean waste variants and Stakeholder salience criteria in decision-making models used by organizations that perceive themselves as Lean and have multiple diverse Stakeholders?
5. Is there a viable Stakeholder instrument that incorporates all of the Lean waste variants?

To answer questions 2, 3 and 4 the associated research hypothesis statements are set up as follows:

1. There is no higher probability of finding any Lean waste variants than the probability of finding stakeholder salience criteria in decision-making models or methods used by organizations that perceive themselves as Lean and have multiple diverse Stakeholders. (Proportions test; H_0: $P_S = Pj$ for s = influence, power, urgency, network, interest [attitude]; j = overproduction, delays, transportation, processing, inventory, motion or defects.).

   Ho1: There is no statistically significant difference between Lean waste variants and Stakeholder salience criteria in making decisions.

   Ha1: There is a statistically significant difference between Lean waste variants and Stakeholder salience criteria in making decisions.

2. There is no significant difference between the mean rankings of Lean variants and Stakeholder salience criteria for the following groups: organization type (manufacturing, service, non-profit or other); first-line managers vs. middle level managers or senior managers; small and medium size organizations vs. large organizations; or organizations which introduced Lean over 5 years ago (Experienced) vs. organizations which introduced Lean less than 5 years ago (Inexperienced). One final group is the location of the organizations represented by the respondents. (ANOVA analysis $\bar{\mu}_M = \bar{\mu}_N$, $\bar{\mu}_F = \bar{\mu}_B = \bar{\mu}_C$, $\bar{\mu}_L = \bar{\mu}_U$, $\bar{\mu}_E = \bar{\mu}_I$, and $\bar{\mu}_W = \bar{\mu}_O$). For this hypothesis $\bar{\mu}_M$ = manufacturing, $\bar{\mu}_N$ = non-manufacturing, $\bar{\mu}_F$ = first-line managers, $\bar{\mu}_B$ = middle managers, $\bar{\mu}_C$ = senior managers, $\bar{\mu}_L$ = large organizations, $\bar{\mu}_U$= small or medium organizations, $\bar{\mu}_E$ = experienced, $\bar{\mu}$, = inexperienced, $\bar{\mu}_W$ = located within Wisconsin, and $\bar{\mu}_O$ = located outside of Wisconsin.

   Ho2: There is no statistically significant difference in the average ranking between Lean waste variants and Stakeholder salience criteria in making decisions when organization type, respondent position, organization size, perceived experience, or geographic location are considered.

   Ha2: There is a statistically significant difference in the average ranking between Lean waste variants and Stakeholder salience criteria in making decisions when organization type, respondent position, organization size, perceived experience, or geographic location are considered.

3. There is no significant inverse relationship between the average ranking of Lean waste variants and the average ranking of Stakeholder salience criteria found in

decision-making models or methods used by organizations that perceive themselves as Lean and have multiple diverse Stakeholders. (Paired "t-test" analysis; H_o: $\bar{\mu}_j = \bar{\mu}_s$ for j = Lean variants per sample and s = stakeholder criteria per sample).

Ho3: There is no statistically significant difference between the average ranking between Lean waste variants and Stakeholder salience criteria in making decision for all organizations.

Ha3: There is a statistically significant difference between the average ranking between Lean waste variants and Stakeholder salience criteria in making decision for all organizations.

Statement of Purpose

The research is part of a platform of research regarding the relationship between Stakeholder interaction and value-added work in a decision-making process. Halal (2001) demonstrated that managers understand what is important to Stakeholders but are not always able to measure it. Pederson (2010) followed that observation by demonstrating that first-line supervisors do not always make decisions based upon highest priorities. Some work has been done which shows that rank in the organization (Carrington & Combe, 2013) and external influences (Clark, Quigley & Stumpf, 2014) have an effect on decision-making by managers. Susniene and Vanagas (2005) studied how a focus on total quality management integrated in Stakeholder management can lead to conflicts in decision-making. Zaki (2007) took the approach that Lean (part of a quality management system) and Stakeholder management are separate and should be managed that way. The purpose of this exploratory sequential design is first of all to quantify the qualitative data via mining scheme in literature regarding Stakeholder

management and Lean non-value added activity to understand if Lean waste and Stakeholder salience are related. The next phase is administering a survey to managers in organizations that embrace Stakeholder Theory and Lean management regarding their consideration of salience and waste in decision making and performing a descriptive analysis. The final phase is two case studies of organizations that applied a decision-making model that incorporates Stakeholder salience and Lean waste variants with equal emphasis. This research will add to the understanding of decision-making for organizations using Lean quality management and Stakeholder mapping models.

Statement of Need

While some authors recognize the opportunity for increased value for the organization through Stakeholder management (Allen, Carletti, & Marquez, 2007; Asif et al., 2010; Berman, Wicks, Kotha & Jones, 1999; Bettiol, 2013; Garcia-Benal & Ramirez-Aleson, 2015; Harrison et. al., 2010; Nartey 2012; Preble, 2005; Stopper, et al., 2011) none appears to have undertaken a correlation to decision-making in a Lean environment. Carrington & Combe, (2013) and Clark, Quigley & Stumpf, (2014) did not connect Stakeholder decision-making to Lean environments much less to the interaction between Lean and Stakeholder interests. One opportunity for research is the awareness (or the lack thereof) of the extent of Stakeholder influence on the day-to-day valued-added efforts within the organization.

In another stream of thought, there is recognition of Lean's value for the organization. Some include Stakeholder Theory in quality systems (Gee, Richardson & Wortman, 1995; Oakland, 1999; Bowie, 2011; Westcott, 2014), but they do not appear to consider the effect of competing Stakeholders in a Lean system on day-to-day decision-making. Grossi (2003) Matty

(2010) and Sisto (2010) bring Stakeholder salience together with Lean management yet they spend little time discussing the utilization of Lean waste variants in the decision-making model. Rodchua (2009) demonstrated that small and medium size enterprises have the same internal failure costs as large enterprises while the external failure costs for small and medium size enterprises is statistically significantly lower than that of large enterprises. A follow-up question could be, "Is it possible that smaller companies have a better day-to-day understanding of Stakeholder needs and thus, when resources are scarce, align accordingly to reduce costs, thereby increasing the organization's value?"

One tool for decision-making is Stakeholder mapping models (Baarends, 2015; Camilleri, 2009; Grossi, 2003; Kivits, 2011; Preble, 2005; Sisto, 2010; Susniene & Vanagas 2005). Stakeholder salience criteria are mentioned approximately 7 times more than Lean waste variants in these decision-making models. This research addresses if there is a link between Stakeholder salience used for decision-making and Lean waste variants in a practical environment. Does that link, if it exists, affected by the type of organization, the decision maker's position within the organization, the organization size or the amount of exposure to Lean management within the organization. If such a link does not exist, can the two be brought together to make a better decision-making model?

Inputs and Methods

Statement of Assumptions

The following assumptions apply to this study:

1. The seven Lean variants first described by Womack, Jones and Roos (1990) are commonly accepted words for waste within the Lean community.

2. Stakeholder salience or prioritization variants developed by Rowley (1997), Mitchell et al. (1997), Gardner et al. (1986), and used by Agle, Mitchell and Sonnenfeld (1999) for their research are the best representative words for use in this research. Each source has been cited over 2000 times indicating acceptance as meaningful factors.

3. Survey results reflect an accurate picture of decision-making by participants representing organizations that practice stakeholder management.

4. Stakeholder mapping models are considered comprehensive by the organization that uses it. Some organizations include more Stakeholders in their models than others. This research assumes that models used by organizations have all of those Stakeholders considered pertinent by the participants.

5. The analysis of variation (ANOVA) and the paired "t"-test assumptions of independence of variables, normality of distribution of quantitative variables, and homogeneity of variation assumptions are addressed in chapter 3.

Statement of Limitations

The Lean waste variants are limited to the original seven types of wastes identified by Womack and Jones (2003). These wastes have been accepted and are still referred to by authors discussing Lean wastes. These are: delays, transportation, over-processing, excess inventory, over-production, associate motion, or defects.

Lean experience is limited to the years that the respondents are cognizant that they personally have been participating in the organization's Lean program.

The Stakeholder variants are limited to five commonly used factors that were proposed early in the current discussion of Stakeholder theory initiated by Freeman in 1984. The five variants consist of power, interest or attitude (Gardner et al., 1986), urgency, influence (Mitchell et al., 1997), and network (Rowley, 1997).

The results and analysis are limited to those who perceive that they are in an organization that supports Lean and that recognizes multiple Stakeholders.

There is no specific strategic planning method discussed in this research. This research does not investigate strategic planning methods but it is limited to those organizations that recognize more than one stakeholder in the strategic planning process.

There is no discussion of how people make decisions. The decision-making model is based upon the rational decision-making process but does not imply that heuristic, intuitive or other decision-making processes cannot use it.

There is no attempt to quantify value-added in a process or to define what constitutes value to the organization or to the stakeholders of that organization. There are general perceptions of value usually associated with worth and often described in monetary terms. This may not be the case for all who participated in this research.

The decision-making models are primarily those used by first-line supervisors/managers or middle level managers for “everyday” decision making. Decision-making models that apply to project planning are not be used. Project planning can be done in an environment prior to determining resources requirements. Hence, there may not be Lean limitations put on the “everyday” decision-making process for projects. The project can be halted until renegotiations

are completed to balance the Stakeholder needs can be analyzed and what appears to be waste can be reformed into value-added work for which the customer is willing to pay.

Because of the convenience sampling, the inference statistics cannot be generalized. A mathematical model of the optimum level or categories of independent variables is not done. Similarly, the binomial statistics are descriptive in nature and there is no attempt to be inferential.

This research does not propose or try to prove that using a Stakeholder mapping model that includes both salience criteria and Lean waste variants guarantees improved decision-making. That is for a future study.

Statement of Methodology

The purpose of this exploratory sequential design is to first to quantify the qualitative data regarding operational decision-making via survey analysis looking for the presence of Lean variants in decision-making models that use or have an implied Stakeholder salience. The construct validation of the survey instrument is done using a panel of experts (Warner, 2013) and a test-retest method is used to establish the reliability of the survey instrument (Warner, 2013). A pilot study is done (Creswell, 2014) to verify the content validation. Appropriate risk values are chosen depending upon Type I error that is considered acceptable based upon potential bias from literature search. Each response to a survey administered to managers of organizations that perceive themselves as Lean and have multiple diverse Stakeholders is considered a sample. Response bias (Bryman & Bell, 2015; Creswell, 2014) is addressed.

There is a proportions test run to see if proportion of organizations using Lean waste variants is similar to the proportion of organizations using Stakeholder salience criteria for

decision-making. A binominal "Z" test is used to determine the difference between the two proportions. The descriptive statistics are calculated using 99 percent confidence interval.

Five separate one-way analyses of variations (ANOVA) are done to see if the average ranking of Lean waste variants used in decision-making and the average ranking of Stakeholder salience criteria used in decision-making are affected by type of organization, respondent's position within the organization, organization's size, the maturity of Lean thinking within the organization, or the organization's location. The inferential statistic is computed using a 95 percent confidence interval. Inferences are made regarding the best application of the mapping model among the categories of the different variables.

In addition, a paired "t-test" analysis is done between individual rankings of Lean waste variants used in decision-making and the rankings of Stakeholder salience criteria used by all organizations in decision-making. The survey asks each respondent to rank in priority from most important to least important the Lean waste variants and the Stakeholder salience criteria used in the typical decision. A ranking value for each variant and criteria is computed for each respondent. Each of those differences is treated as a data point for the paired "t-test" statistic. The descriptive statistics are calculated using 99 percent confidence interval.

Two case studies of organizations located in Northeast Wisconsin that made a Stakeholder mapping model using both Stakeholder salience and Lean waste are presented. These case studies are used to determine if the model is a viable decision-making tool. Viability is measure by the successful completion of the Stakeholder model to include all Stakeholders in a prioritized relationship with the organization and each other.

Statement of Terminology

Decision-making: choosing a course of action and allocation of resources by a representative of an organization or a segment of that organization.

Lean: the elimination of activity that does not add value to the task, process or operation. The word "Lean" used to describe a process was first employed by Womack and Jones (2003).

Lean experience: the perception by the respondent as to how long the organization has been participating in Lean thinking. This does not mean how long the organization has actually been practicing Lean thinking. This is just a measure of the respondent's perceived participation in Lean.

Lean waste: the impediments in a process that reduce the value of the output generated. The phrase "non-value added" is also used to refer to waste. A Lean process is one in which waste is non-existent or is minimized. For this research the following terms are used to describe Lean waste (Womack & Jones, 1990, p. 15): delays, transportation, associate motion, over-processing, excess inventory, over-production, and defects. Each of these variants is explained further below.

Delay: any wait time in a process (Liker, p. 28-29) in any process that follows it (Womack & Jones, p. 15). This includes waiting for clarifications or looking for something (Bicheno & Holweg, 2009).

Transportation: moving physical materials, electronic data, or customers from one location to another where there is nothing done to it (Womack & Jones, p. 15). This includes work in process (WIP) (Liker, p. 28-29) or multiple stations for service (Bicheno & Holweg, 2009).

Associate motion: any purposeless movement of an associate/employee (Womack & Jones, p.15) (walking, bending, sorting, typing, filing, repositioning, etc.) that does not improve the product or service (Liker, p. 28-29). This includes having multiple service locations. (Bicheno & Holweg, 2009).

Over-processing: doing something to a product or a service that is not needed (Womack & Jones, p. 15) or requested by the customer (Liker, p. 28-29). This includes duplication of effort (Bicheno & Holweg, 2009).

Excess Inventory: a stockpile of raw materials, WIP, parts, finished product (Womack & Jones, p. 15) or anything that is used to make the product or generate the service (Liker, p. 28-29). This includes people, supplies, or customer wait lists for services (Bicheno & Holweg, 2009).

Over-production: making more product (Womack & Jones, p. 15) or doing more service than is ordered by the customer (Liker, p. 28-29). This includes extra "paper work" (Bicheno & Holweg, 2009).

Defects: a product or service that does not meet either the specifications or the customer's requirements leading to rework, scrap (Liker, p. 28-29) or discounts (Womack & Jones). This includes lost, damaged or incomplete services (Bicheno & Holweg, 2009).

Manager: a person whose role within an organization requires decision-making. For this research this could be a person in the operations section of the organization or a support person within the organization. A first-line manager is the person in the organization who is immediately responsible for those who execute the most basic level of the organization's mission. Middle managers are those to whom other managers report. Senior managers are those who set strategic plans for the organization.

Organization: for this research the organization is the single geographic location of a group of people gathered to achieve an objective. For organizations that work primarily over the internet their designation is "Internet." Organizations have some structure, and for this research an organization makes a distinction between managers and non-managers. While there are many types of organizations, for this research four types are defined: manufacturing, service, non-profit, or any other.

Ranking value: one ranking value is a number computed for this research that is obtained by averaging the survey rankings of Stakeholder salience for each respondent. A second is the number obtained by averaging the rankings of Lean waste variants for each respondent. This means that each respondent will have a salience ranking value and a waste ranking value.

Stakeholder: a person or group that "can affect or is affected by the achievement of the organization's objectives" (Freeman, 1984, p. 46). Stakeholders can be within or outside of the organization.

Stakeholder model: a methodology of representing all Stakeholders and their relationship to the organization. Each relationship is perceived and valued differently. Relationship extent is dependent upon Stakeholder salience.

Stakeholder salience: the characteristic that makes one Stakeholder stand out or be more prominent than any others. Mitchell et al. (1997, p. 854) describe it as "…to whom and what managers actually pay attention." For this research interest, power, legitimacy, urgency and network are used as Stakeholder salience criteria. Each criterion is further defined below.

Interest: The extent to which the Stakeholder is concerned about the outcome and has a strong positive or negative attitude regarding the outcome of the decision (Gardner et al.,

1986). Interest also considers how vocal or emotional the stakeholder will be towards the decision.

Power: A relationship in which the Stakeholder can get the organization to do something that the organization would not have otherwise done (Mitchell et al., p. 865).

Legitimacy: The perception that the claims of the Stakeholder are proper and appropriate within some system of norms, values, beliefs or definitions (Mitchell et al, p. 866).

Urgency: The degree to which the stakeholder claims call for immediate action (Mitchell et al., p. 869) by the organization.

Network: The consideration of how this decision will impact other stakeholders (Rowley, 1997, p. 893) inside or outside of the organization.

Stakeholder salience value (or just salience value): a number used to prioritize Stakeholders salience toward an organization or process. The preliminary salience value is computed prior to adjustment with Lean waste variant considerations. The final salience value is computed using the adjusting for the effect of Lean waste variants.

CHAPTER 2

LEAN MANAGEMENT AND STAKEHOLDER THEORY LITERATURE

Lean management can be viewed as science or discipline of identifying what does and does not add value and applying that knowledge to different processes. Within the context of this research a process is considered any activity that takes inputs and makes outputs.

Toyota is an organization that has come to typify the implementation of Lean principles in processes (Davies & Greenough, 2010; Liker, 2004; Mann, 2005; Russell & Taylor, 2000; Westcott, 2014; Womack, Jones & Roos, 1990). But Lean systems predate Toyota. Bicheno and Holweg (2008) refer to Maudslay in 1797, Womack and Jones (2003) refer to the Venetians' use of Lean in ship making in the 12th century, and even Toyota itself readily admits that its managers used some of Henry Ford's thinking found in his book *Today and Tomorrow* (1926) for the origins of some of their Lean thinking (Liker, 2004). No matter the origins of Lean thinking, it is associated with the processes of producing goods and services within the technology management framework of quality systems (Bowie, 2011; Evans, Foster & Linderman, 2014; George, 2002; Liker & Hoseus, 2008; McLean, Antony, & Dahlgaard, 2017; Westcott, 2014).

Lean Management: Identifying Value and Waste

As a quality system Lean is explained in various ways. Taylor (2014) shows how "waste" and "value" are dominant terms associated with Lean in literature. Womack and Jones (2003), who introduced the word "Lean" to the contemporary business market, define the system as it relates five principles of Lean Thinking to value. The first principle is creating value not waste. They discuss value streams (Womack & Jones, p. 29) in which the organization looks at all of its processes and determines what adds value and what is wasteful. They add flow and pull in relationship to how goods or services move through the organization from inputs to outputs. The fifth principle is perfection, where ultimately an organization will perform only activities that add value to the inputs. In other words, total elimination of waste. In an earlier work, Womack, Jones and Roos (1990) discussed these principles in not such well-defined terms, but in light of the work that Toyota did to change the way automobiles were manufactured. This focus on a single industry appears to have given birth to the thought that Lean was initially applied only to manufacturing, and in particular, to the manufacturing of automobiles (Hines, Holweg, & Rich, 2004).

Womack and Jones', (2003) understanding of "Lean" is picked up and reworked by others to apply to many different types of organizations (Baarends, 2015; Bicheno & Holweg, 2009; Dennis, 2007; Maleyeff & Campus, 2007; Stopper et al., 2011). Hines et al. (2004) discuss their perception of how Lean has progressed from Lean manufacturing for the automotive industry to a wider application in strategic thinking. Hence, Lean principles are applied to organizations outside of automobile production. Bonavia and Marin (2006) in ceramic tiles production, Cameron (2005) and Sisto (2010) in aerospace, Gurumurthy and Kodali (2008) in valve manufacturing, Smith and Synowka (2014) in chemicals, Allison (2004) in batch shops and

Todorova (2013) in job shops are examples of other non-assembly line or non-automotive manufacturing applications. This work is even extended to sectors that do not include manufacturing, for example, Balzer (2015) in education; Brandao de Souza (2009), Latino (2004), Robinson, Radnor, Burgess and Worthington (2012) also Williamsson, Eriksson, and Dellve (2016) in healthcare; Islam and Tura (2013) in software development; and finally, Kumar and Bauer (2010) along with Maleyeff and Campus (2007) in public organizations. Holweg (2005) points out that Womack, Jones and Ross worked at adapting Lean thinking to different sectors of business. In summary, Lean thinking or the adaption of Lean principles extends over a broad range of applications.

This history gives support to the concept that Lean has an enterprise-wide application. The Lean Enterprise Institute which was created by Womack identifies their mission as sharing with the world principles and practices of Lean that grew out of the Massachusetts Institute of Technology (MIT) research (*About the Lean Enterprise Institute*, n.d.). Holweg (2006) also says that Jones went on to found the Lean Enterprise Research Centre with the objective of extending Lean research into various segments of society. For example, Jones and Mitchell (2006) have written a book applying Lean thinking in the British National Health Services (NHS).

While Lean thinking is applied to a broad range of organizations at a strategic level others focus their work on applying Lean to very specific segments of an organization. Beyond actual production, Lean is applied to other processes within manufacturing organizations: engineering (Baarends, 2015), planning (Chen, 2011), maintenance (Davies & Greenough, 2010), new product development (Govender, 2009), manufacturing design (Gurumurthy & Kodial, 2008), supply chain management (Liu, Leat, Moizer, Megicks & Kasturirantne, 2013; Wang, 2001), and human resources (Selvaraju, 2009). These decision-making activities in business use the five

principles that Womack and Jones (2003) initially set forth apply Lean thinking. Healthcare is a particularly good sector in which to see Lean thinking permeating many diverse activities. Grove, Meredith, MacIntyre, Angelis and Neailey (2010) discuss it in relationship to visiting nurse services. Hayes, Reed and Fitzgerald (2010) look at Lean in sonographic services. Robinson et al. (2012) propose a Lean simulation model for clinics to insure timely patient care. Stopper et al. (2011) show how Lean thinking can be applied to dialysis treatment. Toussaint and Adams (2010) discuss application of Lean thinking to the interaction with patients in a hospital setting. The conclusion is that the literature is rife with examples of Lean thinking being applied to very specific tasks that are not manufacturing in nature or design.

Hence, while there are applications of Lean to the organization as a whole, work is also being done to utilize Lean thinking within business segments or specific business tasks. In these articles the mention of Lean thinking as an overall system is acknowledged but usually as a starting point. The mention of production application of Lean may be omitted and if included is only as background of the history of Lean.

Lean Value

Lean quality systems are managed for a purpose. Organizations seek to increase their value, for-profit organizations seek to increase profit, and non-profits seek to increase resources to better serve the community. Lean quality systems are in place to contribute to that. Value, from a Lean system of quality management perspective, can be described as "…creating more value for customers with fewer resources," (Womack & Jones, 2003, p. 6). It can also be described as activities or materials for which the customer is willing to pay (Liker, 2004, p. 27). Atkinson et al. (1994) show a direct connection between quality systems and financial value,

specifically profit. They discuss how senior managers can initiate strategies to make quality part of the organization's business plans; and then how those plans can be implemented by lower level managers and associates to control operating costs. Using examples of real organizations which have used quality management as a competitive weapon, the authors seem to say that any organization can do the same. Heinloth (2000) picks up that theme of improved return on investment to show how preventive measures cost less than corrective measures. Rodchua's (2009) study uses quality costs as a percent of sales revenue for one indicator of the impact of quality systems on value for an organization. That research indicates a range of 2.5 to 5% of sales revenue which is an improvement over previous studies. Ryan (2004), in a white paper for the American Society for Quality, reviews studies that show the positive economic impact that quality systems have on various organizations. Yeh (2014) takes it a step further and shows how application of Lean and the understanding of it affect not only operational costs but also strategic financial objectives. Yeh uses a qualitative analysis of 108 managers in Taiwan to demonstrate that what has traditionally been considered non-strategic costs have an effect on the strategic objectives. It is added that first-line mangers need to align with senior managers for the value to be realized. Hines et al. (2004) show that distinction of Lean thinking at the strategic level and Lean production at the operational level are crucial to understanding Lean as a whole in order to apply the right tools and strategies to provide customer value.

The benefit of quality systems is beyond the limited, albeit important, value of increased profit or the achievement of strategic financial objectives. Garcia-Benal and Ramirez-Aleson (2015) in a post-hoc analysis of 208 companies in Spain demonstrated that all stakeholders benefit from application of a quality management system. They include a measure of normative perspectives of value by various stakeholders to assess organizational financial performance.

Their conclusion is that stakeholders are not the only ones to profit from implementation of a quality management system. Stopper et al. (2011) demonstrate that Lean quality systems create more value for all stakeholders in a healthcare setting. In their work they find that a dialysis provider who uses Lean to improve treatment creates savings for the payer and shareholders as well as avoids hospitalization for the patient; the latter being a perceived value to the patient.

In an even wider inclusion of Lean value for organizations Balzer (2010) discuses value for a non-profit organization -- a university. One such application is making the most of volunteer time using Lean. One example is the use of Lean in the process of moving the possessions of incoming freshmen into the dormitories.

Since there are a variety of ways that Lean quality systems and value are related, then there must be some activities that can be defined as non-value added or waste in processes that Lean quality systems address.

Lean Waste

Running through all of this body of work is the consistent theme that there are activities that are of value to the organization, and/or the customer, and there are activities that do not add value. These activities that do not add value are called waste (Dennis, 2007; Gee et al. 1995; Grove et al., 2010; Holweg, 2006; Imai, 1997; Liker, 2004; Ohno, 1988; Westcott, 2014; Womack & Jones, 2003). Liker and Dennis explain the concept of waste in three components. Using the Japanese words Muda, Muri and Mura, they explain waste as internal (they called it manufacturing waste) which is Muda, overburden waste which is called Muri, and uneven work flow which is called Mura. Baarends (2015), Holweg, Stopper et al. (2012), Westcott, also Womack and Jones focus just on Muda when discussing waste. Depending upon the

organization, the flow of work may or may not be controlled by first-line managers. Likewise, depending upon the organization, it is not uncommon to have separate departments to do planning and scheduling instead of the first-line manager. For the purpose of this research the word "waste" means exclusively internal waste, i.e. Muda.

Waste, as used here, has itself undergone some modifications. Womack and Jones (2003, p. 15) define waste, as the Toyota organization does, within the context of a manufacturing organization as:

1. Mistakes that require rectification.
2. Production of items that no one wants.
3. Inventories and remaindered goods pile up.
4. Processing steps which aren't actually needed.
5. Movement of employees from one place to another without any purpose.
6. Transportation of goods from one place to another without any purpose.
7. Groups of people downstream waiting.

This list of wastes is reworded, reworked and reapplied to various contexts. Westcott (p. 366- 369), for example, in an attempt to apply waste elimination to all processes within the framework of quality systems, reduces the list to one or two words for each type of waste.

1. Defective parts.
2. Overproduction.
3. Excess inventory.
4. Processing.
5. Wasted motion.
6. Transportation.

7. Delays, waiting.

Although Womack and Jones (2003) apply their list of seven types of waste to manufacturing, and specifically a production assembly line (Hines et al., 2004), others apply it to manufacturing segments that are not production-line oriented. Baarends (2015, p. 39), referring to Ohno's (Ohno, 1988; Morgan & Liker, 2006; Oppenheim, 2011) original work on waste for Toyota, develops a list of the seven wastes from the perspective of an engineering firm that can support the production of products (see Figure 1).

Seven Wastes	What Is It?	Examples
Defects (Correction)	Inspection to catch quality problems and fixing an error that has already been made	• The killer "re's": Rework, Rewrite, Redo, Reprogram, Recertify, Recalibrate, Retest, Reschedule, Recheck, Re-inspect, Return, Remeasure, etc. • Incomplete, ambiguous, or inaccurate
Overproduction	Producing more than the next process needs (Reinventing the wheel)	• Creating too much information • Engineering beyond the precision needed • Over dissemination = sending information to too many people
Inventory	A buildup of information that is not being used	• Batching • System overutilization • Arrival variation • Lacking central release

Seven Wastes	What Is It?	Examples
Over Processing	Doing unnecessary processing on a task or an unnecessary task	• Redundant tasks, reinvention, process variation—lack of standardization • Creating documents that nobody requested • Point design used too early, causing massive iterations
Motion	Excessive motion or activity during task execution	• Long travel distances • Redundant meetings • People having to move to gain or access information
Transportation	Moving information from place to place	• Hand-offs/excessive information distribution • Uncoordinated complex document taking so much time to create that it is obsolete when finished
Waiting	Waiting for information or decisions or information/decision waiting for people decision.	• Long approval sequences • Waiting for data, test result, information, • Unnecessarily serial effort • Late delivery • Poor planning, scheduling, precedence

Figure 1. Seven Wastes as Defined by Baarends

This list draws attention to the flow of information and how the seven wastes appear in information processes. While this might be viewed as an elaboration of the concept of good communication, it does give very specific examples of Lean waste within a service context.

Moving beyond manufacturing organizations, the seven wastes are applied to services in general. In fact, Womack and Jones (2003, p.15) recognize the need to include some service-oriented waste and add an eighth waste to Toyota's original list of seven. In contrast, Bicheno and Holweg (as found in Robinson et al., 2012, p.190) building upon Holweg's (2006) earlier work, take the original seven wastes (Holweg goes back to Ohno's original work) and make a corollary list of service sector waste for each one instead of adding an eighth. Figure 2 below is that corollary list. The order is different from the list that Womack and Jones developed but covers the same seven wastes. The application of this list increases the reach of Lean waste from the manufacturing floor to other parts of the organization. In Bicheno's and Holweg's list the focus is on transactional service which applies waste elimination to businesses that may or may not be related to the production of a product.

Ohno's Original Manufacturing Wastes (Ohno, 1988)	Service Wastes (Bicheno and Holweg, 2009)
1. *Transportation*: moving products that are not actually required to perform the processing	*Delay* on the part of customers waiting for service, for delivery, in queues, for response, not arriving as promised.
2. *Inventory*: all components, work in process and finished product not being processed	*Duplication:* Having to re-enter data, repeat details on forms, copy information across, answer queries from several sources within the same organization.
3. *Motion*: people or equipment moving or walking more than is required to perform the processing	*Unnecessary Movement:* Queuing several times, lack of one-stop, poor ergonomics in the service encounter.

Ohno's Original Manufacturing Wastes (Ohno, 1988)	Service Wastes (Bicheno and Holweg, 2009)
4. *Waiting (Delay)*: waiting for the next production step	*Unclear Communication* and the wastes of seeking clarification, confusion over product or service use, wasting time finding a location that may result in misuse or duplication.
5. *Overproduction*: production ahead of demand	*Incorrect Inventory:* Out-of-stock, unable to get exactly what was required, substitute products or services.
6. *Over- or inappropriate processing*: resulting from poor tool or product design creating activity	*Opportunity Lost* to retain or win customers, failure to establish rapport, ignoring customers, unfriendliness, and rudeness.
7. *Defects*: the effort involved in inspecting for and fixing defects	*Errors* in the service transaction, product defects in the product-service bundle, lost or damaged goods.

Figure 2. Bicheno and Holweg List of Seven Wastes in Service Sector

Lean thinking has been applied to specific sectors; for example, healthcare. So too, Lean waste has been redefined for specific segments of the healthcare sector. The British National Health Services (Westwood, James-More, & Cooke, 2007, p. 5) has developed its own list of seven wastes for the healthcare sector (see figure 3).

Examples of Healthcare Wastes (NHSI, 2007)		
Correction:	• Rework due to faulty processes • Repeating things because correct information was not provided in the first place	• Readmission because of failed discharge or adverse drug reactions • Repeating tests because correct information was not provided

Examples of Healthcare Wastes (NHSI, 2007)		
Overproduction	• Performing unnecessary processing steps that do not add value.	• Requesting unnecessary tests from pathology • Keeping investigation slots 'just in case'
Inventory	• Too much work in progress or stock • Information or patients waiting in a queue	• Excess stock in storerooms that is not being used • Patients waiting to be discharged • Waiting lists
Overprocessing	• Performing unnecessary processing steps that do not add value.	• Duplication of information e.g. asking for patients' details several times • Repeated clerking of patients
Motion	• Unnecessary people motions, travel, walking and searching • Things not within reach • Things not easily accessible	• Unnecessary staff movement looking for paperwork e.g. drug sheets not put back in the correct place, storing syringes and needles at opposite ends of the room • Not having basic equipment in every examination room
Transportation	• Moving materials unnecessarily	• Staff walking to the other end of a ward to pick up notes • Central equipment stores for commonly used items instead of items located where they are used
Waiting	• People unable to process their work because they are waiting for people, equipment or information	Waiting for: • Patients, theatre staff, results, prescriptions and medicines • Doctors to discharge patients

Figure 3. Examples of Waste in British National Health Services

Although the focus is on the same seven wastes identified by Womack and Jones (2003), this distinct application is within healthcare. It is still general enough to apply to any organization within that sector. The understanding and identification of waste permeates to very

specific activities within segments. Stopper et al. (2012, p.325) identify waste (Muda) specifically for a dialysis center (see figure 4). Their list gives examples of each waste in this application.

Muda		Examples in dialysis centers
1	Defects	Mistakes in prescribing and delivering the appropriate therapy
2	Overproduction	For example, that of ultrapure water and dialysate
3	Inventory	Inaccurate capacity planning and forecasting
4	Motion	Unnecessary movement of people, e.g. because equipment or material was placed where space was available
5	Waiting	Idle time for patients or employees resulting from material, information, equipment, etc. that is not ready
6	Transportation	Suboptimal transportation of dialysis disposables and machines inside the dialysis center
7	Overprocessing	Overachieving therapeutical targets to increase the average of the center
8	Underutilization of personnel resources	Physicians puncturing patients, dialysis nurses cleaning machines, etc.

Figure 4. Waste Identified by Stopper et al. in a Dialysis Center

Another application of Lean waste was made by Maleyeff and Campus (2007, p. 28) to public organizations like government.

1. Mistake: Redoing work because of errors or omissions identified internally (e.g., correcting data entry errors) or noticed by external customers (e.g., resending a bill originally mailed to an incorrect address).

2. Duplication: Activities that are done elsewhere in the system or that can be done more easily in another part of the system (e.g., writing data onto a form prior to computer entry or making a hard copy of a form that is saved electronically).
3. Resource inefficiency: Ineffective management of personnel, equipment, materials, or capital (e.g., idle workers or using workers for tasks not requiring their skills).
4. Processing inefficiency: Performing a task in an ineffective manner (e.g., "reinventing the wheel" every time a report is generated or punching holes in paper after copying).
5. Movement: Physical transport of information, personnel, or equipment (e.g., traveling to attend a meeting or mailing reports to a customer).
6. Review: Inspection of completed or partially completed work to check for errors or omissions (e.g., confirming conformance with standard accounting procedures or checking work of a new employee).
7. Delay: Time spent in a visible queue (e.g., paperwork in an in-box) or time spent waiting for information (e.g., a voice-mail message response).

It appears that the understanding and application of Lean waste is common and acceptable in literature. Recognizing and addressing waste can be considered part of every aspect of every organization that is working to apply Lean thinking to the organization.

Lean Waste and Decision Making

Given that Lean thinking or Lean principles can add value to an organization, and that Lean thinking identifies specific non-value activities is there any research showing that decision-

making that includes consideration of non-value, activities is of value to an organization? Is that value beyond the normative assessment that removing waste must increase value? If so, has any research built models for decision-making using Lean waste considerations?

Laureani and Antony (2017) developed a leadership model connecting company size and industry sector to lean practices. They found that the more people centered and service centered organizations and the smaller the organization the greater the need for strong leadership to implement Lean.

Todorova (2013) examines the applicability of sixteen different Lean tools to three manufacturing settings: job shop, batch shop and assembly line. The author demonstrates that waste elimination (Muda) is used by three types of manufacturing facilities analyzed in this dissertation. Specifically, the study compared manager's familiarity with Lean tools to relationship to operational performance. The second research question is most applicable to this research; "RQ2: Is there a relationship between the operational performance of the firm as perceived by the respondents and the perceived alignment of the Lean tools with the type of manufacturing setting?" (Todorova, p. 24). The research shows a statistically significant, positive relationship between the perceived operational performance of firms in job shop and batch shop settings and the implementation of Muda Elimination (MUDA) Lean tools. For assembly line settings MUDA is not far behind the significant factors contributing to operational performance. The author states that a decision-making system is needed to link bottom-up measures to success. Staying within the context of manufacturing organizations, Awofala (2014) proposes a relatively innovative approach to quality management of an assembly line. This approach is called "Quality Loop Framework" and is primarily an administrative approach to

insuring that all phases of a quality management system, including Lean waste, are considered when making decisions to solve problems.

Davies and Greenough (2010) make the point that value-focused thinking aids in decision-making within the context of maintenance activities in a manufacturing organization. This research specifically shows waste elimination is relevant to maintenance and improves the effectiveness of it. The measure of effectiveness consists of 23 indices (Davies & Greenough, p.73):

> Index 1- Manpower efficiency, index 2- Overtime, index 3- Utilization (craft hours), index 4- Predictive and PM coverage Performance, index 5- Overdue tasks, index 6- Work orders planned and scheduled, index 7- Work orders turnover measures, index 8- Degree of scheduling measures, index 9- Breakdown repair hours, index 10- Maintenance hours applied, index 11- Breakdown frequency, index 12- Equipment downtime, index 13- Evaluation of PM and Predictive maintenance, index 14- Equipment availability, index 15- Length of running performance, index 16- Emergency man-hours, index 17- Emergency unscheduled tasks, index 18- Cost of maintenance hours, index 19- PM costs percent Breakdown, index 20- Inventory turnover rate, index 21- Breakdown severity, index 22- Scheduled service cost, index 23- Maintenance cost for unit of production.

Beyond the manufacturing floor, Lean waste is considered in making decisions about manufacturing design (Chen, 2011; Gurumurthy & Kodali, 2008) and employee scheduling (Selvaraju, 2009). Chen's research developed a simulation-based framework for decision-making regarding capacity planning, scheduling, and inventory control using Lean principles.

One of those principles is waste minimization. Gurumurthy and Kodali present a case study which focuses on a decision between Lean and computer integrated design of manufacturing processes. The authors show that in one particular application in India Lean is preferred over a computer integrated model for multi-criteria decision-making when performance value analysis is important. Selvaraju's research integrates workforce efficiency and Lean into a model for scheduling workers. The research shows that higher throughput and reduced work hours can be achieved using Lean process improvements in a manufacturing environment.

Shifting the focus from solely internal processes to those that involve external organizations, Ho, Xu, and Dey (2012), Liu et al. (2013) and Wang (2001) all discuss supply chain decisions made using Lean. Ho et al. and Wang will be discussed later in other contexts. Liu et al. use a Dell laptop global supply network cases study to demonstrate the effectiveness of the decision-making model that they developed. The heart of the model is identifying Lean waste - - knowing why it occurs and advice on how to eliminate it, thereby, lowering cost. The authors specifically target managers who need to make supply chain decisions. These decisions can "…be significantly improved by using a well-developed waste elimination knowledge base." (p. 2135). Baarends (2015) incorporates the elimination of Lean waste in engineering systems to develop "Lean Systems Engineering." The author uses a case study of a civil engineering design firm in the Netherlands to compare customer requirement specifications with Lean waste. Baarends' research question is, "To what extent the Customer Requirement Specification process for infrastructure projects can be enhanced in order to prevent waste and if so, in what way?" (p. 22). The conclusion is that the case study demonstrates that engineering processes can be enhanced to a "considerable extent" (p. 98) by eliminating waste. Ryan Suydam (personal communication, June 7, 2016) makes the point that his work shows that

exceeding customer expectations may increase waste (over-processing). In a similar vein to engineering projects is software development. Islam and Tura (2013) explore Lean in the world of software development. They find that Lean is useful in developing software faster and aids in decision-making. One example they cite is the desire by the users for simplicity (the opposite of over processing a Lean waste). Hence, for a developer making a decision about software the choice to make it simple is preferred. In this way the developer is reducing waste and making the user happy.

Moving outside of manufacturing, Lean decision-making has impacted public organizations (Kumar & Bauer, 2010; Tomaževič, Tekavčič, & Peljhan, 2017). Public housing property managers face decisions regarding the best way to serve clients who require affordable housing (Kumar & Bauer). This work applies Lean thinking to public housing in a Midwestern city based upon work done in the United Kingdom. The conclusion is that Lean can be applied to public housing to save money and be more effective in a limited resource environment. For the purposes of this research Kumar and Bauer show that Lean will improve coordination among multiple functions and develop human skills of teamwork and problem solving - - key elements of decision-making within organizations. A model for decisions in public administration was developed for institutions in Slovenia by Tomaževič, Tekavčič, and Peljhan. Performance improvement was determined to be a key element in excellence in public administration.

Healthcare has also seen an impact from Lean decision-making (Brandao de Souza, 2009). In particular, the elephant-in-the-room decision that faces healthcare providers is the choice between the amount of service provided to the customer and the containment of costs for the payer (Dahlgaard, Pettersen & Dahlgarrd-Park, 2011; Grove et al. 2010; Hayes et al. 2010; Radnor, Holweg, & Waring, 2012; Stopper et al. 2011; Toussaint & Adams, 2010). Dahlgaard,

Pettersen & Dahlgarrd-Park propose a model that tries to balance people management and partnerships (Stakeholders) with process and product results (Lean). Grove et al. approach the decision-making process as a team responsibility. Value stream maps are the means to identify waste, forty one are identified, and the team decides how to address each. Using a case study approach, Radnor et al. studied four public health organizations in the United Kingdom. While Lean has improved efficiency, Radnor et al. are very critical of the decision-making role that Lean has provided beyond tools for efficiency. They see Lean as a means of decision-making to fix problems, particularly in meeting critical demands. In contrast, Stopper et al. sees broad ranging decision-making improvements from Lean, including strategic level decisions and tools for efficiency. In their case of NephroCare dialysis provider Lean has created a win-win situation with decisions easier to make because both patient and payer get more value. Toussaint and Adams focus on how implementing Lean in a hospital setting has improved the quality of decisions. By moving to a collaborative approach among the medical team, the decision-making process is smoother and faster. This includes processes from admittance to aftercare.

Because, as shown earlier, Lean thinking and Lean waste can be extended to a broad range of applications the specific application for this research is to decision-making by first-line managers. Of the variety of the decision-making applications of Lean discussed in the research the model used to apply Lean appears to be almost intuitive: 1) identify the waste, 2) prioritize waste, 3) remove highest priority waste, and 4) continue until all waste has been removed (Davies, 2003; Mawbry, 2005 and Tague, 2005). The argument is made that good strategic planning will make decision-making easy for first-line managers (George, 2002; Marchwinski, 2007; Rochetti, 2016 and Westcott, 2014). Decision making may be perceived like problem-solving. Quality systems do not lack for problem-solving tools (Bicheno & Holweg, 2008;

Chaudhry, 1994; Juran, 2010; Mizuno, 1988; Tague, 2005; and Wesctott, 2014), but few specific models for decision-making using Lean waste for first-line managers have been given. For example, Anderson-Cook and Lu (2015) propose a DMAIC based decision-making process that modifies the stage where choice is made based solely upon the priority of the decision maker. Ho, Xu & Dey (2012) propose a complex model that combines analytical hierarchy process with quality functional deployment in a linear program with 20 sub-factors to be analyzed. Even then, they admit changes in stakeholder needs may make the model less than optimum. Cabral and Cruz-Machado (2012) attempt to build a decision-making model based upon Lean and other management tools using an analytical network process. The admission is made that this is a complex problem.

Healthcare research, while discussing Lean waste and well defining it, often does not provide a specific detailed model for decision-making involving waste. The situation is best summarized by Radnor et al. (2012, p. 15) quoting McGuire (1988) "'the derived demand for health care relies upon the decision-making capacity of the provider" (p151).'" But they add, "in the majority of cases the implementation of Lean centred on narrow and often disjointed tasks at the department and ward level," (Radnor et al. p. 10). Evans et al. (2014) performed a review of 1978 quality-related articles, 251 appearing in "A" journals, to summarize key research. They conclude that the research has shown that quality is beneficial.

Stakeholder Theory and Salience

Adding Value to Organizational Interactions

Standing in what appears to be a contrast to the minimization found in Lean thinking is Stakeholder theory. While Lean focuses on meeting the needs of the customer and reducing flow

time, decreasing waste, and improving activity -- all to meet the customer's needs -- Stakeholder theory appears to allow for increased time, no apparent interest in decreasing waste, and a focus on more than just the customer. Cameron (2005), Camilleri (2009), Flynn, Schroeder and Sakakibara (1995), Grossi (2003), Grove et al. (2010), Power (2010), Sisto (2010), and Zaki (2007) are a few who see a relationship between the two. Before discussing the connection between Lean thinking and Stakeholder Theory, a review of stakeholder theory -- what it is, who are stakeholders, and what comprises stakeholder salience -- is considered.

Stakeholder Definition

Yoshimori (1995) did a survey of senior managers from 378 firms in France, Germany, Japan, the United Kingdom, and the United States. That survey was done to determine who is perceived as important to the managers. The choice was between shareholders and stakeholders. For managers to make a choice between the two requires a distinction between them. Shareholders are well-defined and one school of thought says the role of management is to provide profits for the owners, or shareholders (Friedman, 1970). Stakeholders are not so well defined. Modern references to the theory start with Rhenman (1968, p. 24) who defines stakeholders as "individuals or groups which depend on the company for the realization of their personal goals and on whom the company is dependent" in a lecture he gave in Stockholm in 1964. Freeman (1984) credits Stanford Research Institute as the first to use the word "stakeholder" in an internal memo from 1963. In either case, it is Freeman (1984, p. 53) who proposes a commonly used definition, "…any group or individual who can affect or is affected by the achievement of the organization's purpose."

Since Freeman many others have redefined Stakeholder Theory in various ways. Mitchell et al. (1997) developed a chart of twenty three definitions of stakeholder from 1983 through 1995. As time has progressed more definitions have been added. Fontaine, Haarman and Schmid (2008) identified 75 different definitions of "Stakeholder."

Within the quality management community Westcott (2014, p. 107) sees stakeholders as, "…individuals, groups, or organizations who will be directly or indirectly affected by an organization carrying out its mission." The Malcolm Baldrige National Quality Award refers to stakeholders as those who are interested in the organization. Finally, the ISO 9000 recognizes the existence of Stakeholder.

Beyond a dictionary type definition, Stakeholder Theory embraces a thought: that it is the responsibility of an organization to incorporate Stakeholders into the organization's processes and visa-versa. Agbim, Owutuamor and Oriarewo (2013) and Bettiol (2013) represent a group of those who see Stakeholder theory applying to corporate social responsibility, proposes that organizations have a "social license" from society to be in business, and therefore, are responsible to all of society. Agency Theory, which is credited to Jensen and Meckling (1976), competes with Stakeholder Theory. Jensen and Meckling see the role of a business as overwhelmingly, if not exclusively, to make a profit for the owners by changing less valuable goods or services from the supplier into more profitable goods or services for the customers and in so doing create a profit for the owners. They do not see any responsibility to be equally concerned with the other groups who have a stake in the success or failure of the organization. Barry (2002) represents a group which takes Agency Theory a step further and sees the organization as primarily responsible to generate a profit. Barry (p. 551) summarizes it well as, "stakeholders have become merely all those who claim something *from* it, as if they had

entitlements to the wealth generated by its operation. In a stakeholder firm, their divergent demands are irreconcilable." Atkinson et al. (1997), and Hill and Jones (1992) attempted to combine Stakeholder Theory and Agency Theory to create a theory that allows for the organization to be an agent of many diverse stakeholders, but in practice it appears as though in this battle it is the owner who really wins out. The words stakeholder and stockholder may be used interchangeably as if the only stakeholders are the stockholders which makes Stakeholder Theory and Agency Theory the same thing. Staking out a middle ground, Grossi (2003) indicates that there is a continuum between organizations that practice "pure" Stakeholder Theory and those that practice "pure" shareholder management.

Stakeholder theory is associated with corporate governance, strategic planning, and establishing values (Asif, Fisscher, de Bruijn & Pagell, 2010; Atkinson et al., 1997; Cameron, 2005; Clarkson, 1995; Dess, Lumpkin & Eisner, 2007; Freeman, 1984; Freeman & Reed, 1983; Frooman, 1999; Grossi, 2003; Harrison, Bosse & Phillips, 2010; Laplume, Sonpar & Litz, 2008; McShane, & Von Glinow, 2010; Matty, 2010; Preble, 2005; Tiffany, Barrow, & Peterson, 2012). Stakeholder theory is also associated with operational issues. Chinyio and Olomolaiye (2011) apply stakeholder theory to managing construction projects. Elias, Cavana and Jackson (2001) use Stakeholder Theory to solve a very specific problem for a supermarket in Wellington, New Zealand. Epstein and Widner (2011) apply Stakeholders in terms of a very specific energy development program in Wyoming. Tague (2005, p. 476) sees Stakeholders as those "…individuals or groups with an interest in an issue."

With such a wide variety of how Stakeholder Theory is defined and perceived, trying to develop a definition that is universally embraced might be difficult and could lead to misinterpretations. Phillips, Freeman and Wicks (2003) take it upon themselves to address seven

misinterpretations of Stakeholder Theory. These include, socialism and an entire-economy theory, comprehensive moral doctrine, the need for legislating Stakeholder theory, application to for-profit organizations only, all Stakeholders must share equally in profits, managerial excuse for poor financial performance, and strategic level only. For this research Stakeholder will be loosely defined as a person or group that can affect or is affected by, either positively or negatively, the achievement of the organization's objectives. This definition incorporates any Stakeholder that has an effect on the success or failure of the organization. Hence, it allows for the inclusion of Stakeholders who bring value to the organization and those that do not. This definition can be applied at the primary operational level with great latitude. Stakeholder Theory will not be used in this research on the strategic level, but instead, is more aligned with the operational level. For this research it is not a requirement that all participants subscribe to this precise definition. The only requirement is the concession that there may be Stakeholders who bring non-value added requirements to the organization.

Stakeholders Identification

Stakeholders can be found within or outside of an organization. Customers may be the first group that comes to mind. The simplest identification of Stakeholder is done by Kelada (1999) who recognizes three: customers, employees and shareholders. Atkinson et al. (1997, p. 35-37) include suppliers and the community in general along with the three mentioned by Kelada. Freeman (1984) adds competitors to the list. Susniene and Vangas (2005) add government oversight, business associations and political groups to the list. Over time, others such as unions, media, investment funds, consumer organizations and NGO's (Fassin, 2009) have been added to the list. Medical care organizations have the most inclusive list of stakeholders. The University of Wisconsin's (Alliance of State Pain Initiatives, 2016) extension

department lists 34 potential Stakeholders and states that it is not an exhaustive list. Within the quality community the lists are generally short: Gee, Richardson and Wortman (1995, p. VI-33) mention only two; Oakland (1993, p. 155) and Westcott (2014, p. 108) mention only five.

Some stakeholders are hard to imagine, like competitors. For example, in the 1980's General Motors should have considered Toyota (who later overtook them as marketplace leader) as a competitor-stakeholder. They did not, as Kochan and Clutcher-Gershenfeld (2008) point out. The competition has a stake in your success or failure. Therefore, within the broad range of Stakeholders could be any organization within the same market. Stakeholders could be those indirectly affected by an organization. An example of how this version is seen in the real world is the dissolution of an organization. Employees and their families are immediately affected, and therefore, a family could fit into the working definition of a stakeholder (Hayes et al., 2010).

Beyond identification of stakeholders by specific role or title, some identify stakeholders by category. Donaldson and Preston (1995) are the first to specifically identify stakeholders in this way. Their work is mostly focused on justification for stakeholder theory, but they do establish that there are appropriate Stakeholders and those that are not appropriately considered Stakeholders. They also propose categorizing stakeholders by the amount of power they have over the organization. All of the work is post hoc and implicit. The authors do open the door to Mitchell et al.'s (1997) work on stakeholder salience by recognizing that stakeholders differ in importance and power. Mitchell et al. introduces the concept that Stakeholder salience is connected to Stakeholder identification. They describe seven relationships between the organization and the Stakeholders: Dormant, Discretionary, Demanding, Dominant, Dangerous, Dependent, and Definitive. They also include a relationship called Non-stakeholder. These relationships are based upon the presence of any of three attributes found in the relationship:

power, urgency and legitimacy. More will be discussed in the Stakeholder salience section. Phillips (2005) divides legitimate relationship into normative (morally deserving) and derivative (those deserving because of others).

Stakeholder Salience

Not all Stakeholders are affected by the organization in the same way or influence the organization to the same degree (Bryson, 2004; Cassie & Montreuil, 2014, Chamberlain & Stutesman, 2006; Freeman, Harrison, Wicks, Parmar & DeColle, 2010; Harrison et al., 2010; Kejuo & Nuruzzaman, 2008; Oak, 2013; Preble, 2005). Decision-making with regard to Stakeholders is often difficult (Nutt, 2002). Firestein (2010) provides two good examples, Wal-Mart's bribery issue and Coca-Cola's water use issue, of ignoring those who would be perceived as minimal Stakeholders to their own their own peril. Another example is the comment by Robert Lutz (former vice chairman of Chrysler Corporation) in which he attacks "stakeholder symbiosis" (Lutz, 2003, p. 132-133). Unfortunately, Chrysler Corporation went bankrupt during his tenure because they ignored Stakeholders. The risk of ignoring Stakeholders is very real not only in the strategic decisions but also in the first-line managers' decision-making (Mankelwicz & Kitahara, 2010).

Early in the history of Stakeholder Theory Gardner et al. (1986) developed a simple X-Y matrix to be used to determine Stakeholder priorities. One axis is the power the Stakeholder has over the organization and the other is the interest the Stakeholder has in the organization. The higher the power and interest the more priority the organization should place on that Stakeholder. This understanding is one that is commonly held and researchers do not even reference it.

Mitchell et al. (1997) recognize that there are many potential Stakeholders for an organization. They develop an objective method for managers to determine to whom to pay attention. They use the term Stakeholder salience. Throughout this research Stakeholder salience will be used to reference identification and prioritization of Stakeholders. The work of Mitchel et al. is theoretically based, yet a search in Google Scholar shows that it is cited by over 8400 authors (as of 2016). They propose that there are three criteria for determining Stakeholder salience: power, legitimacy and urgency. Power is "access to coercive, utilitarian, or normative means to impose its (the stakeholder's) will in the relationship." (p. 865). Legitimacy is a perception that the Stakeholder actions are appropriate within some value, belief or definition of normal. Urgency is timeliness and criticality of the Stakeholder demand. There are three propositions to this work (p. 873, 874 & 876).

- Proposition 1: Stakeholder salience will be positively related to the cumulative number of stakeholder attributes---power, legitimacy, and urgency--perceived by managers to be present.
- Proposition la: Stakeholder salience will be low where only one of the stakeholder attributes-- power, legitimacy, and urgency-- is perceived by managers to be present.
- Proposition lb: Stakeholder salience will be moderate where two of the stakeholder attributes--power, legitimacy, and urgency-- are perceived by managers to be present.

The result is seven types of Stakeholder salience: Dormant – those who have power but not legitimacy or urgency; Discretionary – those who have no legitimacy but power or urgency;

Demanding – those who have urgency but not power or legitimacy; Dominant – those who have power and legitimacy but not urgency, Dangerous – those who have power and urgency but not legitimacy; Dependent – those who have legitimacy and urgency but no power; and Definitive – those who have power, legitimacy and urgency. One not-so-obvious example from Mitchel et al. should suffice: the example of the oil spill during the 1990's in Prince William Sound by the oil tanker Exxon Valdez shows the dependent Stakeholders. Here, people and wildlife were dependent on the organization's ability to rectify an environmental condition, but they had no power to make the organization do anything.

In contrast, Rowley (1997) proposes that network analysis is the key to Stakeholder salience. When initially proposing Stakeholder theory Freeman (1984) gives a pictorial representation of the relationship between Stakeholders and the organization as each being an individual entity tied to the organization alone. His perspective is that it is not so important to get Stakeholder-to-Stakeholder relationship as it is to get the Stakeholder-to-organization relationship (R.E. Freeman, personal communication, February 28, 1995). Rowley proposes that Stakeholders do not just interact with the organization but that there are networks of Stakeholders interacting with the organization. This theory is based upon social networking and its growing prevalence. Rowley refers to the organization as the focal organization. Two defining propositions are made (p. 898, 900):

- Proposition1: As network density increases, the ability of a focal organization's stakeholders to constrain the organization's actions increases.
- Proposition 2: As the focal organization's centrality increases, its ability to resist stakeholder pressure increases.

Density means how close the Stakeholder's network is and the degree of Stakeholder-to-Stakeholder interaction. Centrality asks how critical the relationship between the Stakeholders and the organization is. Is the organization central to the network or is it tangential? Hence, there can be four different types of Stakeholder networks: high density and high centrality, high density and low centrality, low density and high centrality, and low density and low centrality. One example will be given to summarize Rowley's work (p. 904). The Stakeholder relationship between a parts manufacturer who supplies General Motors (GM) and GM itself is an example of high density and low centrality. If we view a parts manufacturer (A) as the central organization and GM as the customer/Stakeholder where A is a small player in the network of parts suppliers to GM (others are competitor Stakeholders to A), then A is not central to the relationship with GM and GM can work with other parts suppliers to change the salience of its Stakeholders in relationship to A. In contrast, if A was the only supplier to GM of a critical part, the network would be low density and high centrality. GM would have a very difficult time changing its Stakeholder salience with A in that network arrangement.

Beyond propositions, Agle, Mitchell and Sonnenfeld (1999) did a study of 80 chief executive officers from the Kinder, Lydenberg, Domini, and Company database showing that stakeholder power, legitimacy (which could be called interest) and urgency impacts Stakeholder saliences. They show that shareholder salience, employee salience, community salience, and government salience are related to power, legitimacy and urgency (all $p < .01$).

Gardner et al. (1986), Mitchel et al. (1997), and Rowley (1997) represent three approaches to Stakeholder salience. Others have built upon one or more of these works to develop a modified model of Stakeholder salience (Barnett, 2007; Chamberlain, Stutesman, 2006; Fasin, 2009; Jawahar & McLaughlin, 2001; Jones, Felps, & Bigley, 2007; Kivits, 2011;

Kochan, & Rubinstein, 2000; Murray-Webster, & Simon, 2006; Phillips, 2005; Preble, 2005). Some literature adopts one of the three models for a specific application. Asif et al. (2010) do an ex post facto research of four manufacturing organizations in Pakistan to show how integration of Stakeholders develops organizational excellence using Mitchel et al.'s three criteria for determining Stakeholder salience. Ballejos and Montagna (2008) and Islam and Tura (2013) use Mitchell et al. criteria in determining Stakeholder salience for software development. Islam and Tura show that understanding Stakeholder salience before starting a project decreases the problem later in the project. Ballejos and Montagna demonstrate that understanding the diverse roles of Stakeholders inter-organizationally affect salience. Camilleri (2009) uses Mitchell et al. criteria for assessing potential Stakeholders for a winery in Australia. This study balances the requirements of a producer with the demands of oversight Stakeholders. Rowley's network analysis can be seen in Henisz, Dorobantu and Narty (2011) who use it to do a post hoc analysis of Stakeholder value measurement involving 26 gold mines in 20 countries. Heugens, van den Bosch and Van Riel (2002) use qualitative research of the Dutch food industry to build a model based upon Rowley's network concept. They present four categories of Stakeholder salience based upon the locus of the relationship (a network or a dyad) and the Modus (formal structured or informal structure). This model is specifically built for achieving value from appropriate Stakeholder salience management. Matty (2010) applies Mitchell et al. criteria to defense department purchasing, showing that improved understanding of Stakeholders can reduce the cost over-runs of weapons systems purchased. Reed et al. (2009) combine several salience models but primarily use the model proposed by Gardner et al. in an environmental context. In the field engineering design Sharp, Finkelstein, and Galal (1999) discuss Stakeholder identification using the Gardner et al. model. In the quality field Tague (2005) applies the work

of Gardner et al. to quality management of projects. Varvasovszky and Brugha (2000) apply a model similar to Gardner et al. to the national alcohol policy in Hungry but change power to influence and interest to support. In applying salience to construction management Walker (2008) modifies legitimacy from Mitchel et al. to be proximity but keeps the other elements.

Some researchers have combined one or more of the models to develop a research method for their work. Cameron (2005) uses parts of Mitchell et al. (1997) and Rowley as reworked by Kochan and Rubinstein, to do post hoc analysis of the benefit of Stakeholders' recognition and Lean for those supplying NASA. Grossi (2003) uses both Rowley's model and the model from Mitchell et al. applied to an aerospace equipment manufacturer to build a model to quantify the effect of Stakeholders on an entire organization. Sisto (2010) specifically studies Stakeholder salience using both these models applied to a post hoc study of a sporting goods manufacturer.

The field of Stakeholder analysis is not without its issues. Siltaoja and Lähdesmäki (2015) do a qualitative study of 33 organizations in Finland and draw two conclusions. First, significant Stakeholder salience is affected by emotions, both social and cultural. Second, those emotions impact the owner–managers' personal and moral autonomy in decision-making by limiting it. Consideration behind the assignment of salience to specific Stakeholders will not be a part of this research. It is sufficient to have it assigned to Stakeholders. Windsor (2010) writes that Stakeholder dynamics is a key conceptual and methodological issue for Stakeholder thinking. The author discusses how dynamic reasoning helps to build a practical Stakeholder theory and improve practice of Stakeholder management. Notions of competition, influence strategies, change in Stakeholder networks, mindsets, salience or values, learning, creative destruction, long-term sustainability, Stakeholder reciprocity, sustainable development, and

value creation all embed change in Stakeholder relationship over time. This is reasonable for future research, but not for the study at hand. There is only one survey and the measurement is for a point in time. Conclusions of Stakeholder dynamics will be for later research.

Stakeholder identification and salience assignment must be done for a reason. As mentioned previously, some use Stakeholder analysis to generate value for the organization. Kejuo and Nuruzzaman (2008) did a qualitative study of 843 organizations in Sweden. They use Mitchell et al. (1997) criteria of Stakeholder salience with a pragmatic world view to study the value it brings to the organization. The survey indicates that 96% ($P < 0.05$) believe that a firm can create value for all Stakeholders. The survey also indicates that only 74% ($P < 0.05$) believe that value can be effectively created for each Stakeholder without making any one group worse off. Kejuo and Nuruzzaman propose using six factors to analyze Stakeholder relationships (p 35):

1. Objectives and purposes of analysis: develop purpose and procedures of analysis and initial understanding of the system.
2. Identification: identify key stakeholders or brainstorming work.
3. Investigate stakeholders' interests: analyzing of potential conflicts or interests among stakeholders, theirs characteristics and circumstances.
4. Basis of stakeholders' context: identify patterns and contexts of interaction between stakeholders.
5. Basis of stakeholders' power: assess stakeholders' power and
6. Legitimacy and potential roles, and strategic options: assess options and use the findings to make progress.

It is worth discussing the value-added component of Stakeholder Theory and the analysis of Stakeholder Salience.

Stakeholder Management and Making Decisions

Stakeholder Management and Value

Jensen (2000, p. 3) said, "We cannot create value without good relations with customers, employees, financial backers, suppliers, regulators, communities, and the rest." The importance of this statement is that Jensen is an advocate of Agency Theory. (Agency Theory, the descriptor theory where the only viable Stakeholder group is the owners, is not included in this research.)

Donaldson and Preston's (1995) touchstone work explores how three different Stakeholder perspectives (descriptive, instrumental power, and normative validity) affect the actions of organizations and how managers can use each to create benefits, or value, for the appropriate Stakeholders. They present four theses (three of which will be discussed now and one later).

Thesis #1 Stakeholder Theory is a way of describing what a corporation is beyond the organizational chart. The value is in the recognition of Stakeholders.

Thesis #2 Stakeholder Theory is instrumental; it establishes a framework for examining connections between Stakeholders and achievement of corporate performance goals.

Thesis #3 Stakeholder Theory is normative because there is some intrinsic value to recognizing and accepting Stakeholders.

All of the work is post hoc and implicit. The authors discuss Stakeholder Theory and Agency Theory together. In fact, they propose that there is no way instrumental justification of Stakeholder Theory can be made (Donaldson & Preston, 1995, p. 81) apart from the normative

justification. Succinctly put, in order for Stakeholder theory to work the organization must believe that it will work.

This theory is not universally accepted. Bryson (2004) gives examples of organizations that have used normative, justification by logic, methods for recognizing Stakeholders or ignoring Stakeholders. In contrast, Harrison et al. (2010) propose that recognizing Stakeholders and managing for them creates competitive advantage, sustainability, and customer dependency.

Over time instrumental perspective of Stakeholder Theory has gained support. Berman, Wicks, Kotha and Jones (1999) do a post hoc analysis of 81 publically held Fortune 500 companies to study organizational profitability and Stakeholder focus. Financial performance is used as a measure of value for that research. Their research had three hypotheses (p. 490,) only two of which will be discussed now.

> Hypothesis 1a: both strategic variables and stakeholder relationship variables will have direct and separate effects on firm financial performance.

> Hypothesis 1b: strategic variables will have a direct effect on firm financial performance which will be moderated by stakeholder relationship variables.

The authors provide data that supports the hypotheses. Since all of the data is ex post facto, the conclusion can be drawn regarding correlation but not causation.

Allen, Carletti and Marquez (2007) do mathematical modeling of eight distinct propositions that demonstrate Stakeholder firms increase profits over Stockholder-driven firms; Stakeholder firms can maintain higher prices than Stockholder-driven firms; Stakeholder firms maintain better prices and profits internationally; Stakeholder firms have a greater probability of surviving than Stockholder-driven firms.

Bettiol (2013) undertakes a study of 95 US-based companies over a three-year period to measure the effect of seven corporate social performance (Stakeholder awareness) criteria on five performance measures. Using a multiple linear regression analysis the results show a positive relationship to the performance measures of net revenues and earnings before interest taxes and debt.

Nartey (2012) did a post hoc study of 19 publicly traded companies that operate gold mines with at least one outside of Australia, Canada or the United States. Using market value as the measure of value for the organization, this study shows a 300% greater improvement in market value for companies that have good Stakeholder relationships.

Preble (2005) takes data from an earlier study of 67 large corporations within the United States to show how Stakeholder Theory can aid the financial performance of an organization. The post hoc study was of 270 correlations (in the form of direct correlations and lead-lag correlation) over an 11-year period. The results showed not a single negative correlation.

In an earlier section discussing Lean value Garcia-Benal and Ramirez-Aleson (2015) along with Stopper et al. (2011) were mentioned as using Lean to bring value to all Stakeholders. These studies also support the proposal that understanding and applying Stakeholder Theory adds value to an organization.

While many like Donaldson and Preston appear to be looking for the ideal path to justify using Stakeholder Theory in business strategy, very few have worked on trying to justify using Stakeholder Theory on the primary operational level, the day-to-day efficiency activity list of associates. This research will take that a step further to look at an approach which recognizes and differentiates Stakeholders that can work in practice at the primary organizational level not

only to work alongside of each other but to aid in making immediate decisions regarding continuous improvement activities.

There could also be non-value added legal implications for organizations if resources are not allocated in a timely manner so as to meet Stakeholders' expectations (Bader, 2014). These legal implications could result in judgments against the organization which will have a negative financial impact on profitability.

Stakeholder Salience and Making Decisions

Stakeholder Theory is applied to strategic thinking (Freeman 1984) and corporate governance (Freeman & Reed 1983), each being a decision-making activity. But should the salience component be used in making decisions? Barry (2002) says Stakeholder Theory should not be used for decision-making. The author sees large organizations where Stakeholders act to exploit the corporation for their own benefit at the risk of long term viability (get mine before others get theirs). To embrace the author's position the reader needs to be a strong Theory "X" person and consider others as inherently self-seeking. This relates to the discussion of the actual value creation from implementing Stakeholder Theory. In contrast, Kim (2011) presents several case studies to demonstrate that Stakeholders are integral to the strategic decision-making of an organization. One metric of a successful organization, according to Kim, is how well strategic decisions align with Stakeholder interests. Alignment is not automatic. Ghosh (2015) analyzed Stakeholders involved in decision-making during building information model planning. The study showed that Stakeholders gave value to their immediate utility not on utility for others. Clark, Quigley and Stumpf (2014) conducted a study of 388 MBA students who are all employed full-time regarding their framework for decision-making in a Stakeholder aware organization.

The conclusion is that in order to maximize the success factor for either profit or Stakeholder awareness a consistent message is best. In addition, how the decision is framed and how the decision-maker is primed will affect the decision outcome. The author's hypothesis that those facing a decision that is framed in alignment with the vision will make a decision aligned with the frame work was supported by the data ($p < 0.05$). Therefore, Stakeholder incorporation within the decision-making process may require more than just recognition of their existence.

One position is that all Stakeholders should be treated equally in decision-making no matter what their salience toward the organization. Epstein and Widner (2011) use a real world example of expanding energy development in Wyoming. The research consisted of 650 surveys of various Stakeholders. The authors treat all Stakeholders as equals and work at developing tradeoffs to satisfy all participants. Grove et al. (2010) studies the United Kingdom's National Health Services primary care visiting health services. Stakeholders Theory is used to understand the scope of the program but not used to determine salience. The authors appear to want to satisfy all Stakeholders equally. Liu et al. (2013) refer to Stakeholders but it appears to be an amorphous mass to the authors. There is no differentiation or determination of salience. The focus is on who can and cannot be controlled by the entity making organizational purchasing decisions.

An opposite position is that Stakeholder salience has a significant effect on decision-making. Carrington and Combe (2013) did a case study of a healthcare organization in the United Kingdom. The research shows Stakeholder salience affects four different sub-cultures within the organization. Elias et al. (2001) discuss how supermarket managers prioritize Stakeholders to make decisions. Fernández Gago and Nieto Antolín (2004) did a survey of 277 environmental managers of major manufacturing organizations in Spain. Their research shows a

hierarchy of Stakeholders where government has a statistically more significant salience than do suppliers ($P < 0.001$). Halal's (2001) research focuses on Stakeholder partnership in decision-making. The focus of this research is a survey of 540 mangers and their perception of Stakeholder collaboration. As if Halal is responding to Barry's comments, the research shows that 86% of the managers "strive to co-operate with important stakeholders" (Halal, p. 35), and 72% make decisions based upon consensus with Stakeholders. Jawahar and McLaughlin (2001) did qualitative research into how to make decisions in a resource limited environment. They propose two theorems, the second of which is applicable to this discussion. The authors theorize that in times of threats to an organization only the issues of relevant Stakeholders will be addressed denying responsibility for other Stakeholders issues. In addition to the actual salience of Stakeholders, Mankelwicz and Kitahara (2010) discuss how "weak signals" from Stakeholders can compromise key decisions by managers. Reynolds, Schultz and Hekman (2006) present a two-part research regarding Stakeholder salience and decision-making. The first study of 93 full-time MBA students enrolled at a West coast (USA) institution looks at how unequal salience of Stakeholders affects managers' decisions. Reynolds et al. (p. 287-289) have four hypotheses for the first study but only three apply.

> Hypothesis 1.1. Highly divisible resources will lead to more balanced stakeholder interests than will highly indivisible resources.
>
> Hypothesis 1.2. Stakeholder claims of relatively equal saliency will lead to more balanced stakeholder interests than will stakeholder claims of relatively unequal saliency.

Hypothesis 1.3. There will be a significant difference in the balance of stakeholder interests between decisions that involve stockholders/owners and those that do not.

The survey results supported hypotheses 1.1 and 1.2 but hypothesis 1.3 was not supported. Statistically sound but lack depth, the study gives only a general analysis of the decision-making process used by individual managers and supports the position that managers want to be fair to all Stakeholders but limited divisibility and skewed saliency tend to unbalance the decisions they make regarding Stakeholders. This is true even when stockholders are involved because they did not have a significant impact on decision-making in this study; hypothesis 1.3 was not supported indicating inclusion of owners did not change the balance. Winn and Keller (2001) propose a six-step model for decision-making in a multi-Stakeholder situation. Using a case study of Starkist Corporation, the authors work to establish a hierarchy of Stakeholders and propose a way to validate the developed hierarchy.

In expanding the application of Stakeholder salience to decision-making Tsai, Yeh and the research done by Wu (2016) show how the legitimacy of the union, as a Stakeholder, has an impact on business downsizing. Kivits (2011) develops a framework for incorporating it differently over time. The concept of making decisions based upon a changing relationship to Stakeholders is also discussed by Fassin (2009), Jawahar and McLaughlin (2001), Win and Keller (2001).

Jensen (2002, p. 237) summarizes it best:

> Stakeholder theory, on the other hand, says that managers should make decisions so as to take account of the interests of all the stakeholders in a firm. Stakeholders include all individuals or groups who can substantially affect the welfare of the firm

> not only the financial claimants, but also employees, customers, communities, and governmental officials, and under some interpretations, the environment, terrorists, blackmailers, and thieves.

Tying Together Lean and Stakeholder Theory

On a broad level work has been done to tie quality systems together with Stakeholder theory. Garcia-Benal and Ramirez-Aleson (2015) Mganga (2013), Susniene and Vangas (2005) discuss how Total Quality Management can optimize the relationship with all Stakeholders. Recognizing and addressing Stakeholder needs are elements of both the two major national organizational excellence awards, the Malcolm Baldrige National Quality Award and The Shingo Prize for Operational Excellence, as well as The International Organization for Standardization ISO 9004.

Asif et. al (2010) make the case that continuous improvement systems and Stakeholder recognition can be integrated to work alongside of each other. The conclusion of their research is that there are two sub-systems in all businesses: a technical sub-system (Lean) and a social sub-system (Stakeholders). The case studies show that how well the two sub-systems are designed in relationship to each other determines the organization's effectiveness. Boyle and Scherrer-Rathje (2009) did a study of 168 managers to find best practices in manufacturing. The authors do not use the term Stakeholder but imply it in their use of the term flexibility. Their conclusion is that the two need to be compatible to arrive at best practices. It is of note that they say the two are not inherently synergistic. Baarends (2015) mentions Lean and Stakeholder analysis together as a potential part of planning a project. This project planning model situates Stakeholder salience determination as a method of waste reduction for a project. The result is that critical Stakeholders are identified and strategies for approaching each can be identified.

Camilleri (2009) uses a case study of an Australian winery implementing Lean enterprise and Stakeholder recognition in order to reach a sustainable competitive advantage. A specific challenge addressed is the lack of analytical tools to address trade-off issues between environmental responsibility, a component of community salience, and competitive position obtained through Lean management. The case study illustrates how non-value added activities were removed if possible but if demanded by Stakeholders their influence was reduced. In a similar fashion Rebelo, Santos and Silva (2014) brought together Lean and Stakeholders in a study of small and medium Portuguese organizations. Through the use of key performance indicators and a balance of elimination of waste, dialogue among main Stakeholders within the framework of commitment to organizations competitiveness they developed a model for combining various quality initiatives for the organizations studied. Islam and Tura (2013), mentioned earlier, discuss both Lean and Stakeholder theory for better design of computer software. Smith and Synowka (2014) give an example of supply chain integration of Lean with Stakeholder Theory in value manufacturing and in adhesive manufacturing. The authors focus on how using Lean and recognizing Stakeholders will eliminate poor decisions by purchasing agents.

Healthcare systems appear to be fertile ground for merging Lean thinking and Stakeholder Theory. Grove et al. (2010) has been cited several times previously in both the Lean literature review and the Stakeholder Salience literature review. The impact of Lean has already been discussed in relationship to work done by Hayes et al. (2010), Radnor et al. (2012) and Robinson et al. (2012). In addition to the Lean aspect, the authors introduce Stakeholders in the context of engaging them in the work standards that can be improved by Lean. In addition, Feibert, Andersen and Jacobsen (2017) present a case study to show how decision criteria related to

Lean, as related to manufacturing industry, is one of the most important criteria that can lead to efficient and effective healthcare logistics in serving Stakeholders.

Some recent work has been done at the Massachusetts Institute of Technology (MIT) in tying together Lean, called enterprise architecture (EA), and Stakeholder Theory. Cameron (2005) introduces a value network model to benefit diverse Stakeholders. The research identifies Lean as a method to evaluate how strongly Stakeholders will support the implementation of aerospace designs. Grossi (2013) uses a case study of a supplier to the aerospace industry to develop a model for Stakeholder salience and a Lean organization. This model incorporates three tools: identification of Stakeholders, determining the salience of each Stakeholder, and developing a structure of the Stakeholder system. The case study demonstrates that using the model makes implementation of EA very practical. There is a recognition that waste in relationships between Stakeholders and organization can create "functional barriers." Through case studies Matty (2010) develops a framework to incorporate Stakeholder salience and value creation within the purchasing system of the Department of Defense. The conclusion is that Stakeholder salience can influence value creation within the purchasing process. The second conclusion is that the EA implementation was affected positively if Stakeholder salience was important. Sisto (2010) uses a case study of a sporting goods manufacturer to show how Stakeholder salience over time affects an EA. The two questions studied relate to how salience affects strategy, knowledge, information flows, processes, product, services policy and organization structure, and how salience context is changing. The author concludes that the more salient the Stakeholder and the more value delivered the more important the relationship is to the organization. The second conclusion is that as organizational context changes so do Stakeholder saliences.

Grossi (p.23) summarizes it well,

> Knowing who the enterprise's stakeholders are, their relevance, how they are structured, and why do they participate in the efforts of an integrated enterprise are key factors to properly define and implement a value creation process that conducts to a better implementation of Lean principles and practices.

While these have brought quality systems and Stakeholder Theory together, each has a tendency toward a strong focus on either Lean waste variants or Stakeholder salience. A measurement of the strength of this tendency is made by comparing the frequency of occurrence of salience criteria (interest, power, legitimacy, urgency and network) from Gardner et al. (1986), Mitchell et al. (1997) and Rowley (1997) with the frequency of occurrence of Lean waste (defects, over production, inventory, over processing, motion, transportation and delay) from Womack and Jones (2003) within the literature. The measurement is a count of each variable within every specific inspection set in order to keep the area for opportunity the same for direct comparison (Grant and Leavenworth, 1980, p. 262-263). In this case the variables are the salience criteria and the Lean waste variants. The inspection set is every 1000 words in a piece of literature. This provides an equitable method of comparing frequency in literature of different lengths. From a comparison of the frequency of salience words to the frequency of waste variants an approximate relationship is measured. For this research the ultimate goal is to incorporate Lean waste variants into Stakeholder salience. Therefore, the salience criteria frequency is assigned as the dependent variable (Y) and the waste variants frequency is assigned as the independent variable (X). A mathematical model of the relationship of independent variable to dependent variable is developed. The resulting correlation is best described as inversely exponential. The following mathematical model represents the relationship; Y =

$11.2e^{(-0.83\ X)}$. The strength of the relationship is described by $R^2 = 0.8578$, indicating a strong correlation (Warner, 2013, p. 364); the greater the frequency of Lean waste variants the less frequent the salience criteria. Not only is there an inverse relationship but it is inversely exponentially in nature.

Decision-making using Lean Waste and Stakeholder Salience

On a strategic level decision-making using quality management systems (Flynn et al., 1995) show a positive relationship between quality performance effects of the decisions and management incorporation of Stakeholders in the process. Asif et al. (2010) propose that a leaner infrastructure and enhanced connectivity with Stakeholders facilitates quicker decisions for all Stakeholders. The authors' research concludes with a proposition that integration of continuous improvement systems and Stakeholder recognition leads to greater flexibility for managers to make decision. Cabral et al. (2012) and Peek (2012) have shown how Lean and agile operations, which are often related to what has been defined as Stakeholder salience in this research, affect organizational decision-making. Oak (2013) takes this comparison a step further. The author establishes two exclusive concepts "Lean" and "Agile" with the choice between the two becoming more difficult as the process gets more complex. This position is not unusual; Peek (2012) and Zaki (2007) both used the same premise in their work. Using qualitative data from surveys establishes that senior managers face the challenge to sustain processes (meeting needs of various Stakeholders) while facing constraints. Of the eight hypotheses only two will be reviewed now (Oaks, p 85 & 87). The author proposes them in two parts each.

Hypothesis #4 (1) an ensemble of business processes can be regarded as a complex system, but (2) the mechanistic view of business processes does not sufficiently capture the complexity since it obscures the role of relationships which are crucial to determining the complexity of a system.

Hypothesis #5 (1) Complexity arises because of entanglements between processes and (2) addressing complexity requires reduction or removal of such entanglements.

Hypothesis #4 was proven but the caveat should be added that the survey participants perceived a mechanistic view as one that excludes some information. The author talks about how multiple Stakeholders add to the complexity. Hypothesis # 5 was considered valid. The inference for this research is that excluding information does not make for less complex systems and that removing entanglements will address complexity. Rephrasing this, ignoring information about the non-value added component of a Stakeholder requirement will not simplify a decision-making process, but addressing or removal of such impediments will simplify the decision-making process.

Finally, the work being done at MIT (Camerson, 2005; Grossi, 2003; Kim, 2011; Kochan & Cutcher-Gershenfeld, 2008; Matty, 2010; Sisto, 2010) is used to make decisions at the organizational level or the EA as they refer to it. For example, the phrase "impact driven lean decision-making" (Kim, 2011, p.33) is set in contrast to a balanced scorecard. But decision-making at the first-line manger level is different from decision-making at the strategic level. Hosseini, Hsiang, Leming, and Liu (2014) differentiate between day-to-day decision-making and strategic decision-making within the construction industry. Even so, Oak (2013, p. 230-231) could not find enough evidence to validate hypothesis #6 which stated that the level of

entanglements correlates to the challenge to sustain processes. This can be reduced to say that the challenge for first-line managers (those who would have low complexity and fewer entanglements) cannot be shown to be easier than that of senior managers.

At the operational level, applying Lean waste considerations and Stakeholder salience to purchasing decisions (Bidgoli, 2010; Cabral et al., 2012; Ho et al., 2012; Liu et al., 2013; Smith & Synowka, 2014; Wang, 2001) is one example of how these two are merged not only at a strategic level but also at an operational level. In this application the considerations of Lean waste and Stakeholder salience are initially applied to corporate level models but the ultimate decisions must be made by a purchasing agent. Healthcare is another example of using Stakeholders and Lean waste to improve decision-making at both strategic and operational levels. Hayes et al. (2010) show that poor assessment of Stakeholder salience could jeopardize Lean initiatives and have adverse effects on decisions regarding service. This work attempts to find a common language between the considerations given to customers in business and key Stakeholders of healthcare that allows a decision-maker at any level in the organization to apply Lean practices effectively.

Specifically at the operational level, Hekkala, Urquhart and Iivari (2009) study the impact of Stakeholder power on decision-making by project managers in eight international Scandinavian information systems projects. While most of the literature discusses Stakeholder power and how it needs to be understood, there are references to difficulty in decision-making due to previous knowledge of wastes that were generated.

Within the context of a traditional supervisor and operations employee Camarillo (2002) develops a non-quantitative method to show how agreement of what is non-value to first-line managers and the workers improves performance. This can be understood, if put in the context

of my research, to say that agreement on non-value added work allows the workforce to better interact with Stakeholders.

In similar research among managers in the Republic of Ireland in organizations with limited resources (like Lean environment) O'Dowd and Roche (2009) look at how first-line managers' decisions were impacted by Stakeholders. The authors do not use the phrase "Stakeholder salience" but instead use the term "integrated business partnerships." The term "exploratory partnerships" is used for the Stakeholder relationships where salience is not considered. The most applicable part of this study is the last two hypotheses (O'Dowd & Roche, p.23); the first three establish the positive perception of Stakeholder interaction with their organizations.

> Hypothesis 4: When the views of managers involved in integrated business and exploratory partnerships are compared, the disparity in expectations of future outcomes will be more pronounced than the disparity in assessments of current outcomes.
>
> Hypothesis 5: The expected future outcomes of managers involved in integrated business partnerships will be more balanced across stakeholder groups than pertain to the outcomes of current arrangements.

The criteria measured were… Business performance, Workforce productivity, Union members' understanding of business, Union members' support for change, Union members' flexibility in work practices, Speed of making decisions, Clarity of management's right to decide, Quality of strategic decisions, Effectiveness of implementation of strategic decisions, Quality of operational decisions, and Effectiveness of implementation of operational decisions. Hypothesis #4 was not supported by the research. The business criteria that did not support the

hypothesis are speed of decision-making and effectiveness of operational decisions. O'Dowd and Roche show that there is no advantage of integrated partnerships (Stakeholders) compared with exploratory partnerships (non-Stakeholder) in those two business criteria. This stands in contrast with eight other measured criteria which support the hypothesis. Hypothesis #5 was also not supported by the research. In an apparently strong union – management organization there is little expectation that all Stakeholders will be satisfied in either an integrated (Stakeholder-focused) partnership or an exploratory (non-Stakeholder-focused) partnership.

Pederson's (2010) survey of supervisors indicates little time spent on balancing Stakeholder needs. In fact, of the forty-nine responsibilities identified only five address non-internal Stakeholder needs. In addition, 20% of the responsibilities are exclusively focused on the subordinate workforce. The study indicated that supervisors did not spend the bulk of their time on tasks/responsibilities that they consider important (non-value added). The question could be asked whether some important Stakeholders who are important are not being given sufficient attention.

Reynolds et al. (2006) demonstrate how managers make day-to-day decisions differently when there are highly divisible resources (a non-Lean organization) and when there are indivisible resources (a Lean organization). The authors' fourth hypothesis is that managers who want to balance Stakeholder interests in an environment that has indivisible resources will attempt to take in outside influences to make their decision rather than just look at the decision as a singular event. Rephrased within the context of my research, managers look to more than just Stakeholder salience when making decisions in a Lean environment.

A follow up question to the research on decision-making among Stakeholders in a Lean organization is, "Will experienced managers make better decisions than inexperienced

managers?" Pieterse, Grobbelaar and Visser (2014) present a study of managers' choices on how to respond to potential risk in two hypothetical situations within the petrochemical industry in South Africa and the United States. The problems (one simple and one complex) are similar to common problems faced by decision-makers on a daily basis. The survey participants are given a choice of several responses. A panel of experts rated the answers from preferred to poor. There is no indication in the study of any association between level of experience and increase in correct answers with regard to risk management. This is true for both simple and complex systems. This study shows that it is equally difficult for experienced managers and inexperienced managers to make good decisions among Stakeholder needs.

Gaps in the Literature

Islam and Tura (2013), Oak (2013), Peek (2012), and Zaki (2007) try to show that Lean and agile (which may be perceived as Stakeholder management) are not the same. They fail to show that the two cannot work together. Only Islam and Tura provide some tie but that is only through literature search and not a research project.

In the same way, quality systems and Stakeholder theory are treated as two separate entities within the quality community; they are not brought together to synthesize a whole for first-line manager decision making. The Malcolm Baldrige National Quality Award and Shingo provide no model to address how to integrate Stakeholder Theory and Lean waste at the primary operational level. Tague (2005) and Mawbry (2005) both discuss the decision-making process and mention Stakeholders but direct the focus toward customer needs. Mawbry (p. 53) says that Stakeholders are those who are affected by decisions but does not include them as having impact on the decision. This means that the reader is given no help to figure out how non-value added

requirements should impact his/her decision making process. Rochetti (2016), in extoling the advantages of Hoshin Kanri planning, admits that other Stakeholders (like regulators, employees or a training department) complicate daily decisions made. The author's solution is to focus on corporate goals and not on other Stakeholder needs. Todorova (2013) supports the position that Lean tools are used for decision-making but does not discuss how waste elimination is specifically used and does not consider Stakeholders. Evans, et al. (2014, p. 35) point out that research is lagging to, "…provide managers with better understanding of the impact of decisions…" They propose that more work be done at the operational level within the quality management community.

Of those outside of the quality community who espouse Stakeholder theory, (Bettiol, 2013; Carter, 2015; Heugens et al., 2002; Jawahar & McLaughlin, 2001; Preble, 2005) there is little attempt to understand the non-value impact of Stakeholders. In the healthcare literature (Grove et al., 2010; Robinson et al., 2012; Stopper et al., 2011; Toussaint & Adams, 2010; Varvasovszky & Brugha, 2000) the perspective is that Stakeholders bring only value to the organization never non-value; win-win negotiation is often mentioned.

Harrison et al. (2010) discuss how an organization can allocate value to Stakeholders but do not consider how Stakeholders can contribute to, or force, non-value added work. The section on increased efficiency does not consider any possible waste generation by and for Stakeholders.

Another gap is limiting who decides what a non-value interaction with a Stakeholder is. For example, Baarends (2015) combines Lean and Stakeholder theory, yet, while recognizing that non-value added activity can adversely affect decision-making, he only allows the client to define what non-value added activity is. This limit is complicated by not having a standard Stakeholder analysis model. Ghosh (2015) draws the conclusion that first-line supervisors must

design work values in agreement with workers to improve decision-making. While laudable, it also excludes other Stakeholders. Camilleri (2009) allows for a wider sweep of determining waste but eliminates some Stakeholders (for example the community) from the assessment of non-value added activities.

It is common in surveys to fail to differentiate between first-line managers and other managers. That is a limitation of Clark et al. (2014) who did not differentiate between first-line managers and other more senior managers. In addition, their survey does not measure actual performance, but instead measures responses of MBA students who may or may not find it easier to embrace a hypothetical proposition. Their work is useful within the limited context of a controlled study of a very specific group of managers. The authors point out that further research could be done with higher level leaders but do not suggest that a study of front-line managers would be useful as a follow-up to see how they would react. While simulations are helpful, one might question if the participants would act the same way if their career was affected by the decisions made. In the same manner, Carrington and Combe's (2013) study of framing and vision priming is done only at the higher levels of management. They suggest a study to understand what is considered at the lower levels of managers/supervisors. These authors do not connect Stakeholder decision-making to Lean environments, much less to the interaction between Lean and Stakeholder interests.

Kim (2011) of MIT mentions the need for first-line managers and the need to incorporate them into the strategic planning process. Yet that research, as with all of the other MIT work, is focused only on higher levels within the organization. D. J. Nightingale (personal communication, June 8, 2016) is unaware of any work being done at the operational level to facilitate decision-making by first-line managers. (Nightingale is the advisor for four of the six

theses from MIT cited in this research). In a discussion with Chet Marchwinski of the Lean Enterprise Institute (personal communication June, 27, 2016) he knew of no other researcher working on bringing Lean and Stakeholder salience together on the operational level to facilitate decision-making by first-line managers. In the same way, Stakeholder theory and Lean have found a home in the environmental arena but at the strategic level (Epstein & Widner, 2011; Henisz et al., 2011; Hines et al., 2004; Reed et al., 2009) not at the operational level.

In the works that did mention first-line mangers, Pederson's is helpful but limited in scope to job shops in Northwestern Wisconsin. Halal (2001) shows that while Stakeholder partnerships are important, the low number of managers include Stakeholders and the formal evaluation of partnership. O'Dowd and Roche's (2009) work applies to how decisions are made by supervisors. It demonstrates that there is difficulty for supervisors in making good decisions within the context of organizations that are either Stakeholder-focused organizations (integrated partnerships) or non-Stakeholder focused (exploratory partnerships). The limitation is that it was conducted only in Ireland, among unionized organizations, and focuses on interaction between organizations and primarily one Stakeholder (unions).

Mankelwicz and Kitahara (2010) add a complication to their position that weak signals compromise decision-making. They say (p. 7), "However, because of the vulnerability to bias, management probably cannot at this point conduct a full and accurate analysis of Stakeholders, their saliencies, or the behavior of any premature coalitions among them." Siltaoja and Lähdesmäki (2015) appear to support that with their study that shows emotions have impact on Stakeholder analysis. An opportunity exists to see if that bias can be mitigated to some degree.

CHAPTER 3

METHODOLOGY

Overview

This research brings together both a positivist world view (Bryman & Bell, 2015; Grix, 2010) and a transformative world view (Babbie, 2014; Creswell, 2014). Using a survey instrument research method and quantitative analysis to answer the research questions the positivist aspect is addressed. The transformative aspect is addressed using a management tool for prioritization of factors used in decision-making. This chapter describes the quantitative methodology used to answer the research questions and determine if the hypotheses can be validated. The instrument is described, reliability of measurement is reviewed, and validity is discussed. Data sources, number, and characteristics are included. Variables are identified and assigned as either independent or dependent. Data collection, handling, and preparation for analysis are introduced. Analytical methods and limitations are presented in this chapter. The tool developed out of this research is discussed in chapter 5.

Introduction

The purpose of this exploratory sequential design research is first to quantify the qualitative data regarding decision-making using Stakeholder mapping via survey analysis looking for the presence of Lean variants in decision-making models that use or have an implied Stakeholder salience mapping. Creswell (2014, p. 156) states that a survey design provides

quantitative descriptions of attitudes or opinions. This analysis, along with associated theory, is the basis of the proposed program-level logic model (Yin, 2013) for decision-making. This model is tested by two organizations for practicality. The results of the analysis are presented in chapter 4 and a discussion of the results along with application in phenomenological studies is presented in chapter 5.

The study starts with quantitative data regarding perceptions of the use of Lean waste variants and Stakeholder salience criteria in decision-making processes obtained from the survey instrument. The data is analyzed via statistical tools to determine the presence and propensity of each. This data is descriptive in nature (Thompson, 2006; Warner, 2013) for the first analysis, and will then be used for inferential analysis within the limits defined. Variables and inferential limits will be defined in detail later.

The survey instrument was developed specifically for this research. The construct validation of the survey instrument is done using a Cronbach analysis of the instrument by a panel of experts, and a test-retest method is used to establish the reliability of the survey instrument (Warner, 2013). The instrument was administered and processed in accordance with Institutional Review Board (IRB) requirements.

Restatement of Problem, Questions and Hypotheses

Restatement of Problem

The problem for this study is the lack of an integrated day to day decision-making model for first line managers that takes into consideration the effects of common Stakeholder salience factors and Lean waste management within manufacturing and service organizations.

Restatement of the Research Questions and Hypotheses

1. Do Lean and Stakeholder theory share a common language?
2. Are the seven types of waste identified by Womack, Jones and Roos (1990) which are associated with Lean (Lean waste variants) found in decision-making models or methods used by organizations that perceive themselves as Lean and have multiple diverse Stakeholders?
3. Is the degree of inclusion of both Lean waste variants and Stakeholder salience criteria dependent on type of organization, organization size, position of the respondent within the organization, location of the organization or length of time since introduction of Lean management to the organization?
4. Is there a difference between the prominence of Lean waste variants and Stakeholder salience criteria in decision-making models used by organizations that perceive themselves as Lean and have multiple diverse Stakeholders?
5. Is there a viable Stakeholder model that incorporates all of the Lean waste variants?

To answer questions 3, 4 and 5 the associated research hypothesis statements are set up as follows:

1. There is no higher probability of finding any Lean waste variants than the probability of finding Stakeholder salience criteria in decision-making models or methods used by organizations that perceive themselves as Lean and have multiple diverse Stakeholders. (Proportions test; H_0: $P_S = Pj$ for s = influence, power, urgency, network, interest [attitude]; j = overproduction, delays, transportation, processing, inventory, motion or defects.).

Ho1: There is no statistically significant difference between Lean waste variants and stakeholder salience criteria in making decision.

Ha1: There is a statistically significant difference between Lean waste variants and stakeholder salience criteria in making decision.

2. There is no significant difference in the mean rankings of Lean variants and Stakeholder salience criteria for the following groups: organization type (manufacturing, service, non-profit or other); first-line managers vs. middle level managers or senior managers; small and medium size organizations vs. large organizations; or organizations which introduced Lean over 5 years ago (Experienced) vs. organizations which introduced Lean less than 5 years ago (Inexperienced). One final group is the location of the organizations represented by the respondents. (ANOVA analysis $\bar{\mu}_M = \bar{\mu}_N$, $\bar{\mu}_F = \bar{\mu}_B = \bar{\mu}_C$, $\bar{\mu}_L = \bar{\mu}_U$, $\bar{\mu}_E = \bar{\mu}_I$, and $\bar{\mu}_W = \bar{\mu}_O$).

   Ho2: There is no statistically significant difference of the average ranking between Lean waste variants and stakeholder salience criteria in making decision when organization type, respondent position, organization size, perceived experience, or geographic location are considered.

   Ha2: There is a statistically significant difference of the average ranking between Lean waste variants and stakeholder salience criteria in making decision, when organization type, respondent position, organization size, perceived experience, or geographic location are considered.

3. There is no significant difference between the larger and smaller of the average ranking of Lean waste variants and the average ranking of Stakeholder salience criteria found in decision-making models or methods used by manufacturing and non-manufacturing organizations located in Wisconsin and outside of Wisconsin. (Paired "t-test" analysis; H_o: $\bar{\mu}_{d\,(j-s)} = 0$ where $\bar{\mu}_d$ is the average of the differences between the larger average ranking and the smaller average ranking for j = Lean variants per sample and s = Stakeholder criteria per sample).

   Ho3: There is no statistically significant difference between the average ranking between Lean waste variants and Stakeholder salience criteria in making decision for all organizations.

   Ha3: There is a statistically significant difference between the average ranking between Lean waste variants and Stakeholder salience criteria in making decision for all organizations.

Variables

For the descriptive portion of the research the same sets of variables are used to address the first two hypotheses. For the first hypothesis the variables are in two different proportions. The first proportion estimate is that of the Stakeholder salience criteria previously used by Agle, Mitchell and Sonnenfeld (1999) in the sample of respondents. These criteria – influence, interest, power, network, and urgency – constitute the first set of variables. The second proportion estimate is that of the Lean waste variants in the same sample of respondents. These variants – over production, delays, transportation, processing, inventory, motion and defects – constitute the second set of variables. For the second hypothesis the same two sets of variables

are used. The difference is that ranking value is computed and used to compute a continuous number used for paired dependent variable.

For the inferential portion of the research there are five independent variables:

1) Type of organizations – manufacturing, service, non-profit, or some other.
2) Managerial level of the respondent – first-line managers, middle level managers, or senior manager.
3) Organization size – small and medium size or large organization.
4) Location of the organization – state or country.
5) Lean thinking maturity – perceived introduction to Lean over 5 years ago (Experienced) or introduced to Lean less than 5 years ago (Inexperienced).

In addressing hypothesis #2 the categories or levels of the independent variables are assigned the following single letter codes, with no letter used for two different variables. The codes are:

1) Organization type: M= Manufacturing, S=Service, N=non-profit, O=other.
2) Position within the organization: F=first-line manager, B=middle (between manager), C=senior manager (for C-suite and the like).
3) Organization size: L=over 500 (large organization), U=under 500.
4) Location: the postal abbreviation for that state is used.
5) Perceived experience with Lean: E=more than 5 years of perceived experience, I=less than 5 years of perceived experience (inexperienced).

The means of the two different sets of ranking values are used to address the second hypothesis are the dependent variables for the paired t-test inferential portion of this research.

The following is a chart of the variables included in this study; the source for all of the variables is the survey instrument.

Table 1

Variables

Variable name or description	Units	Range or levels	Accuracy	Easy or hard to ascertain	Experimental control	Other
Influence	Yes/No	Binomial	Perception	Hard	Independent/ Dependent / variable	Salience component
Interest	Yes/No	Binomial	High	Easy	Independent/ Dependent / variable	Salience component
Power	Yes/No	Binomial	High	Easy	Independent/ Dependent / variable	Salience component
Network	Yes/No	Binomial	Perception	Hard	Independent/ Dependent / variable	Salience component
Urgency	Yes/No	Binomial	Perception	Easy	Independent/ Dependent / variable	Salience component
Over production	Yes/No	Binomial	Attribute assessment	Easy	Independent/ Dependent / variable	Waste component
Delay	Yes/No	Binomial	Attribute assessment	Easy	Independent/ Dependent / variable	Waste component
Transportation	Yes/No	Binomial	Attribute assessment	Easy	Independent/ Dependent / variable	Waste component
Processing	Yes/No	Binomial	Attribute assessment	Easy	Independent/ Dependent / variable	Waste component
Inventory	Yes/No	Binomial	Attribute assessment	Easy	Independent/ Dependent / variable	Waste component

Variable name or description	Units	Range or levels	Accuracy	Easy or hard to ascertain	Experimental control	Other
Motion	Yes/No	Binomial	Attribute assessment	Hard	Independent/ Dependent / variable	Waste component
Defects	Yes/No	Binomial	Attribute assessment	Easy	Independent/ Dependent / variable	Waste component
Stakeholder salience mean	Unit-less	1 to 13	+/- 0.1	Easy	Dependent variable	Calculated from rank
Lean waste mean	Unit-less	1 to 13	+/- 0.1	Easy	Dependent variable	Calculated from rank
Organization type	Discrete	M, S, N, O	High	Easy	Independent variable	Used for ANOVA
Managerial level	Discrete	F, B, C	High	Easy	Independent variable	Used for ANOVA
Organization size	Discrete	L, U	+/- 10%	Dependent on ownership	Independent variable	Used for ANOVA
Organization location	State (or country)	Any one of 50+	High	Easy	Independent variable	Used for ANOVA
Perceived experience of the organization	Discrete	E, I	Moderate	Easy, perception of respondent	Independent variable	Used for ANOVA

Research Instrument

The survey administered to manufacturing, service, and other organizations located in Wisconsin and outside of Wisconsin is designed in accordance with the guidelines set by Bryman and Bell (2015), Creswell (2014), Fowler (2013) and Thompson (2006). In general a survey is used to directly collect data regarding some behavior that is not recorded in another way (Bryman & Bell, 2015; Fowler, 2013; Rea & Parker, 2014). For this research a survey is used because there are several different methods that people can use to make decisions and there is no universally accepted metric of decision-making components (Krajewski, Ritzman &

Malhotra, 2007; McShane, & Von Glinow, 2010; Nelson & Quick, 2013). A survey is used because it is a relatively quick and inexpensive way to collect data from a convenience sampling of the entire population. It also allows for quantitative data collection that can be used for statistical analysis and, hence, limited inferential conclusions. Each survey respondent is considered a sample data point of the entire population of managers in organizations within manufacturing, service, and other organizations located in Wisconsin and outside of Wisconsin. Not clustering respondents all from the same organization and treating that as one data point may be perceived as disproportionally representing some organizations because that particular organization may have multiple data points. Decision-making is individual in nature even if a preferred method is employed by the organization (Nelson & Quick, 2013); and in light of Box and Narasimhan's (2010) conclusion that random samples are not really random, the threat of auto-correlation is considered limited. The survey represents a cross-sectional sampling done December 2016. Data is collected through electronic mailing of the instrument and Survey Monkey in order to have as broad a sampling as possible within the expense limits.

The instrument was based upon Agle, Mitchell and Sonnenfeld's work designed (1999) but adapted specifically for this research with regard to first-line managers. The first three questions establish if this respondent meets basic criteria for survey. There is a question regarding Lean implementation. There is a question regarding Stakeholder recognition. In order to identify for removal all of those respondents who respond to only one Stakeholder, a third question is included to insure the respondent recognizes multiple Stakeholders. Organizations which are not Lean or which are not concerned about Stakeholders are outside the scope of this research. The next two questions are designed to collect data regarding the variables previously mentioned. Question #4 requires a binary response to inclusion into the decision-making process

of each of the first twelve variables found in Table 1. This is designed to allow computation of proportions for addressing the first hypothesis. Question #5 requires a rating of 1 to 8 for each of the eight most critical variables into the decision making process. The same survey as mentioned previously asked each respondent to rank in priority from most important to least important the Lean waste variants and the Stakeholder salience criteria they use when making a typical operating decision. The respondents were allowed to give equal rankings to more than one criteria or variant. The data points are clustered by Lean waste and Stakeholder salience (giving two sets of data). The value for each variant or criteria is considered as a data point (giving 12 data points). This allows computation of means to address the second hypothesis. The final five questions are demographic questions to collect categorical data in order to do an Analysis of Variation (ANOVA) with the data collect in question #5 to address the third hypothesis. Question #6, "which of the following best describes your organization: manufacturing, service, non-profit, or other?" This establishes three categories for ANOVA. Question #7, "what best describes your position within the organization; first-line, middle level or higher in management?" This yields three categories for the ANOVA. Question #8, what is the organization size; over 500 employees or under 500 employees? This sets up the two categories for the ANOVA. Question #9, "where is your organization located?" This provides two categories for the ANOVA (within Wisconsin and outside of Wisconsin). Question #10, "what year did your organization start practicing Lean management?" The maturity of the respondent is placed into two categories for the ANOVA. Any respondent that perceives Lean has been practiced for less than 5 years is put into the category of "Inexperienced" and those practicing more than 5 years are put in the category of "Experienced." Succinct definitions or guidelines

are given with each question to facilitate understanding and an accurate response to the questions.

The construct validation of the survey instrument is done using a panel of experts (Warner, 2013) who, by reviewing the survey in Appendix B, determined that the instrument meets the validation criteria. The panel participants were chosen to represent the quality community, the academic community, and/or those who have developed surveys in the past. In particular, some members were chosen because of their familiarity with IRB requirements. The following is a list of the expert panel:

Larry Brown – Adjunct faculty, University of Central Missouri (ASQ member).

Jay Deuster –Training Manager, Little Rapids Corporation (survey developer).

Thomas Dlugopolski – independent consultant (ASQ member).

Jeff Guinot– Senior Product Quality Engineer, TRW Corporation (Lean expert).

Angela Huenerfuth – Siemens Corporation (survey developer).

David Lange – Consultant, Optima Corporation (Lean expert).

The survey instrument was reviewed by the panel along with a summary of the purpose for each question and explanation of each variable. After two iterations the final survey instrument was content validated. The final survey was approved by the Indiana State University Institutional Review Board (Project Title: [996678-1] Incorporating Lean non-value added variants into first-line manager's decision making, approved February 21, 2017).

A construct consistency test was done to determine if the respondent could differentiate between options that relate to Stakeholder salience and options that relate to Lean waste. A

panel of managers from ASQ section 1206 was asked which variables referred to Lean management and which related to Stakeholder priority. For computation, a "1" is assigned to the variables perceived as Stakeholder salience and a "2" is assigned to the variables perceived as Lean waste. A Cronbach analysis of the results shows a strong correlation between all participants that the first five variables are related to Stakeholder salience, and the last seven variables are related to Lean waste, Cronbach's alpha = 0.9887. The results are interpreted according to the work done by George and Mallery (2010) where >0.9 Excellent, > 0.8 Good, > 0.7 Acceptable, > 0.6 Questionable, > 0.5 Poor, < 0 .5 Unacceptable. Table 2 shows the relationship among the participants in perception of variables related to Stakeholder salience or Lean waste. The rows and columns are labeled with the last name of the participant.

Table 2

Construct Consistency

	Bozzacco	Santy	Dlugopolski	Guinot	Wise	Anderson	Jorgensen
Bozzacco							
Santy	0.845						
Dlugopolski	1.000	0.845					
Guinot	0.845	1.000	0.845				
Wise	1.000	0.845	1.000	0.845			
Anderson	1.000	0.845	1.000	0.845	1.000		
Jorgensen	1.000	0.845	1.000	0.845	1.000	1.000	

A test-retest method is used to establish the reliability of the survey instrument (Warner, 2013, p. 906). The expert panel of people who are members of ASQ section 1206 local leadership participated twice in the survey as if they were first-line managers. The reliability is

measured by the similarity of responses by the participants. There are two measures of reliability; probability of salience or waste inclusion in decision-making, and mean ranking of salience and waste variants. An average ranking of salience criteria and an average ranking of waste variant is calculated for each response. Because each person responded twice a paired "t" could be made (Warner, 2013, p. 966). Because the paired "t" measures same group of participants the null hypothesis is that there should be no difference between the first response and the second response, H_o: $\bar{\mu}_d = 0$. Minitab is used to do the calculations. The results show that there is no statistical evidence to indicate a difference between each person's first response and their second response. An average probability of choosing a salience criteria and an average probability of choosing a waste variant are measure the same way. Minitab is used to do the calculations. The results show that there is no statistical evidence to indicate a difference between each person's first response and their second response (Salience probability p-value = 0.133, waste probability p-value = 0.170, salience ranking value p-value = 0.187, and salience ranking value = 0.299).

In the literature chapter a correlation is made between the mention of Lean waste variants and Stakeholder salience criteria in the literature reviewed that mention both variants and criteria. That strong inverse relationship might lead one to believe that a Type I error could be made more easily than a Type II error in the survey results for the first and second hypotheses of this research. Hence, for those hypotheses of this research a more challenging alpha (α) was chosen prior to initiating the survey. For this research there is a possibility of either probability being significantly greater than the other; therefore, a two-tailed test method is used. A common choice for researchers is to use Sir Ronald Fischer's choice of 0.05 for an acceptable alpha risk (Warner, 2014, p. 89). Since 0.05 is a common α, for this research a two-tailed α of 0.01 is

chosen, thus increasing the confidence interval and making it more difficult to have sufficient evidence to disprove the first hypothesis or the third hypothesis. For the second hypothesis there is no preconceived bias towards any relationship between independent variables and dependent variables. Secondly, the dependent variables are means and tend toward a centrality. Accordingly, a 95 percent confidence interval was chosen for the ANOVA analysis to determine if there is sufficient evidence to support the third hypothesis.

Data Discussion

Data Collection

The following is the sampling protocol for the Qualtrics survey:

1. Develop a list of candidates.

2 Contact the candidates from the ASQ to determine willingness to participate.

3. Set response deadline; anticipated to be 2 weeks from initial contact of participants.

4. Provide survey instrument with cover sheet (including IRB notifications) to potential participants.

5. Follow-up when deadline is approaching and has passed to insure that potential participants are aware of the survey.

6. Repeat steps 1 – 5 for other professional societies.

7. Collect completed surveys returned to researcher for analysis.

The following is the case study protocol:

1. Develop a list of candidates from ASQ (primary list will be from local North East Wisconsin section of ASQ).

2. Contact potential candidates to explain the research and ask for their participation.

3. Secure consent to proceed with the case study.

4. The principle researcher meets with each participating organization: one meeting with each organization.

5. Members of the participating organization brainstorm Stakeholder priorities and assign preliminary salience value. Lean waste activities are identified and then tool for considering both when making decisions by the first-line managers is developed.

6. Decision-making tool will be left with the organization and included in the research dissertation.

Prior to administering the survey and after validation was complete a pilot study (Bryman & Bell, 2015; Creswell, 2014) was conducted among the leadership of ASQ section 1206 to improve the format and confirm the content validation of the instrument. As with the reliability analysis each participant was asked to answer the questions as if they were a first-line manager. For the full study a convenience sampling process was used (Babbie, 2014; Creswell, 2014). The sources of the samples are people who are part of organizations known to the researcher, such as the local American Society for Quality section 1206 (400 members), the continuous Improvement Consortiums (approximately 450 members), Lean Division of ASQ (approximately 500 members) and Organizations participating in the case studies (15 people). The initial net of potential candidates was not limited by any constraints. Because of the broad nature and potential application of this research the population is not specifically identified. Therefore, there is no attempt to determine a representative number of samples for margin of error (Brynman & Bell, 2015; Creswell, 2014). This, of course, means that the results are not

generalizable to the entire population. This also allows for the sampling process to proceed while working to obtain samples. (This research may not be high on priority lists of many managers and, hence, is easy to ignore since the researcher does not have any Stakeholder power salience over the candidates). In order to motivate responses, all participants were entered into a drawing for one of 10 donations of $10 to the charity of their choice. There are 85 respondents; 48 responses are usable the rest are not complete or did not meet the criteria of being in an organizations that perceives itself as Lean and has multiple diverse Stakeholders. The typical organizations represented by the respondents is: 37 Manufacturing, 8 Service, 3 Non-profit; 15 First-Line Manager, 23 Middle Manager, 10 Senior Manager; the organization size, 22 over 500 employees, 26 under 500 employees; the experience with Lean, 32 over 5 years, 16 under 5 years; and eight different states and/or countries represented.

Bryman and Bell (2015) and Creswell (2014) discuss response bias. Thompson (2006) and Warner (2013) state that bias will impact any correlations and inferential conclusions. The difficulty in addressing any bias due to non-respondents is that the population for this research is not clearly innumerate. Any respondent who did not complete the survey or completed it in error is removed from the population. The limitations established in this research, the research questions, and the hypotheses set the initial boundaries for correlation (Warner). The responses to the first three questions determined the acceptability of the survey from a particular person. The respondent must have indicated that both Lean and Stakeholder awareness is part of their organization. In addition, the respondent must have indicated three unrelated Stakeholder groups in order for the survey to be used for analysis. This serves to identify any bias in recruitment (Warner) towards either Lean or Stakeholder theory. Nevertheless, there is some assumption of accuracy, honesty and no influence by another person from the survey sampling. Because the

survey is administered through electronic means, it is impossible for the researcher to personally verify all response.

Data Preparation

The surveys that did not indicate both Lean and Stakeholder awareness were removed from the sampling. Any incomplete surveys were removed from the sampling. The samples were recorded on an Excel spread sheet by the researcher for further analysis. All samples were assigned a number that did not give any indication of the identity of the respondent. Salience probability is calculated by summing the total number of "Y" (yes) responses for each salience criteria from the included surveys and dividing that number by the total possible salience criteria (which is five for each respondent). The Lean waste variant probability is calculated by summing the total number of "Y" (yes) responses for each Lean waste variant from the included survey and dividing that number by the total possible salience criteria (which is seven for each respondent). Respondents ranked salience criteria and waste variants in the response to question #5 from 1 to 8; where 1 is the most important criteria used in decision-making and 8 is the least important criteria in decision-making. The average response includes only a total of seven salience criteria and waste variants. Hence, for the ranking values only the top seven ranked criteria or variants are used for calculations. Those rankings were then turned into ranking values by subtracting from 8. Hence, a 1 ranking is given a 7 value and a 7 ranking yields a 1 value. A salience ranking value for each respondent is computed by averaging the ranking values of the five salience criteria. A waste ranking is computed by averaging the ranking values of the seven waste criteria. In preparation for paired "t" test analysis the difference between each salience criteria ranking value and each waste variant ranking value is computed.

In addressing hypothesis #2 the categories or levels of each independent variable are recorded as single letters, with no letter used for two different variables. This is done to reduce any error when transposing data to analytical programs. When entering data into the Minitab program some combination of variables is done to keep from having some very small groups. Because of the limited number of responses from service and non-profit organizations, those two groups are combined into one group for the ANOVA analysis. Because of the limited number of responses from outside of Wisconsin, all of the responses from location not in Wisconsin were labeled as others.

Stakeholder salience values are computed in the case studies. First a preliminary Stakeholder salience value is computed by assigning values to each potential salience criteria from a qualitative ranking. For example, significant criteria, moderate criteria, or low criteria may be assigned. The higher the ranking the greater the value assigned for each criteria. If three levels are used, significant criteria are assigned a "2" (the highest number), all moderate criteria are assigned a "1", and any low criteria are assigned a "0." The average of all assigned numbers for any one organization or process is the salience value ($S_{pr} = \sum_1^5 Cx\ /5$), where S_{pr} is the preliminary salience value and Cx is the assigned number for each criteria rank. For example, one organization may indicate that interest, power and legitimacy are significant criteria while urgency is moderate, and network is low. The salience value for this organization is 7.

All data is saved on a removable drive that is only accessible by the researcher. The data spreadsheet is attached. The spread sheet does not contain the combinations mentioned above for hypothesis #2 where all independent variables identified in the survey are recorded just as indicated in the surveys.

Data Analysis

A binominal "Z" test is used to determine if the difference between the two proportions is statistically significant (Hayden, 2008). Box, Hunter and Hunter (1978) point out that it is acceptable to do a normal approximation of a "Z" value if the sample size is 5 or greater when the proportion is not near an extreme of unity or zero; if not, a minimum of 30 is best. For this research each survey respondent has 5 opportunities to choose a salience criterion and 7 opportunities to choose a Lean waste variant. There are 48 surveys used, therefore, the sample size for salience criteria proportion is 240, and 336 is the sample size for the Lean waste variants proportion. Both are large enough to apply the "Z" test for proportions. The computed "Z" value for a null hypothesis is the difference in the probabilities of salience criteria and that of Lean waste variants, divided by an estimate of a normal variation (Warner, 2013).

The following formula (Levine, 2006) used for computation of the "Z" value difference. $Z = |Ps - Pj|/\sqrt{(P_A\,(1 - P_A\,)(1/n_{\,s} + 1/n_j\,)}$, Ps = Salience probability, Pj = Lean waste probability, P_A= Average probability of salience and Lean waste, n_s = salience sample size, and n_j = Lean waste sample size. Absolute value of the difference in probabilities was established to remove the need to be concerned with + or – signs. Because the research is looking for difference and either tail is considered, the need for determining positive or negative "Z" is unnecessary. The computed "Z" value is compared to the maximum allowable value for "Z" at the chosen error (Z = 2.57, at $\alpha/2 = 0.01$).

Five separate one-way ANOVA are done to see if the average ranking of Lean waste variants used in decision-making and the average ranking of Stakeholder salience criteria used in decision-making are affected by the category or level of each independent variable (Hayden,

2008; Thompson, 2006; Warner, 2013). From the demographic questions included in the survey previously mentioned one-way ANOVA's are completed for the following. Organization type is the first ANOVA. There are two categories or levels of this variable: manufacturing, and all others which comprise those identifying their organization as service, non-profit or other. Respondent's position within the organization is the second. There are three categories or levels of this variable: first-line manager, middle level manager, or higher in management. Organization size is third. There are two categories or levels of this variable: over 500 employees, or under 500 employees. Respondent's perception of years of organizational experience with Lean is the fourth. There are two categories or levels of this variable: an organization that has been practicing Lean for less than 5 years is put into the category of "Inexperienced," and those practicing more than 5 years are put in the category of "Experienced." Location is the fifth ANOVA. There are two categories for this analysis: within Wisconsin or outside of Wisconsin. A separate one-way ANOVA approach was chosen to minimize the inflation risk of the Type I error (Hayden, 2008; Thompon, 2006; Warner, 2013). In addition, the goal of this research is not to develop a mathematical model of the optimum independent variables levels to achieve a balance of Lean waste variants and Stakeholder salience criteria but to understand the variation within each independent variable, and using that understanding of variation to determine where best to apply the model developed. Another consideration is that any mathematical model is limited due to the non-random sampling.

There are certain assumptions that must be made in order to use ANOVA (Box, et al., 1978, Hayden, 2008; Warner, 2013). The dependent variable must be quantitative and the independent variable must be qualitative, i.e. categorical. For this research; the average rankings are an infinite number of possibilities between 1 and 7. First assumption: each observation

should be independent of the others. Because the categories are mutually exclusive and each respondent is independent of the others (see the earlier discussion about Box & Narasimhan, 2010), this assumption is achieved. Second assumption: the samples are taken randomly. As mentioned earlier, the sampling method was a convenience sampling. Both Hayden (2008) and Warner (2013) allow for convenience sampling and stipulate that the only issue with violation of this assumption is the extent of inference. This is recognized and included as a limit to this research. Third assumption: the dependent variable must be normally distributed. The Anderson-Darling test for normality is used. The specific results are discussed in chapter 4. For those analyses that do not satisfy the assumptions for ANOVA a Mood's Median analysis was done. Mood (1954) and later Jett and Speer (2016) demonstrate that testing a null hypothesis of two samples when the shapes of the distributions are not necessarily the same can be done using median analysis. The basis for this comparison is a chi square analysis of number of observations that vary from a calculated overall median. Fligner and Rust (1982), and Hettmansperger and Malin (1975) used Moods Median to test for difference between two medians without making assumptions of the shapes of the distribution of the population. Mood's Median has been used in surveys where distributions are not necessarily normal (Akman, Yazici, Mishra & Arifogl, 2005).

For this hypothesis the independent variables have two categories or levels. The α chosen for this analysis is 0.05, therefore, the Type I risk is greater than for the proportions test in hypothesis 1 but give more confidence that the ANOVA comparisons are between, or among, comparably distributed categories.

Effect or Eta squared analysis (Thompson, 2006; Warner 2013) is not computed because the mathematical model of optimum conditions is not being calculated.

A paired "t-test" analysis is done between the larger of the average ranking of Lean waste variants used in decision-making and the average ranking of Stakeholder salience criteria used in decision-making for each respondent and the smaller of the same two numbers. This is used because the two rankings are in pairs by each respondent, not independent of each other (Anderson Sweeney, Williams, Camm, & Cochran, 2014; Hsu & Lachenbruch, 2008; Thompson, 2006). This is similar to the application of paired "t-test" by Benzion, Cohen, Peled and Shavit (2008) in decision making by news vendors. Box et al. (1978), Diehr, Martin, Koepsell and Cheadle (1995) and Warner (2013) set assumptions for using paired "t-test." These are a normal distribution of the differences, variations independent of mean, and the variations computed from independently distributed means. In addition, when sample size is small the paired "t-test" is preferred (Diehr, et al, 1995, Hsu & Lachenbruch, 2008, de Winter, 2003). The survey design and data preparation insures independence of each individual data pair. The difference between the average ranking of Lean waste and Stakeholder salience criteria are computed for each respondent. First, a test of normality of the differences data shows that (insert the results of the normality test).

The computed paired samples "t" value for a null hypothesis is the mean difference in the salience criteria ranking and the ranking of Lean waste variants divided by an estimate of a standard error (M_d/SE_{M_d}), (Anderson, et al., 2014; Warner, 2013). The mean difference is computed by dividing the sum of the differences by the total number of samples $\sum d/N$ where "d" is the difference in rankings and "N" represents the number of samples (Anderson, et al., 2014; Warner, 2013). The standard error is computed by computing the square root of the variation divided by the number of samples $\sqrt{{s_d}^2/N}$ where s_d^2 = variation (Anderson, et al., 2014; Warner, 2013). Variation is computed by summing the square of the gap between each

individual difference and the mean of the differences, $s_d^2 = \sum(d - M_d)^2/(N-1)$, (Anderson, et al., 2014; Warner, 2013).

A convenient method of comparing means is to compute the allowable confidence interval using an assigned "t" value that is dependent upon the degrees of freedom in each sample (Box et al., 1978; Hayden, 2008; Warner, 2013). With the assigned error of 0.01, a 99 percent confidence interval needs to be calculated. The "t" value is from Warner (2013) using df = N-1.

The data entered into the Excel spreadsheet and ranking values were computed by the spreadsheet. The variables are copied directly from the data preparation spread sheet into a Minitab worksheet. Each variable is titled the same as the column heading to prevent any misinterpretations of the results. All graphical analysis is done by Minitab. The computation for proportions test, normality, "F" test, ANOVA and paired "t' test are done using Minitab computer program.

For the case studies the salience adjustment factor is computed by dividing the total of the waste activities per stakeholder by 2 times the total waste activities for all stakeholders ($f_x = \sum_1^{n_x} Wx \,/2 \sum_{x=1}^{n_T} Wx$). In this empirically developed formula f_x is the adjustment factor for a particular Stakeholder, Wx is a waste activity, n_x is the total waste activities for a particular Stakeholder, n_T is the total number of waste activities for all Stakeholders. For example, if a particular Stakeholder has 2 waste activities and the total for all Stakeholders is 10, then that Stakeholder has an adjustment factor of 0.1 (which is 2 / 20 = 0.1).

The final salience value is computed by multiplying the preliminary value by 1 – adjustment factor to arrive at the salience value ($S_x = S_{pr}\, X\, (1 - f_x)$). In this formula S_x is the

final salience value, S_{pr} is the preliminary salience value composed of the sum of the values for all five criteria. For example, a preliminary salience value of 4 with an adjustment factor of 0.1 has a final salience value of 3.6 which is 0.9 times 4. This empirically developed formula shows a percentage reduction based upon the amount of waste contributed by the Stakeholder. The more waste generated the greater the percentage of reduction in salience value.

The results are discussed in chapter 4 and conclusions along with case studies are discussed in chapter 5.

CHAPTER 4

RESULTS

Overview

This chapter reports on the data from the survey administered during this research. There is graphical analysis followed by statistical analysis. The assumptions made in chapter 3 to allow for the statistical analysis chosen are tested. The test statistics are addressed in the order of the hypothesis. The ANOVA analysis uses Bonett's computation of the p-value because of size of the data base. Each hypothesis is then addressed separately with a conclusion based upon the data analyzed. Because of the broad nature and potential application of this research the population is not specifically identified, but there is recognition that the number of respondents used is small compared to the potential population. Therefore, there is no attempt to determine a representative number of samples for margin of error, the inference statistics are not generalized, and a mathematical model of the optimum level or categories of independent variables is not done. This means, of course, that the results are not generalizable to the entire population.

Descriptive Statistics

Graphical Analysis

The first analyses are graphical representations of the data. A Pareto chart is used to graphically represent the relationship among the 12 salience criteria and waste variants. All salience criteria and waste variants are selected in at least one survey response. Transportation waste is found the least in 33.3 percent of the surveys and urgency salience criteria is found the most in 87.5 percent of the surveys in the data base. The four salience criteria are in the top six categories on the Pareto chart (see figure 5); giving some indication of elevated importance of these criteria over the waste variants. In addition, a Pareto chart of just salience criteria and a Pareto chart of just Lean waste variants show the most chosen within each group (figure 6 and 7).

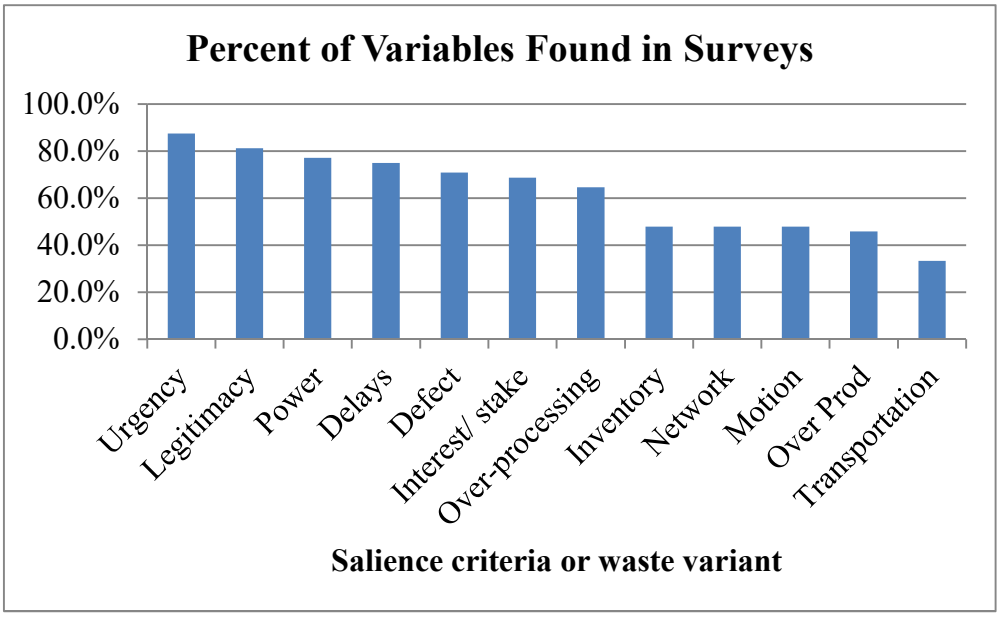

Figure 5. Percent of Variables Found in Surveys

A Second analysis is a series of comparisons using box plots. Each ANOVA category in Minitab is either the variable or the combination of variables as identified in chapter 3. For example manufacturing (M) is represented as one "X" value and all others/non-manufacturing (N) represented as another "X" for one chart. The ranking, either salience criteria or waste variant, constitute the "Y" value. The only comparisons that show an apparent difference are the

ranking of Lean waste variants by organization type and by position. The median ranking value of Lean waste by manufacturing organizations is 3.67 where 2.50 is the median ranking value for non-manufacturing organizations. The median ranking of Lean Waste by senior managers is 4.0 where 2.0 is the median ranking value for first-line managers. All box plots are found in Appendix C. One final box plot was made comparing all salience ranking

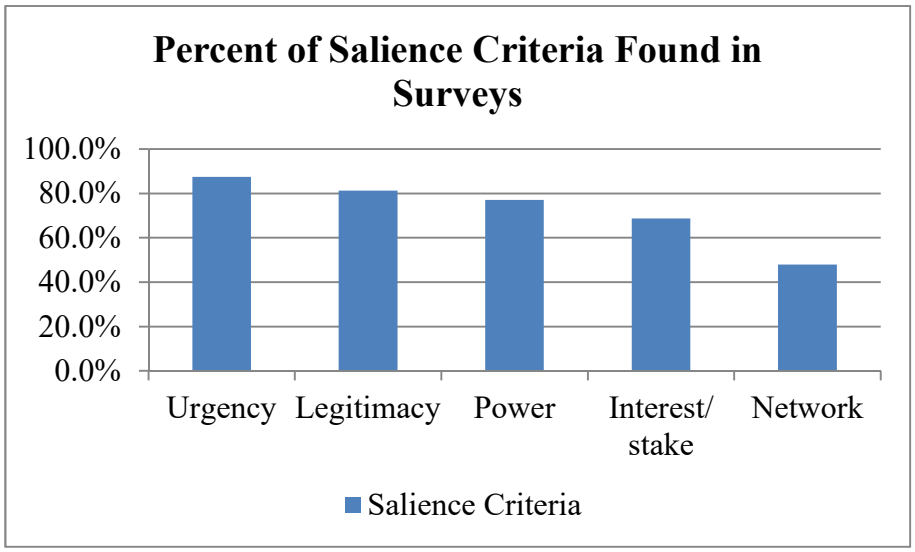

Figure 6. Percent of Salience Criteria in Surveys

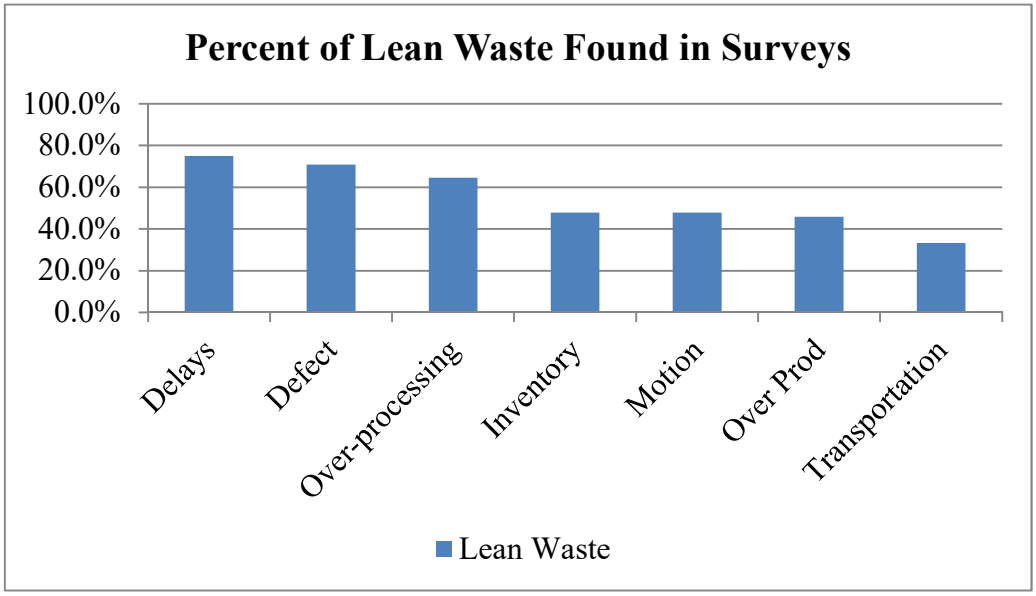

Figure 7. Percent of Lean Waste in Surveys

values and all waste ranking values. The median ranking value of salience at 5 appears to be significantly higher than the median ranking value of waste at 3.17. This box plot is found in Appendix D.

Assumption Analysis

Two of the hypotheses require normality of data, therefore, normality was tested. Anderson-Darling was used because it is an empirical cumulative distribution function of the data with the distribution expected if the data were normal. If this observed difference is sufficiently large particularly at the high and low values of the distribution, the test will reject the null hypothesis of population normality. The superiority of evaluation at the extremes is the reason the Anderson-Darling was chosen in Minitab. An alpha of 0.05 was assigned as the critical value for determining if the distributions are or are not normally distributed. To do a meaningful ANOVA analysis the dependent variable must be normally distributed (Box, et al., 1978, Hayden, 2008; Warner, 2013) and have similar distributions. When p value is greater than the alpha of 0.05 the null hypothesis of normal distribution fails to be rejected and the alternative hypothesis that the distributions are not normal is not accepted. Waste ranking values by organization type ($p = 0.400$ for manufacturing and $p = 0.228$ for non-manufacturing) are normally distributed. Waste ranking values by organization size ($p = 0.476$ for large organizations and $p = 0.187$ for small organizations) are normally distributed. Waste ranking values by location ($p = 0.422$ for Wisconsin and $p = 0.431$ for all others) are normally distributed. Waste ranking values by experience ($p = 0.614$ for experienced and $p = 0.907$ for inexperienced) are normally distributed. For position when the three categories (first-line managers, middle level managers, and senior managers) are kept separate the senior manager category ($p =0.4$) is not normally distributed. But when senior management and middle level

management groups are combined, then the resulting group is normally distributed. This does not adversely affect the analysis and the conclusion since the focus of this research is to compare first-line managers to other mangers. When combined, waste ranking by position ($p = 0.491$ for first-line managers and $p = 0.576$ for higher level managers) is normally distributed.

The analysis of distributions for salience ranking values does not support the null hypothesis of non-normal distribution in some cases but does support it in other cases. Combining middle level managers and senior level managers as done for waste ranking values gives normal distributions ($p = 0.141$ for first-line managers and 0.332 for higher level managers). Salience ranking values by organization type are problematic ($p < 0.005$ for non-manufacturing) because there are some "outliers." This data is analyzed using Mood's Median. Salience ranking values by organization size ($p = 0.302$ for large and $p = 0.096$ for small) are normally distributed. Salience ranking values by location ($p = 0.301$ for organizations outside of Wisconsin and $p = 0.05$ Wisconsin organizations) are normally distributed. Salience ranking values by experience ($p = 0.352$ for experienced and $p = 0.197$ for inexperienced) are normally distributed.

The matter of distribution shapes is likewise challenging for some comparisons but not for others. Comparison of variances between the two groups for each ANOVA analysis remaining (comparison of salience ranking values by organization type uses Mood's Median test not ANOVA) shows most distributions are similar. Variation of waste ranking by organization type (var = 1.834 for manufacturing and var = 1.074 for non-manufacturing, Bonett p-value = 0.068), by position (var = 1.660 for first-line managers, var = 3.519 for higher managers, Bonett p-value = 0.122), by location (var = 3.112 for Wisconsin organizations and var = 2.561 for all others Bonett p-value = 0.749), and by experience (var = 1.635 for experienced and var = 3.607,

Bonett p-value = 0.457) all indicate similar distributions. Only waste ranking value variation by organization size (variation = 4.265 for large organizations and variation = 1.835 for small organizations, Bonett p-value = 0.032) is problematic. Because of the closeness of the means ($\bar{\mu}$= 3.317 for small organizations and ($\bar{\mu}$= = 3.704 for large organizations) ANOVA is still applied. For salience ANOVA analyses the position, as combined, (var = 1.556 for first-line managers and var = 1.214 for higher level managers, Bonett p-value = 0.677), organization size (var = 0.070 for large organizations and var = 1.836 for small organizations, Bonett p-value = 0.105), organization location (var = 1.331 for Wisconsin organizations and var = 1.159 for all other organizations, Bonett p-value = 0.863) , and experience (var = 1.115 for experienced and var = 1.430 for inexperienced, Bonett p-value = 0.809) all show similar distributions. A summary of all normality, ANOVA and Moods Median tests are in table .

Table 3 ANOVA

Analysis Summary

Variable Identification		Normality test	"F" test	ANOVA		Moods Median	
Independent	Dependent	P-value	P-value	Adj. Mean Square	P-value	Median	P-value
M	Salience Rank Value	0.556				4.8	
N	Salience Rank Value	<0.005				5	0.65
M, N	Waste Rank Value	0.400	0.068	6.938	0.127		
Error	Waste Rank Value	0.228		2.867			
F,S	Salience Rank Value	0.141	0.677	0.049	0.849		
Error	Salience Rank Value	0.332		1.318			
F,S	Waste Rank Value	0.491	0.122	2.959	0.322		
Error	Waste Rank	0.576		2.954			

Variable Identification		Normality test	"F" test	ANOVA		Moods Median	
Independent	Dependent	P-value	P-value	Adj. Mean Square	P-value	Median	P-value
	Value Salience Rank Value						
L, U		0.302	0.105	0.015	0.917		
Error	Salience Rank Value	0.096		1.319			
L, U	Waste Rank Value	0.476	0.032	3.395	0.289		
Error	Waste Rank Value	0.187		2.944			
W, O	Salience Rank Value	0.301	0.863	0.987	0.388		
Error	Salience Rank Value	0.050		1.298			
W, O	Waste Rank Value	0.431	0.749	0.627	0.650		
Error	Waste Rank Value	0.422		3.005			
E,I	Salience Rank Value	0.352	0.809	0.681	0.474		
Error	Salience Rank Value	0.197		1.304			
E,I	Waste Rank Value	0.614	0.457	1.856	0.434		
Error	Waste Rank Value	0.907		2.978			

To do a meaningful paired “t-test” the differences between the two data sets must be normally distributed. The data of differences appears to be bi-modally distributed. There is one peak indicating higher rankings for waste variants and another peak indicating higher rankings salience criteria. For two reasons this data is be treated as normal. First, treating the data as normal incorporates both apparently different distributions into one which gives a high variance. This pushes any decision toward not rejecting the null and not seeing a difference where one

does not exist. The second, is that the "α" chosen for the third hypothesis is 0.01 meaning that the p-value for the normally test (p = 0.032) is better than critical value.

Test statistics

The first test statistic is the Z test for the probability that Lean waste variants are considered as often as Stakeholder salience criteria in the decision-making process. The proportion of Lean waste variants identified as part of the decision-making process for all the data base is 0.550 and 0.725 is the proportion of salience criteria identified as part of the decision-making process. The calculated Z value is 4.41 (p-value = 0.000) which is greater than the assigned significant value of 2.57. This indicates that the difference between the proportions is more than can be expected if they were from the same system. Therefore, there is sufficient evidence to reject the null hypothesis. Three additional analyses for each management level are performed. The calculated Z value for first-line managers is 1.12 (p-value = 1.12) which is less than the significant value for Z; calculated value for middle level mangers is 3.32 (p-value = 0.001) which is greater than the significant value for Z; and the calculated Z value for senior managers is 3.02 (p-value = 0.003) which is greater than the significant value for Z.

The second test statistics are nine ANOVA comparisons. There are no comparisons that have sufficient evidence of difference between the means of the dependent variables based upon changing the independent variables compared to a 0.05 alpha level. There is no evidence that the mean of the waste ranking value for manufacturing organizations is different from the mean of the waste ranking value for non-manufacturing organizations. The adjusted sum of squares for the error (131.899) is greater than the adjusted sum of squares for the factors (6.938) with a p-value greater than the assigned α (p-value = 0.127). Therefore, there is insufficient evidence to

reject the null hypothesis. There is no evidence that the mean of the salience ranking value for senior managers (that is, the combination of senior managers and middle level managers) is different from the mean of the salience ranking value for first-line managers. The adjusted sum of squares for the error (60.632) is greater than the adjusted sum of squares for the factors (0.048) with a p-value greater than the assigned α (p-value = 0.849). Therefore, there is insufficient evidence to reject the null hypothesis. There is no evidence that the mean of the waste ranking value for senior managers is different from the mean of the waste ranking value for first-line managers. The adjusted sum of squares for the error (135.878) is greater than the adjusted sum of squares for the factors (2.959) with a p-value greater than the assigned α (p-value = 0.322). Therefore, there is insufficient evidence to reject the null hypothesis. There is no evidence that the mean of the salience ranking value for large organizations (over 500) is different from the mean of the salience ranking value for small organizations. The adjusted sum of squares for the error (60.661) is greater than the adjusted sum of squares for the factors (0.048) with a p-value greater than the assigned α (p-value = 0.917). Therefore, there is insufficient evidence to reject the null hypothesis. There is no evidence that the mean of the waste ranking value for large organizations is different from the mean of the waste ranking value for small organizations. The adjusted sum of squares for the error (135.442) is greater than the adjusted sum of squares for the factors (3.395) with a p-value greater than the assigned α (p-value = 0.289). Therefore, there is insufficient evidence to reject the null hypothesis. There is no evidence that the mean of the salience ranking value for organizations located in Wisconsin is different from the mean of the salience ranking value for organizations located outside of Wisconsin. The adjusted sum of squares for the error (59.664) is greater than the adjusted sum of squares for the factors (0.987) with a p-value greater than the assigned α (p-value = 0.388).

Therefore, there is insufficient evidence to reject the null hypothesis. There is no evidence that the mean of the waste ranking value for organizations located within Wisconsin is different from the mean of the waste ranking value for organizations located outside of Wisconsin. The adjusted sum of squares for the error (138.210) is greater than the adjusted sum of squares for the factors (0.627) with a p-value greater than the assigned α (p-value = 0.650). Therefore, there is insufficient evidence to reject the null hypothesis. There is no evidence that the mean of the salience ranking value for Lean experienced organizations (over 5 years) is different from the mean of the salience ranking value for Lean inexperienced organizations. The adjusted sum of squares for the error (60.000) is greater than the adjusted sum of squares for the factors (0.681) with a p-value greater than the assigned α (p-value = 0.474). Therefore, there is insufficient evidence to reject the null hypothesis. There is no evidence that the mean of the waste ranking value for Lean experienced organizations is different from the mean of the waste ranking value for Lean inexperienced organizations. The adjusted sum of squares for the error (136.981) is greater than the adjusted sum of squares for the factors (1.856) with a p-value greater than the assigned α (p-value = 0.434). Therefore, there is insufficient evidence to reject the null hypothesis. The only Mood's Median test for salience ranking values by organization type indicates that there is insufficient evidence to indicate that the median of manufacturing organizations (4.8) is different from the median for non-manufacturing organizations (5.0) with a p-value greater than the assigned α (p-value = 0.650). Therefore, there is insufficient evidence to reject the null hypothesis.

The final test is the paired "t" test comparing overall salience ranking values with overall waste variant ranking values. There are a total of 48 pairs in the comparison giving 47 as the degrees of freedom. At α = 0.01 the critical T value is under 2.75 (most reference table only go

to 29 degrees of freedom). The computed T value is 4.28 which is significantly higher than the critical value (p-value = 0.000). The null hypothesis is that there is no significant difference between the larger and smaller of the average ranking of Lean waste variants and the average ranking of Stakeholder salience criteria in decision-making models or methods used by manufacturing and non-manufacturing organizations located in Wisconsin and outside of Wisconsin. The alternate hypothesis is that there is a significant difference between the larger and smaller of the average ranking of Lean waste variants and the average ranking of Stakeholder salience criteria. Therefore, null hypothesis is rejected and that alternate hypothesis is accepted meaning there is sufficient evidence that the mean of salience (4.854) is significantly greater than the mean of waste (3.326). The magnitude of the difference is such that the decision to treat the differences as normally distributed appears to be substantiated.

Statistical Decisions

Hypothesis #1

There is no higher probability of finding any Lean waste variants than the probability of finding Stakeholder salience criteria in decision-making models or methods used by organizations that perceive themselves as Lean and have multiple diverse Stakeholders. (Proportions test; H_0: $P_S = Pj$ for s = influence, power, urgency, network, interest [attitude]; j = overproduction, delays, transportation, processing, inventory, motion or defects).

Ho1: There is no statistically significant difference between Lean waste variants and stakeholder salience criteria in making decision.

Ha1: There is a statistically significant difference between Lean waste variants and stakeholder salience criteria in making decision.

Because the calculated Z value is 4.41 (p-value = 0.000) which is greater than the assigned significant value of 2.57($\alpha = 0.01$), there is great confidence that there is sufficient evidence to reject the null hypothesis and hold accept the alternative hypothesis tenable for the population.

Hypothesis #2

There is no significant difference in the mean rankings of Lean variants and Stakeholder salience criteria for the following groups: organization type (manufacturing, service, non-profit or other); first-line managers vs. middle level managers or senior managers; small and medium size organizations vs. large organizations; or organizations which introduced Lean over 5 years ago (Experienced) vs. organizations which introduced Lean less than 5 years ago (Inexperienced). One final group is the location of the organizations represented by the respondents (ANOVA analysis $\bar{\mu}_M = \bar{\mu}_N$, $\bar{\mu}_F = \bar{\mu}_B = \bar{\mu}_C$, $\bar{\mu}_L = \bar{\mu}_U$, $\bar{\mu}_E = \bar{\mu}_I$, and $\bar{\mu}_W = \bar{\mu}_O$).

> Ho2: There is no statistically significant difference of the average ranking between Lean waste variants and stakeholder salience criteria in making decision when organization type, respondent position, organization size, perceived experience, or geographic location are considered.
>
> Ha2: There is a statistically significant difference of the average ranking between Lean waste variants and stakeholder salience criteria in making decision, when organization type, respondent position, organization size, perceived experience, or geographic location are considered.

Because the contributions to adjusted sum of squares due to error are greater than that of the contributions by factors, with the resulting p-values of all of all the ANOVA analyses above

the assigned alpha value ($\alpha = 0.05$); therefore, there is insufficient evidence to reject the null hypothesis, and so it must stand and reject the alternative hypothesis**.**

Hypothesis #3

There is no significant difference between the larger and smaller of the average ranking of Lean waste variants and the average ranking of Stakeholder salience criteria in decision-making models or methods used by manufacturing and non-manufacturing organizations located in Wisconsin and outside of Wisconsin (paired "t-test" analysis; H_o: $\bar{\mu}_{d\,(j\text{-}s)} = 0$ where $\bar{\mu}_d$ is the average of the differences between the larger average ranking and the smaller average ranking for j = Lean variants per sample and s = Stakeholder criteria per sample).

> Ho3: The differences between the larger of the ranking of Lean waste variants and stakeholder salience criteria ranking in making decision for all organizations and the smaller of the two is not statistically significant for all organizations.
>
> Ha3: The differences between the larger of the ranking of Lean waste variants and stakeholder salience criteria ranking in making decision for all organizations and the smaller of the two is statistically significant for all organizations.

Because the computed T value is 4.28 ($\alpha = 0.01$) is higher than the critical T value ≈ 2.75 ($\alpha = 0.01$, p-value = 0.000), there is sufficient evidence to reject the null hypothesis and hold accept the alternative hypothesis tenable for the population.

CHAPTER 5

DISCUSSIONS, CONCLUSIONS, FUTURE WORK

Overview

This chapter contains the presentation and discussion of the decision-making instrument that was developed as a result of the findings of the hypothesis analysis done in chapter 4. This is applied to two specific decision-making situations faced by two different organizations. The steps followed in the decision-making process are outlined. This is followed by the two case studies where this was implemented. Conclusions are drawn to answer the research questions. Finally, there is a brief section on some potential future research work that can be done built upon this platform.

Decision-making Instrument

In light of the results of the research questions an instrument has been developed to balance the Stakeholder salience criteria with the Lean non-valued considerations of Stakeholders. The process consists of the following steps:

1. Identify the process or organization being studied. Set boundaries on the organization. Identify the first-line manager who is making daily decisions (see Figure 8).

2. Identify all Stakeholders and their stake in the process or organization. As a guide, Stakeholders can be viewed in one of four categories: customers, suppliers, overseers or contributors.
3. Assign preliminary salience value to each Stakeholder. The formula is shown in the methods section, using the five criteria identified in this research: interest or attitude toward the process, power to impose the Stakeholder's will, legitimacy of claims by the Stakeholder, urgency of the Stakeholder, and how well developed the network of similar Stakeholders. Those with highest importance to the participants were given the most value. The attempt is to keep the computations simple for the participants; hence, for these case studies high = 2, medium = 1, or low = 0 are assigned. This prevents possible long discussions of every salience criteria for each Stakeholder.
4. Identify activities that appear to be waste. Figure 10 can be used for recording results of steps 4 through 9. This may be done by the immediate supervisor of the first-line manager identified or by an entire group of managers.
5. Survey all legitimate Stakeholders regarding each apparent wasteful activity. Give only two choices: this is waste or this is not waste. It might help if each would answer the question, "Would the customer pay for this activity if it was a separate line item in the bill for the product?"
6. Any activity that is not considered value-added by anyone other than the Stakeholder who is requesting the activity is considered a waste.
7. The wastes for each Stakeholder are totaled. The waste for all Stakeholders is totaled.
8. A salience adjustment factor is computed for each Stakeholder considering the amount of waste identified in step 7. As previously stated in the methodology section

that factor is computed as follows. The total of the waste activities per stakeholder is divided by 2 times the total waste activities for all stakeholders ($f_x = \sum_1^{n_x} Wx \,/\, 2\sum_{x=1}^{n_T} Wx$). Originally the formula did not include the multiplier of 2 in the denominator. While working with organizations in the case studies during the process, they felt the adjustment factor was too severe. The modified formula reflects a more tempered adjustment for waste.

9. The preliminary salience value is adjustment by the factor to arrive at a final salience value. The preliminary value is multiplied by 1 – adjustment factor to arrive at the salience value ($S_x = S_{pr}\ X\ (1 - f_x)$). Details are in the methodology sections.
10. The salience values are used to make a Stakeholder map. A rectangle is drawn representing the boundary of the organization or process. Each Stakeholder is drawn as a rectangle attached to the organization usually grouped as suppliers, overseers, contributors, or customers (see figure 11). The visual representation of salience is done by the length of shared perimeter around the process outline. The greater the salience the more shared perimeter between the Stakeholder and the process.
11. The Stakeholder map with guidance regarding Stakeholder priorities which include salience and Lean non-value variants is now available for first-line managers to be used in decision-making.

The above process is summarized in the following swim-lane diagram (see figure 8). The entities which have responsibilities are listed on the top line. The step numbers of the process, matching the steps listed above, are in left hand column from top to bottom, the first step being on top. The cell location of each step indicates who is responsible for accomplishing the action.

Step	Senior Managers	Process Owner	Owner's Supervisor	Stakeholders
1	Identify process and owner			
2		Identify Stakeholders and what is their stake		
3		Assign preliminary salience values		
4		Identify possible waste		
5				Complete waste survey
6			Confirm waste	
7 & 8		Compute salience adjustment factor		
9		Adjust salience value		
10		Complete Stakeholder map		
11		Use map to make decisions		

Figure 8. Balancing Salience and Waste

The following figures may be helpful in completing each step. Figure 9 can be used for step one through 3. Additional lines can be added for each Stakeholder.

Stakeholder	What is the stake (interaction)?	Interest (attitude)	Power	Legitimacy	Urgency	Network	Total
							0
							0
							0
Total							0

Comments on the priority	Use "H" represents a high value. "M" represents a medium value. Total is sum of "H"*2 plus sum of "M"*1

Figure 9. Preliminary Salience Identification

Figure 10 can be used to record and identify potential waste. More lines can be added for each Stakeholder.

Stakeholder	Over-production	Delay	Transportation	Over-Processing	Inventory	Motion	Defects	Comments on how the waste is demonstrated in the interaction with the specific stakeholder	Total Non-value Added	Preliminary Salience Value	Waste Adj. Factor
									0		0
									0		0
									0		0
									0		0
									0		0
Total									0		

Comments on the priority					*quick waste adjustment formula…* (Preliminary salience value per stakeholder) X 1- (total waste activities per stakeholder/[2 times the total waste activities for all stakeholders])

Figure 10. Waste Identification and Adjustment Factor

Figure 9 and figure 10 can be placed side by side in an Excel spread sheet for ease of use.

Figure 11 is a generic Stakeholder map for this process. The organization/process under consideration is placed in the center. Each stakeholder is a separate box adjacent to the organization/process. The categories may be changed to fit the realities of the organization/process. The visual representation of adjusted salience is done by the length of shared perimeter around the process outline. A larger adjusted salience means more shared perimeter between the Stakeholder and the organization/process.

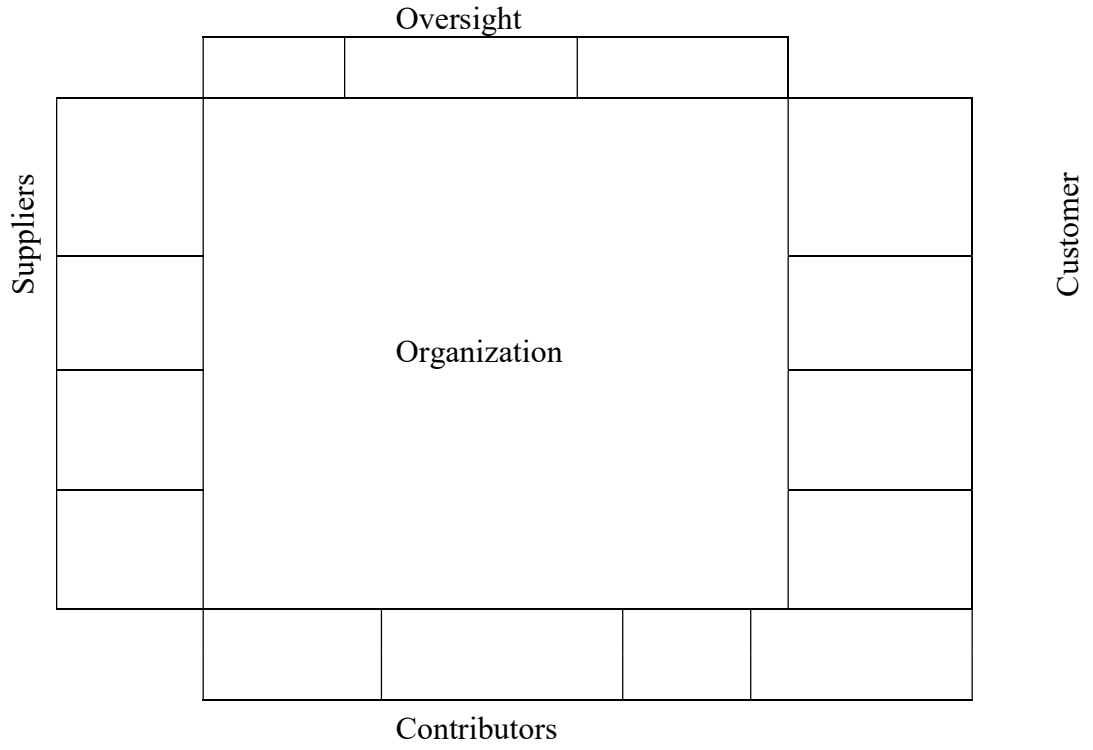

Figure 11. Generic Stakeholder Map

Case Studies

Little Rapids Case Study

Little Rapids Corporation is a manufacturer of paper and paper-based products. Little Rapids Corporation is a privately held company with headquarters in Green Bay, Wisconsin

which is engaged in the manufacturing of disposable paper products for healthcare and beauty organizations. Annual sales are approximately $400M. There are three divisions, all located in Northeast Wisconsin. Sales are made both through representatives and directly to distributors. First, there is a paper-making division which takes pulp and turns it into large rolls of paper. This paper is either used by another division or is sold to outside customers. For example, this paper is used by an external customer to make coffee filters. Second, a printing division takes rolls of paper and prints designs on them. This paper is also either used by another division or sold to an outside customer. For example, this paper is used by an external customer to wrap rolls of toilet tissue. Third, a converting division turns paper into disposable products for the beauty industry or the medical industry. An example of a beauty product is the paper used by barbers as neck protection during a haircut. The healthcare subdivision makes various disposable products for hospitals and physicians' offices sold throughout the United States and Canada.

The third division is the focus of the first case study. This division employs approximately 100 operators, operating 24 hours per day, 5 days per week in three shifts. If demand requires, the machines can operate on weekends. The workforce is represented by a union. Because there are many paper converting businesses in Green Bay offering hiring bonuses, the employees of Little Rapids are constantly changing. All manufacturing occurs in one facility which also houses support functions; one of these is the training department which is the focus of this case study. The organizational structure is classical hierarchical. The training department reports to the Continuous Improvement Department head and not the manufacturing head.

The converting process is relatively straightforward and the machines are not too complex. Large rolls of paper are cut and folded into disposable products of various sizes and plies for the health and beauty industries. There are over 1500 different types of products made on 40

different pieces of equipment. The equipment varies in complexity from easy one-person monitoring to a more complicated three-person operation. It is expected that an employee will master three families of machines to reach the maximum per hour pay.

During 2016 it became evident that there was difficulty in meeting the requirements to train new and existing employees in a timely manner. Due to the turnover of employees, training is a constant need. Little Rapids participated in the survey conducted for this research and participated in application of the decision-making model in the context of prioritizing Stakeholder requirements in the training process.

The training department consists of one management person, one Specialist, and various trainers. Trainers are union represented people who are temporarily assigned from the manufacturing department to the training department. The trainers receive direction and assignments from the Specialist. The trainers assist with the development of training material, present the training material to the trainee, demonstrate proper methodologies, and evaluate the trainee's progress for the purpose of qualifying the trainee as competent. Training usually takes three months to complete and consists of 8 hours of training per day, 5 training days per week. Training takes place during the first shift of the day (7 A.M. to 3 P.M.). The Specialist handles all of the administrative responsibilities and interaction with other departments. (For example, any problems with the computer based training aids will be handled by the Specialist coordinating with the Information Systems department.)

A time study analysis, done prior to this research, shows much wasted time in the process. Stakeholders were requesting resources from the training department that prohibited training of employees. One example is when trainers were removed from the department for one or two

days during the training process and returned to the manufacturing department because they were needed to fulfil customer orders. The waste in the training process caused the average time to completion of training to stretch to 6 months or more which created personnel gaps in come departments.

In this case the Specialist and his immediate supervisor met and, with assistance, identified all of the Stakeholders in the training process. The method of identification of Stakeholders is to brainstorm the potential Stakeholders. For this case the participants identified departments within the organization as potential Stakeholders. The list was reduced to those who have some legitimate salience. Hence, the list became more manageable. The Stakeholders fit neatly into one of four categories; customers, suppliers, overseers and contributors. The customer is the Manufacturing department. The suppliers are not as evident. The Production Planning department determines which employees are to be trained and when they are to be trained so they are supplying the Training department, but the trainee is also a supplier of natural skills and abilities. There are three additional Stakeholders who oversee the training process and completeness as well as the cost of training. These are Accounting, Quality and Safety. There are contributors to the training process. The training staff is one Stakeholder. In addition the Design Engineering department, which provides technical information for training, and the Information Systems department, which maintains the hardware used in training, are also contributing Stakeholders.

The Stakeholders are then assigned preliminary salience values based upon the five criteria. In determining the value of each salience criteria for each Stakeholder the Specialist and supervisor did a nominal attribute assessment as the following: no application, moderate application (M), or highly applicable (H). A computed sub-total of salience is made by assigning

1 point for each “M” and 2 points for each “H”. The results of this assessment are found in Appendix F.

The Specialist provided a list of the daily resource allocation decisions. The Specialist’s supervisor identified activities that appeared to be waste. These apparent waste activities were evaluated by all Stakeholders. They were asked if any of the activities adds value to the process. A binominal attribute assessment for each apparent waste activity was done by all Stakeholders: “Yes”, or “No”. The results are recorded in Appendix G. All Stakeholders were then asked which activity identified as a potential waste is really non-value added. Any activity considered value added was identified and the results of all Stakeholders are recorded as waste (See Appendix H where “X” is assigned to the value-added activity by the Stakeholder). All non-value activities are transferred to the first spread sheet (Appendix I shows that section of the spread sheet).

Once all waste activities for each Stakeholder were recorded then a total of all waste activities were made and a factor for adjusting salience value is computed for each Stakeholder. That factor is the total waste for each Stakeholder divided by twice the total of all waste for this process. The salience of each Stakeholder was adjusted based upon their waste activities. For example, the Stakeholder named “planning” has a preliminary salience value of 1+ 1+ 1+ 1= 4 where there are four criteria all with medium values. There are two wastes identified for this stakeholder, and there are a total of nine wastes identified for all Stakeholders. The waste adjustment factor for planning is 2/ (2*9) = 0.11. The final salience value is the preliminary value adjusted, 4*(1- 0.11) = 3.6. Appendix J has all of the data for Little Rapids recorded.

Stakeholders are prioritized based upon their adjusted salience and placed on a map of Stakeholders. The adjusted salience of each Stakeholder is the length of shared perimeter of the organization (See Appendix K). In this case the consideration of waste affected the prioritization of Stakeholders. Both the Safety department and the Production Planning department had a preliminary salience value of 4. After considering waste the Production Planning department salience was reduced to 3.6, placing them below the Safety department in priority.

Generac Case Study

Generac is a publically held producer of electronic generators used worldwide. The organization is made up of several manufacturing facilities with headquarters in Waukesha, Wisconsin. Annual sales are approximately $1.44B. The facility in Oshkosh Wisconsin is the focus of this case study. This facility employs approximately 500 people working two shifts five days per week. Generac is a manufacturer of electrical generation equipment for both large customers and small consumers. The focus of this organization is design and assembly of the generators. All parts are purchased from outside suppliers. Generac participated in the survey conducted for this research and participated in application of the decision-making model in the context of prioritizing Stakeholder requirements in the training process.

One initiative of the Oshkosh facility is the improvement of the operation of the maintenance department. This is the focus of the case study. The department works two shifts but the only supervisor works the first shift. The department uses SAP for maintenance work order management; although there may also be separate spread sheets or management tools that are being used.

In this case study a team consisting of the Maintenance Manager, her immediate supervisor, two production managers and technicians met to identify all of the Stakeholders in the maintenance planning process. Brainstorming is the method of identification of Stakeholders. For this case the participants identified Stakeholders by types of interactions with the maintenance department. This required several iterations. The team compiled a list of thirty-six Stakeholders. This list was consolidated to 18 by grouping Stakeholders that share the same interaction and preliminary salience values, making the list more manageable. The final list of Stakeholders was divided into four categories; customers, suppliers, overseers and contributors. There are five customer groups: Safety repairs, critical repairs, projects, non-critical repairs, and office requests. There are six suppliers: parts suppliers, contractors, tools service providers, equipment manufacturer service, mechanics (who supply the labor), and others. There are three additional Stakeholders who oversee the maintenance process: Accounting, Quality and Senior Management. Safety, Project Management, Information Technology and a combination of Mechanical Engineering and Industrial engineering all comprise the contributor category.

The Stakeholders are then assigned preliminary salience values based upon the five criteria. In determining the value of each salience criteria for each Stakeholder the team did a nominal attribute assessment as the following: no application, moderate application (M), or strong application (S). A computed sub-total of salience is made by assigning 1 point for each “M” and 2 points for each “S”. The results of this assessment are found in Appendix L. The surprise is that Senior Management had the highest salience value - - not the manufacturing department which would seem to be the customer.

The Maintenance Manager identified for the team activities that appeared to be waste. These apparent waste activities were evaluated by the team to determine if each activity adds

value to the process. This process required several iterations. A binominal attribute assessment for each apparent waste activity was done by all Stakeholders: “Yes”, or “No”. The results are recorded in Appendix M. The list is then reduced to those activities that are considered non-value added by all Stakeholders. This is recorded as waste and transferred to the first spread sheet with an “x” in the appropriate column and row (See Appendix N). To assist in understanding the process those potential wastes that are not deemed non-value are also recorded on the spread sheet but as “o”.

With all waste activities for each Stakeholder recorded a total of all waste activities is made. Each Stakeholder that has a waste contribution has a factor for adjusting salience value. That factor is the total waste for each Stakeholder divided by twice the total of all waste for this process and final salience values are computed for each Stakeholder. For example, the Stakeholder named “manufacturing critical processes repairs” has a preliminary salience value of 1+2+1+2+1 = 7. That Stakeholder has two significant salience criteria and three moderate criteria with one waste identified. There are a total of four wastes identified for all Stakeholders. The waste adjustment factor for manufacturing critical processes repairs is 1/ (2*4) = 0.13. Hence, the final salience value of 7*(1- 0.13) = 6.1. Appendix O has all of the data for Generac recorded.

Stakeholders are prioritized based upon their adjusted salience and placed on a map of Stakeholders. The adjusted salience of each Stakeholder is the length of shared perimeter of the organization (See Appendix P). In this case the consideration of waste affected the prioritization of Stakeholders. Several Stakeholder groups had the same preliminary salience value. The inclusion of waste differentiates the final salience values for several groups. One Stakeholder, manufacturing critical processes repairs, would often submit a maintenance request without first

considering if the work required was set-up work that the operator should be doing. After the Stakeholder mapping the organization realized that the Mechanic's time has an equal salience to the critical repairs requests. Therefore, prior to submitting a maintenance request the operator must confirm that they first verified that the work is not set-up.

Research Questions

1. Do Lean and Stakeholder theory share a common language? While some instances of commonality can be found the two continue to be perceived as separate approaches to adding value. In the literature there is an 82 percent probability of finding a salience criteria and a 58 percent probability of finding a waste variant in common literature. In fact, there is an inverse relationship between finding Lean waste words and Stakeholder salience criteria. It is described by $Y = 11.2\ e^{(-0.83\ X)}$, where Y is the salience criteria frequency X is the waste variants frequency. The strength of the relationship is described by $R^2 = 0.8578$, indicating a strong correlation (Warner, 2013, p. 364). The survey results indicated that approximately 95% of the respondents share waste variants and salience criteria in their common language.
2. Are the seven types of waste identified by Womack, Jones and Roos (1990) which are associated with Lean (Lean waste variants) found in decision-making models or methods used by organizations that perceive themselves as Lean and have multiple diverse Stakeholders? Yes, all of the seven types of waste are used by organizations that perceive themselves as Lean in decision-making. There is a significantly larger proportion of salience criteria (72.5%) used than waste variants (55%) when all managerial positions are considered. First-line managers use approximately the same amount of salience criteria (74%) but more waste variants (66%). Middle managers and senior managers, while using

approximately the same amount of salience criteria as first-line managers (72%) use fewer waste variants (52% for middle managers, 46% for senior managers).

3. Is the degree of inclusion of both Lean waste variants and Stakeholder salience criteria dependent on type of organization, organization size, position of the respondent within the organization, location of the organization or length of time since introduction of Lean management to the organization? No, there is no evidence that there is a difference in inclusion of waste variants or salience criteria due to any of these factors.

4. Is there a difference between the prominence of Lean waste variants and Stakeholder salience criteria in decision-making models used by organizations that perceive themselves as Lean and have multiple diverse Stakeholders? Yes, there is sufficient evidence to indicate that salience criteria are more prominent in the decision-making process than waste variants. In ranking of importance salience criteria were given 45% more weight than waste variants when making a decision when there are conflicting demands and limited resources.

5. Is there a viable Stakeholder instrument that incorporates all of the Lean waste variants? Yes, waste variants can be quantified and used to compute salience values ($S_{pr} = \sum_1^5 Cx\ /5$), for each Stakeholder. By including their waste contribution as an adjustment factor ($f_x = \sum_1^{n_x} Wx\ /2\sum_{x=1}^{n_T} Wx$) more realistic salience value ($S_x = S_{pr}\ X\ (1 - f_x)$) can be identified. These values can be used to develop a Stakeholder map. That map can be used to make decisions regarding priorities and organizational activities. The two case studies show there are Stakeholders who, while having significant salience create opportunities for waste and the instrument adjusts their salience accordingly.

Summary

It is not unusual to find in literature and in practice a combination of Lean waste and Stakeholder salience (priorities). While both are considered, it is not unusual to find greater emphasis on Stakeholder salience. The potential problem of not having balance of the two is that exclusive focus on waste reduction may alienate Stakeholders and exclusive focus on Stakeholder satisfaction may reduce awareness of waste. In either case value can be lost by the organization as demonstrated in the two case studies. Stakeholder mapping using adjusted salience values provides a visually enhanced balanced approach to Lean waste and Stakeholder salience allowing the decision-makers know the impact of both, hence facilitating more precise input to their decision-making process. More precision in the decision-making process can lead to results that create more value for the organization.

Future Work

Future work can be done with more participants. Because it is difficult to determine which organizations in the major bodies contacted meet both the requirements of working on implementing Lean processes and working to satisfice multiple Stakeholders, it is difficult to determine the exact potential population for the survey in the future. One approach would be to have all those who responded to the ASQ 2016 Global State of Quality survey, who indicted that more than customers impact the definition of quality for the organization complete the survey.

With the rejection of the first null hypothesis several other questions arise. Why do organizations who espouse Lean take some waste variants into consideration in decision-making significantly favor Stakeholder salience criteria? This is not just customer salience but all Stakeholders salience is considered more often than waste variants. Why do first-line managers include the use of waste variants and salience criteria while higher level mangers do not? Does this create some disconnect in decision-making within organizations? This research did not find

factors that contribute to more emphasis on salience criteria or on waste variants. Future work to broaden the categories might reveal some contributing factors.

Expanding the survey to medical organizations located in Great Britain would be a good next step because of their apparent emphasis on both Stakeholders and Lean operations (Brandao de Souza, 2009; Grove, et. al, 2010; Jones & Mitchell, 2006; Latino, 2004; Robinson, et. al, 2012; Williamsson, Eriksson,& Dellve, 2016).

The Stakeholder salience values computed for the two organizations in the case studies are empirical, and future work should be done to confirm or modify the computation of the salience adjustment factor and the salience adjustment value.

The Stakeholder map developed for two manufacturing organizations could be applied to a service organization. In addition, it would be interesting to see if separating non-profit organizations from for profit service organizations make a significant difference in salience criteria or waste variants incorporated and the ranking values of each.

This research does not propose or try to prove that using a Stakeholder mapping model that includes both salience criteria and Lean waste variants improves decision-making. Future studies could follow the decisions made by organizations to determine if using the Lean adjusted Stakeholder salience map really contributes to a quantifiable measure of value added.

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APPENDIX A: SURVEY DATABASE

Identifier	Interest/ stake	Power	Legitimacy	Urgency	Network	Delays	Transportation	Motion	Over-processing	Inventory	Over Prod	Defect	Salience Count	Waste Count	Salience Rank Value	Waste Rank Value	Organization type	Position	Size	Location	Lean Experience	Years in Lean
1	6	6	4	5	3	2	1	x	x	x			5.000	5.000	4.8	1.5	N	C	U	WI	I	5
2	1	x	2	x		4		3		5	6	7	4.000	5.000	1.5	5.0	N	B	U	WI	I	4
3		7	4	6		3	x	x	2	x	1	5	3.000	7.000	5.7	2.8	S	B	U	WI	E	5.1
4	6	7	4	5	3	2	x	1	x	x	x	x	5.000	7.000	5.0	1.5	N	F	L	CO	E	10
5	2	4	7	1	6	3	x	5	x	x	x	x	5.000	7.000	4.0	4.0	M	B	U	WI	I	3
6	7	6	5	4	3	2	1	x		x	x		5.000	5.000	5.0	1.5	M	F	U	WI	E	8
7	7	2	6	4	x	3	x	5	1				5.000	4.000	4.8	3.0	M	F	U	WI	E	8
8	2	1	x			7	6	5	4		3		3.000	5.000	1.5	5.0	M	F	U	WI	E	10
9	7	6	4	5		3	x	x	x	2	1		4.000	6.000	5.5	2.0	N	F	L	India	I	3
10	6	5		7		4						3	3.000	2.000	6.0	3.5	M	B	U	WI	E	8
11	5	7	6	4	3	2							5.000	1.000	5.0	2.0	M	B	L	WI	E	12
12	x	x	6	1	x	x	x	5	4	3	2	7	5.000	7.000	3.5	4.2	M	B	L	WI	E	10
13	7	x	6	2	6	x	x	5	x	x	1	3	5.000	7.000	5.3	3.0	M	B	U	WI	E	10
14		6	7			5		1	2	3		4	2.000	5.000	6.5	3.0	M	B	U	WI	I	2
15	7	4	3	2					6			5	4.000	2.000	4.0	5.5	M	B	L	WI	E	17
16		3		6		4			5			7	2.000	3.000	4.5	5.3	M	B	L	WI	E	10
17	7		6	3			5	4	x	1	2		3.000	5.000	5.3	3.0	M	B	U	WI	E	10
18			7	4					5			6	2.000	2.000	5.5	5.5	M	B	U	WI	I	1
19		7			6								2.000	0.000	6.5	0.0	M	F	L	WI	E	10
20	6	3	7	2		5			1			4	4.000	3.000	4.5	3.3	M	B	U	WI	E	8
21		4	5						7			6	2.000	2.000	4.5	6.5	M	C	L	WI	I	5
22			4	3		5		6			2	7	2.000	4.000	3.5	5.0	M	B	L	WI	I	1
23	4		7	5		6			2			3	3.000	3.000	5.3	3.7	S	F	L	MN	I	5
24	7	4	6	5	1	2		3	x				5.000	3.000	4.6	2.5	S	F	L	WI	I	0
25	7		6	4		3			2			5	3.000	3.000	5.7	3.3	M	F	U	WI	E	6
26	7		5	6		2			3			4	3.000	3.000	6.0	3.0	S	F	U	WI	I	1
27	4	7	6	5		3						2	4.000	2.000	5.5	2.5	M	B	L	OH	E	25
28					6	4	1	2	3	x	5	7	1.000	7.000	6.0	3.7	M	F	L	WA	E	25
29	7	3	6	4	5							2	5.000	1.000	5.0	2.0	S	C	U	WI	E	15
30	6	4		5	3	7							4.000	1.000	4.5	7.0	M	B	L	WI	E	15
31	3	7	6	4	5							x	5.000	1.000	5.0	0.0	M	C	L	WI	I	1
32	3	6	7	1	2	4				x		5	5.000	3.000	3.8	4.5	M	B	L	WI	E	10
33		5	1	x	4				3	2	6	7	4.000	4.000	3.3	4.5	M	B	L	WI	I	3
34	5	7	4	6	2	3				1			5.000	2.000	4.8	2.0	M	B	U	WI	I	5
35	5	4	7	6	x	x	x	x	1	x	2	3	5.000	7.000	5.5	2.0	N	C	L	WI	E	15
36	x	x	1	6	x	5	x	4	3	x	2	7	5.000	7.000	3.5	4.2	M	F	U	MI	E	6
37	x	3	4	x		7		6	5	1	2	x	4.000	6.000	3.5	4.2	M	F	U	MI	E	6
38		5		6								7	2.000	1.000	5.5	7.0	M	B	L	WI	I	5
39			7										1.000	0.000	7.0	0.0	M	C	U	WI	E	7
40			4	7					6			5	2.000	2.000	5.5	5.5	M	C	L	IA	E	10
41	7	6	5	4	2	3	x	x	x	x	x	1	5.000	7.000	4.8	2.0	M	C	L	WI	E	8
42	5	3	7	6	2	4	1	x	x	x	x	x	5.000	7.000	4.6	2.5	M	C	U	WI	I	2
43	2	x	7	x		4		1	6	x	3	5	4.000	6.000	4.5	3.8	M	F	U	MI	E	6
44				5	3	6		4	1	2	x	7	2.000	6.000	4.0	4.0	M	B	U	WI	E	10
45	7	6		5		4							3.000	1.000	6.0	4.0	M	B	U	WI	E	20
46	4	5	3	7		6				2	1	x	4.000	4.000	4.8	3.0	S	F	U	WI	E	10
47		7	2	6	5	1			4		x	3	4.000	4.000	5.0	2.7	M	B	L	WI	E	10
48				7									1.000	0.000	7.0	0.0	M	C	U	KY	E	10

APPENDIX B: SURVEY INSTRUMENT

You are being invited to participate in a research study about understand how people, primarily first or second line leaders, make "every day" decisions in situations where there are limited resources and there are multiple, often conflicting, demands by Stakeholders. This study is being conducted by Bruce H. Bader, from the College of Technology at Indiana State University with M. Affan Badar as his sponsor. This study is part of a dissertation research. You are being asked to participate in a survey of managers because you most likely face these decisions regularly.

There are no known risks if you decide to participate in this research study. There are no costs to you for participating in the study. The information you provide will be entered into a data base to look for averages. The questionnaire will take about 10 minutes to complete. The information collected may not benefit you directly, but the information learned in this study should provide more general benefits.

This survey is anonymous. Do not write your name on the survey. The web-site containing this survey will not collect IP addresses of participants. No one will be able to identify you or your answers, and no one will know whether or not you participated in the study. Individuals from your organization will not be given any of the individual results. Individuals from the Institutional Review Board may inspect these records. Should the data be published, no individual information will be disclosed.

Your participation in this study is voluntary. Your responses will not be shared with your supervisor for promotion, retention or pay increase considerations. By completing this survey you are voluntarily agreeing to participate. You are free to decline to answer any particular question you do not wish to answer for any reason. Here is the survey link Decision Making Survey. Please go there to complete the survey.

All participants who provide an e-mail address will be entered into a drawing for $10 contributions to the charity of their choice. There will be 10 participants chosen. Send your acceptance of this consent and choice of charity to bbader@sycamores.indstate.edu.

If you have any questions about the study, please contact Bruce Bader, bbader@sycamores.indstate,edu 920-680-9835

If you have any questions about your rights as a research subject or if you feel you've been placed at risk, you may contact the Indiana State University Institutional Review Board (IRB) by mail at Indiana State University, Office of Sponsored Programs, Terre Haute, IN, 47809, by phone at (812) 237-8217, or by e-mail at irb@indstate.edu.

Question number		Question
1		Does your organization consider itself one that tries to be "Lean"? (see definition on page 3)
2		Does your organization consider itself one that has more than one "Stakeholder"? (see definition on page 3)
3		Name three persons or groups that are your stakeholders
If you answered yes to questions #1 and #2, continue to questions #4 through #10. If not, then return this survey to be entered into the drawing.		
4 (Y/N)		When you are making an operating decision, where there are conflicting demands and limited resources, which of the following twelve factors do you consider? Before answering read the definitions listed on pages 3 and 4.
		1. Do you consider which stakeholder has the most interest in the decision?
		2. Do you consider which stakeholder has the power to force a decision?
		3. Do you consider which stakeholder has a legitimate claim or stake in the outcome of the decision?
		4. Is any stakeholder in an urgent need for a decision?
		5. Is any stakeholder part of a strong network of other stakeholders?
		6. Will delays be created by meeting any stakeholder's demands?
		7. Is any stakeholder creating conditions where there is excess transportation?
		8. Will the stakeholder's demands create conditions that have associates (employees) moving more than usual?
		9. Is over-processing required for any stakeholder?
		10. Does any stakeholder's demand create excess inventory?
		11. Is any stakeholder demanding over-production?
		12. Will defects be created to meet any stakeholder's demands?
5 Rank 1-8)		Now rate **the *8 most important* factors** you answered "Yes" to in question #4 in order of importance (most important is rated 1, the least important is rated the highest number.) If you answered "yes" to less than eight then only rate the ones to which you answered "yes."
		1. Do you consider which stakeholder has the most interest in the decision?
		2. Do you consider which stakeholder has the power to force a decision?

	3. Do you consider which stakeholders have a legitimate claim or stake in the outcome of the decision?
	4. Are any stakeholders in an urgent need for a decision?
	5. Is any stakeholder part of a strong network of other stakeholders?
	6. Will delays be created by meeting any stakeholder's demands?
	7. Is any stakeholder creating conditions where there is excess transportation?
	8. Will the stakeholder's demands create conditions that have associates (employees) moving more than usual?
	9. Is over-processing required for any stakeholder?
	10. Does any stakeholder's demand create excess inventory?
	11. Is any stakeholder demanding over-production?
	12. Will defects be created to meet any stakeholder's demands?

Questions #6 - #10 are demographic questions. Please circle the best answer for #6, #7 and #8. Please write or type in the answer for #9 and #10

6	Which of the following best describes your organization (Manufacturing, Service for profit, non-profit or other)?	Mfg.	Service	Non-profit	other
7	What best describes your position within the organization (first line, middle level manager, higher)?	First line	Middle Mgr.	Senior Mgr.	
8	How large is your organization (more than 500 employees at your location, less than 500)?	Over 500	Under 500		
9	Where is your organization located (State)?				
10	Approximately how many years has your organization been practicing Lean management?				

Lean: the elimination of activity that does not add value to the task, process or operation to continuously improve the organization.

Stakeholder: any persons or group that can affect or is affected by the achievement of the organization's objectives Stakeholders can be within or outside of the organization.

Interest: The extent to which the stakeholder is concerned about the outcome and has a strong positive or negative attitude regarding the outcome of the decision. This looks at how vocal or emotional the stakeholder will be towards the decision.

Power: A relationship among in which stakeholder can get the organization to do something that the organization would not have otherwise done.

Legitimacy: The perception that the claims of the stakeholder are proper and appropriate within some system of norms, values, beliefs or definitions

Urgency: The degree to which the stakeholder claims call for immediate action by the organization.

Network: The consideration of how this decision will impact other stakeholders inside or outside of the organization.

Delay: any wait time in a process or process that follows. This includes waiting for clarifications or looking for something.

Transportation: moving physical materials, electronic data or the customer from one location to another where there is nothing do to it. This includes work in process (WIP), or multiple stations for service

Associate motion: any movement of an associate/employee; walking, bending, sorting, typing, filing, repositioning, etc. that does not improve the product or service. This includes having multiple service locations (for associates).

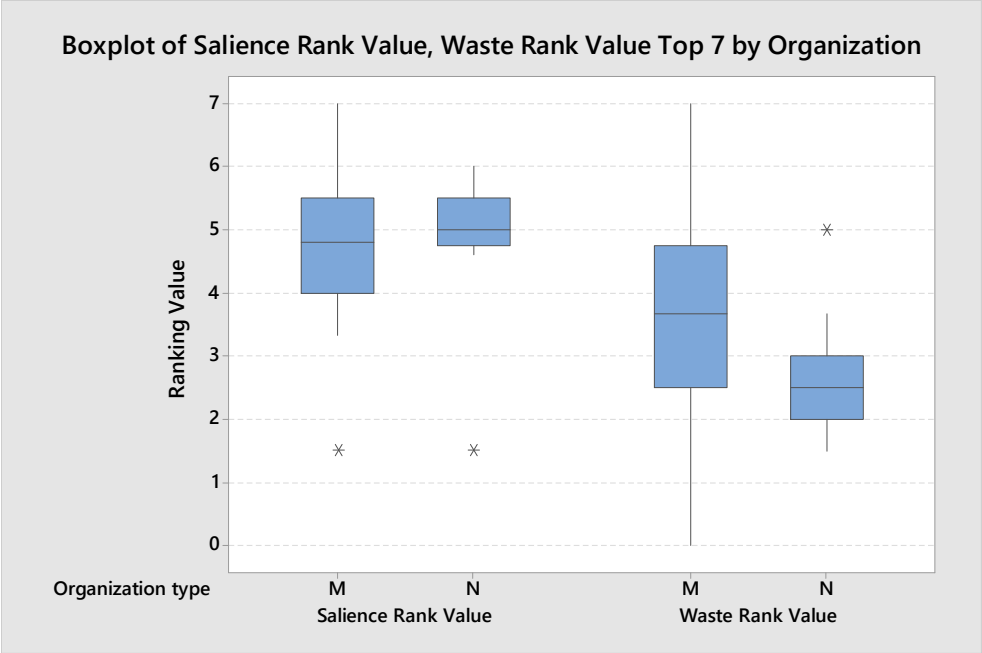
Over-processing: doing something to a product or a service that is not needed or requested by the customer. This includes duplication of effort.

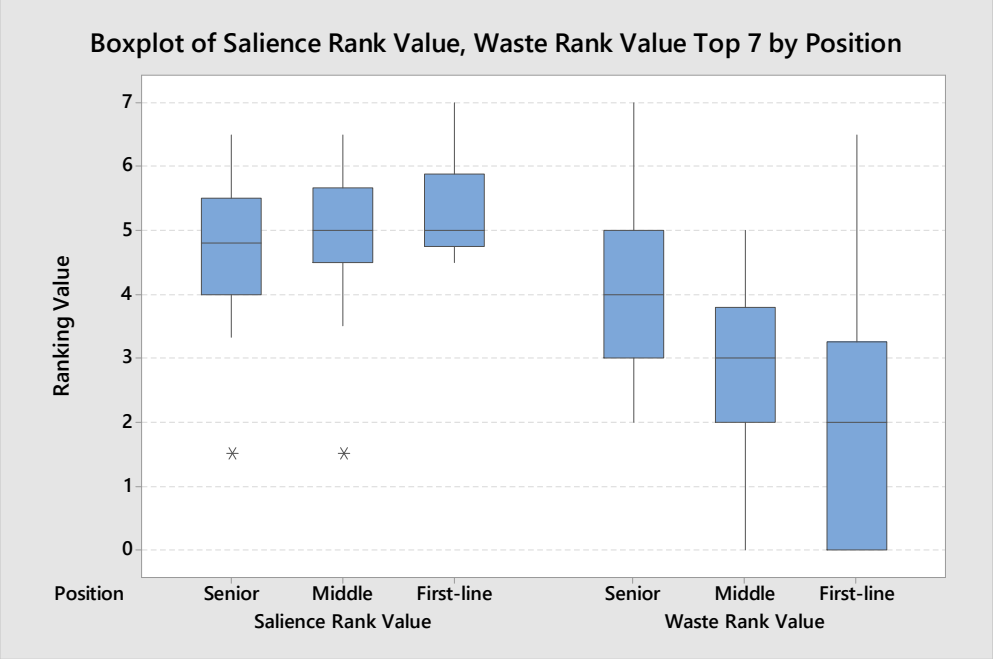
Excess Inventory: a stock pile of raw materials, WIP, parts, finished product or anything that is used to make the product or generate the service. This includes people supplies, or customer wait lists for services.

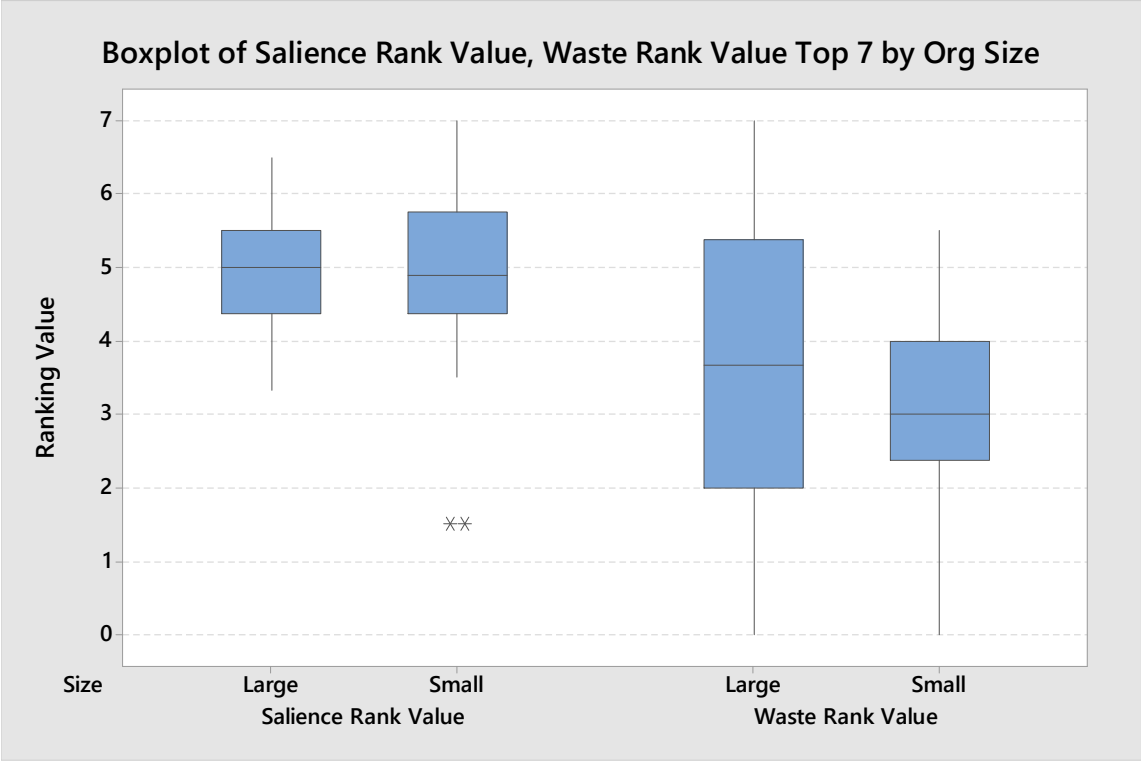
Over-production: making more products or doing more service than is ordered by the customer. This includes extra "paper work."

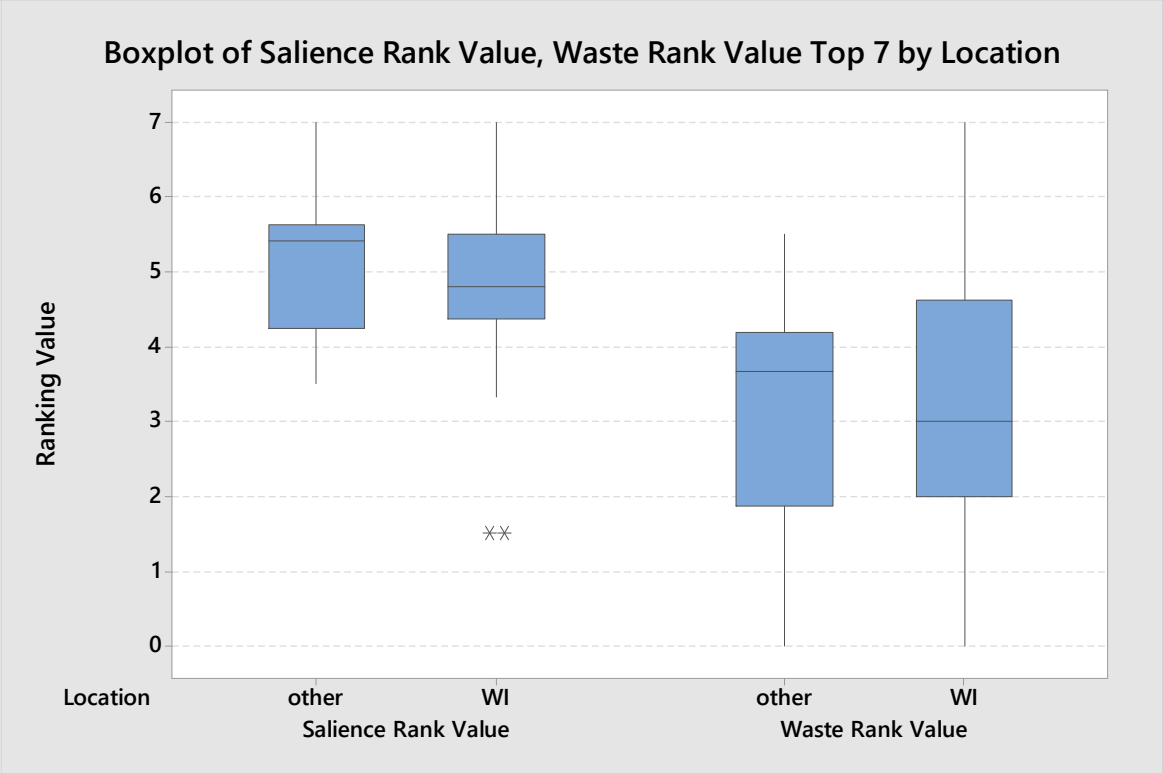
Defects: a product or service that does not meet either the specifications or the customer's requirements leading to rework, scrap, or discounts. This includes lost, damaged or incomplete services.

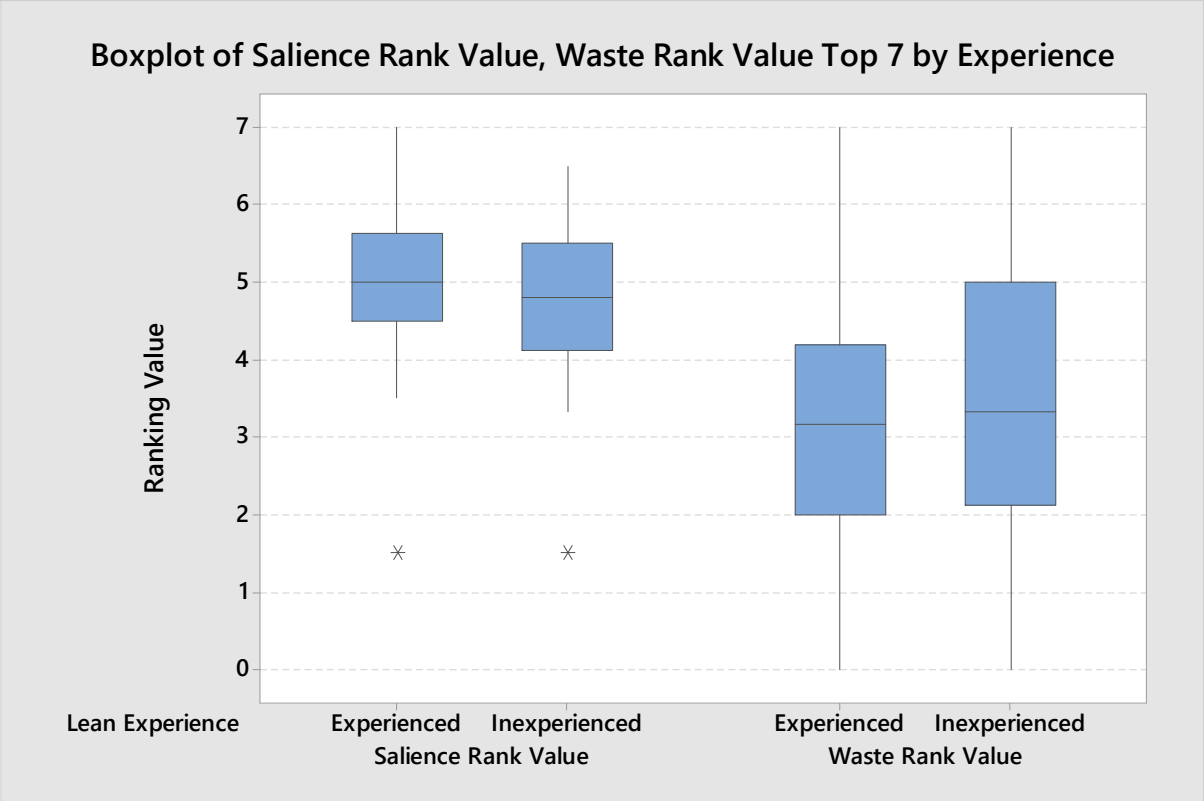
APPENDIX C: BOX PLOTS OF SALIENCE RANK VALUE VS WASTE RANK VALUE FOR INDIVIDUAL CATEGORIES



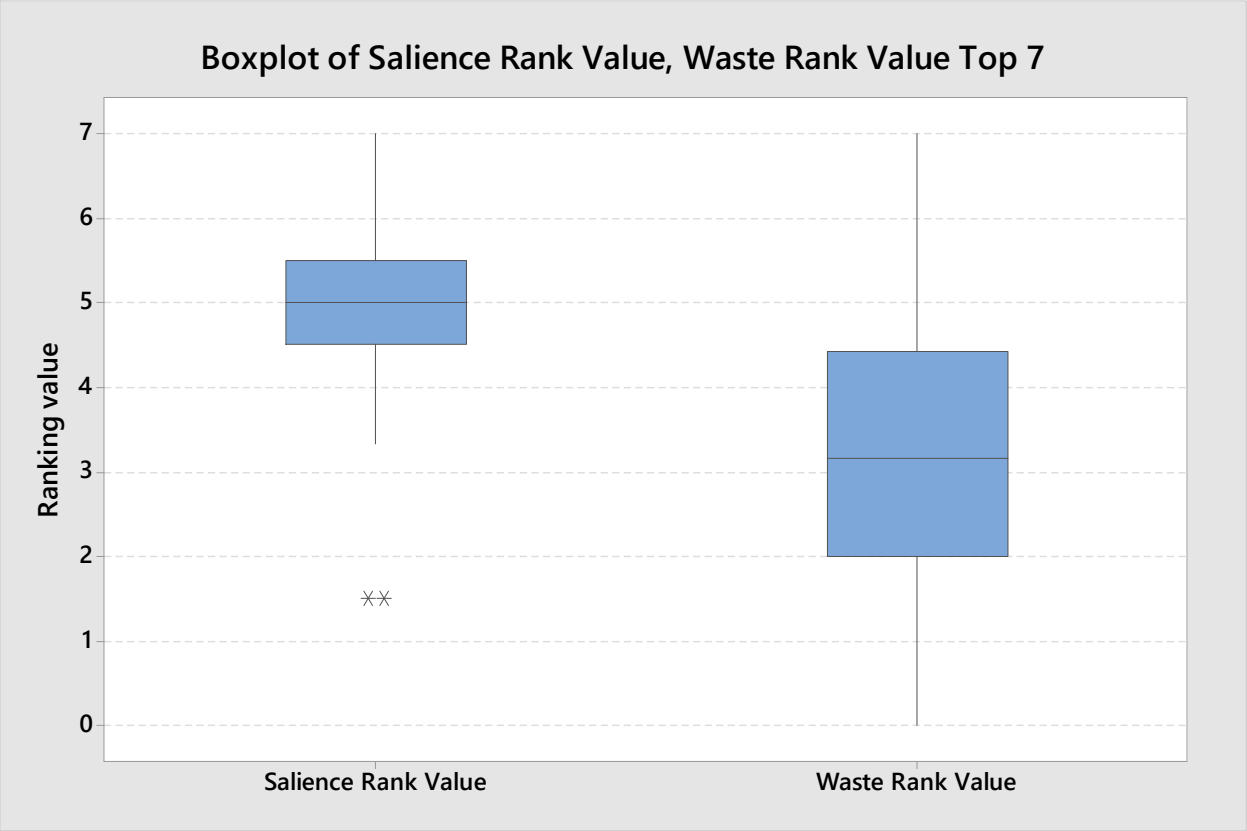



Boxplot of Salience Rank Value, Waste Rank Value Top 7 by Org Size
Ranking Value
7
6
5
4
3
2
1
0
Size
Large
Small
Large
Small
Salience Rank Value
Waste Rank Value


Boxplot of Salience Rank Value, Waste Rank Value Top 7 by Location
Ranking Value
7
6
5
4
3
2
1
0
Location
other
WI
other
WI
Salience Rank Value
Waste Rank Value


Boxplot of Salience Rank Value, Waste Rank Value Top 7 by Experience
Ranking Value
7
6
5
4
3
2
1
0
Lean Experience
Experienced
Inexperienced
Salience Rank Value
Experienced
Inexperienced
Waste Rank Value

APPENDIX D: SALIENCE RANK VALUE VS WASTE RANK VALUE



APPENDIX E: MINITAB OUTPUT

Test and CI for Two Proportions All Mgrs.

```
Sample    X    N  Sample p
1       174  240  0.725000
2       185  336  0.550595

Difference = p (1) - p (2)
Estimate for difference:  0.174405
95% CI for difference:  (0.0968150, 0.251995)
Test for difference = 0 (vs ≠ 0):  Z = 4.41  P-Value = 0.000
Fisher's exact test: P-Value = 0.000
```

Test and CI for Two Proportions First-line Mgrs.

```
Sample   X   N  Sample p
1       52  70  0.742857
2       65  98  0.663265

Difference = p (1) - p (2)
Estimate for difference:  0.0795918
95% CI for difference:  (-0.0591078, 0.218291)
Test for difference = 0 (vs ≠ 0):  Z = 1.12  P-Value = 0.261
Fisher's exact test: P-Value = 0.309
```

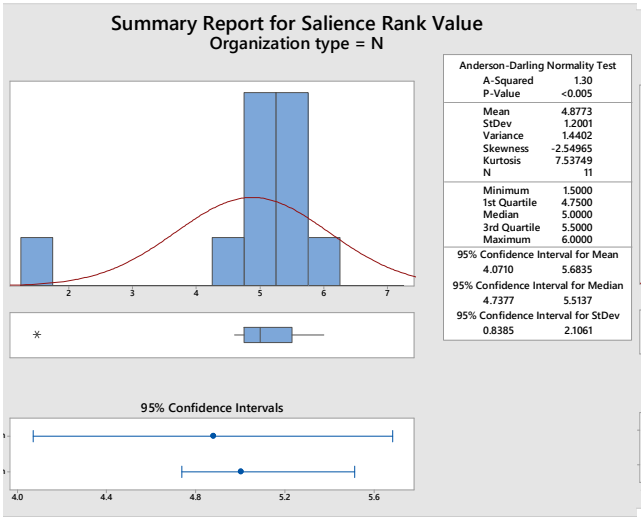
Test and CI for Two Proportions Middle Mgrs.

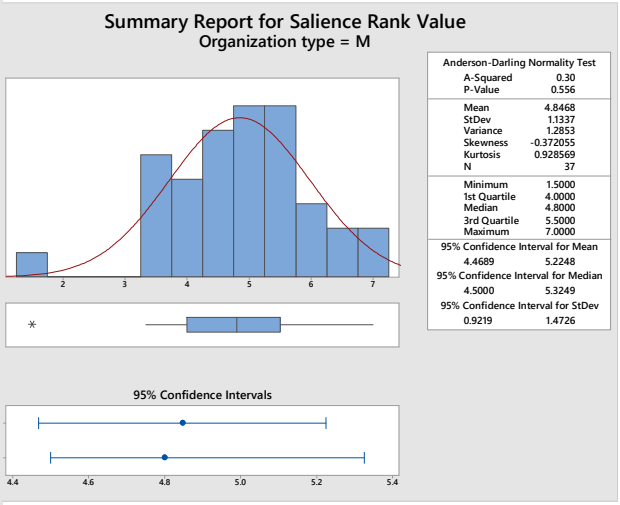
```
Sample   X    N  Sample p
1       82  115  0.713043
2       84  161  0.521739

Difference = p (1) - p (2)
Estimate for difference:  0.191304
95% CI for difference:  (0.0782177, 0.304391)
Test for difference = 0 (vs ≠ 0):  Z = 3.32  P-Value = 0.001
Fisher's exact test: P-Value = 0.002
```

Test and CI for Two Proportions Senior Mgrs.

```
Sample   X   N  Sample p
1       36  50  0.720000
2       32  70  0.457143

Difference = p (1) - p (2)
Estimate for difference:  0.262857
95% CI for difference:  (0.0922481, 0.433466)
Test for difference = 0 (vs ≠ 0):  Z = 3.02  P-Value = 0.003
Fisher's exact test: P-Value = 0.005
```

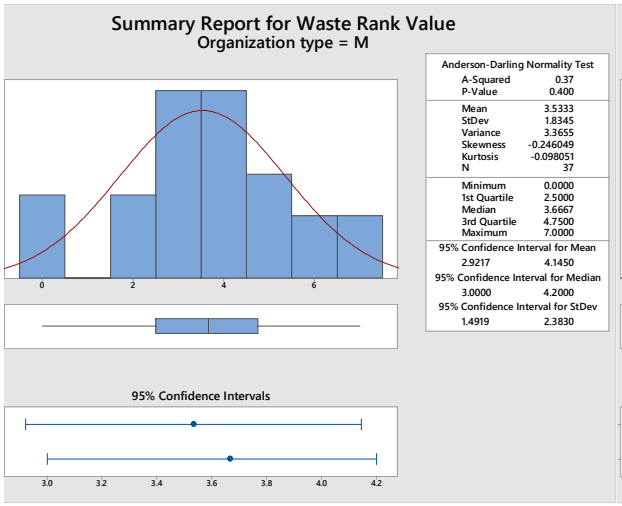
Mood Median Test: Salience Rank Value versus Organization type

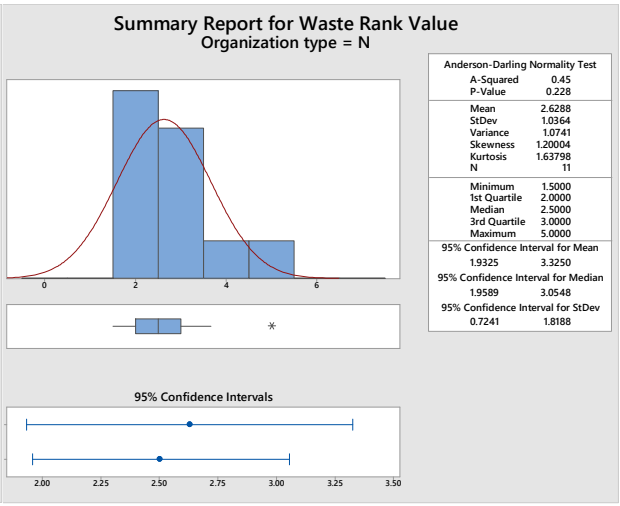





```
Mood median test for Salience Rank Value
Chi-Square = 0.21    DF = 1    P = 0.650

Organization                          Individual 95.0% CIs
type          N≤  N>  Median  Q3-Q1    +---------+---------+---------+------
M             23  14    4.80   1.50    (---------*----------------)
N              6   5    5.00   0.75              (--------*-----------------)
                                       +---------+---------+---------+------
                                      4.50      4.80      5.10      5.40

Overall median = 5.00
A 95.0% CI for median(M) - median(N): (-0.90,0.25)
```

One-way ANOVA: Waste Rank Value versus Organization type

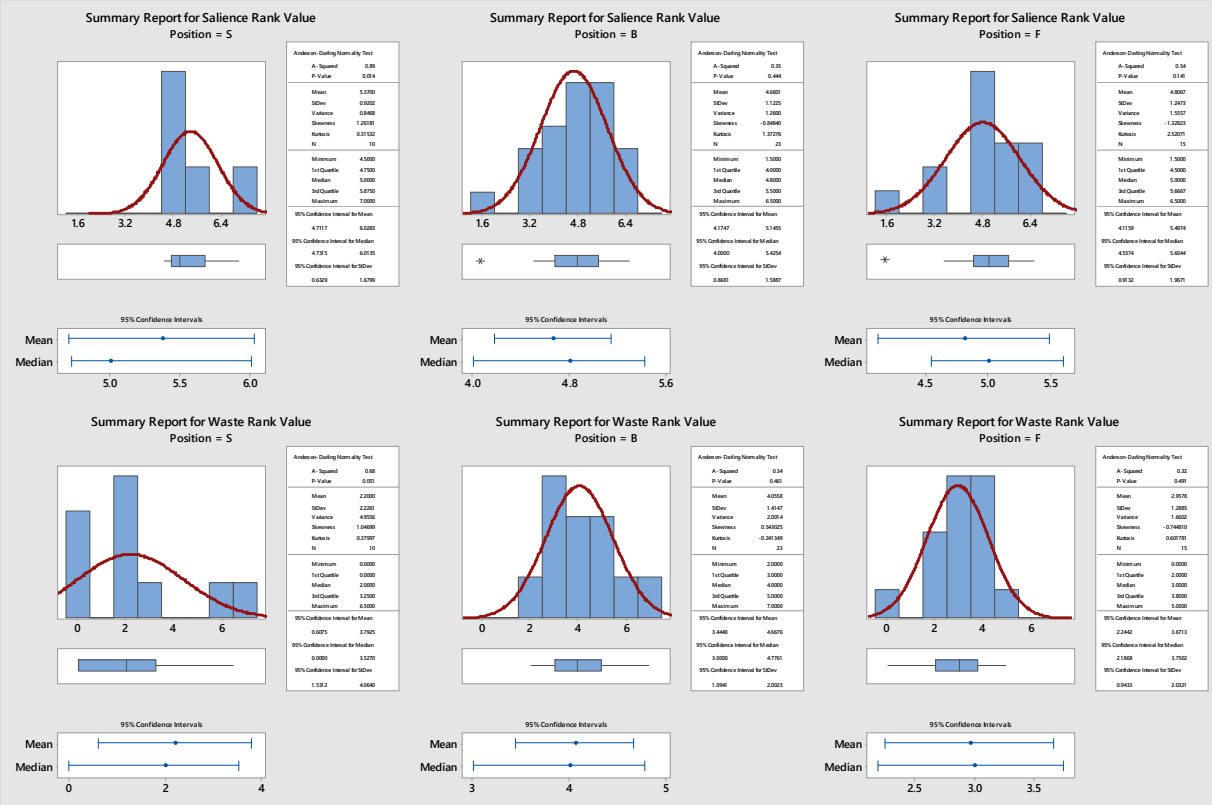





```
Method
Null hypothesis         All means are equal
Alternative hypothesis  At least one mean is different
```

```
Significance level      α = 0.05
Equal variances were assumed for the analysis.

Factor Information
Factor             Levels  Values
Organization type       2  M, N

Analysis of Variance
Source             DF   Adj SS  Adj MS  F-Value  P-Value
Organization type   1    6.938   6.938     2.42    0.127
Error              46  131.899   2.867
Total              47  138.837
```

One-way ANOVA: Salience Rank Value versus Mgr Type & One-way ANOVA: Waste Rank Value versus Mgr Type

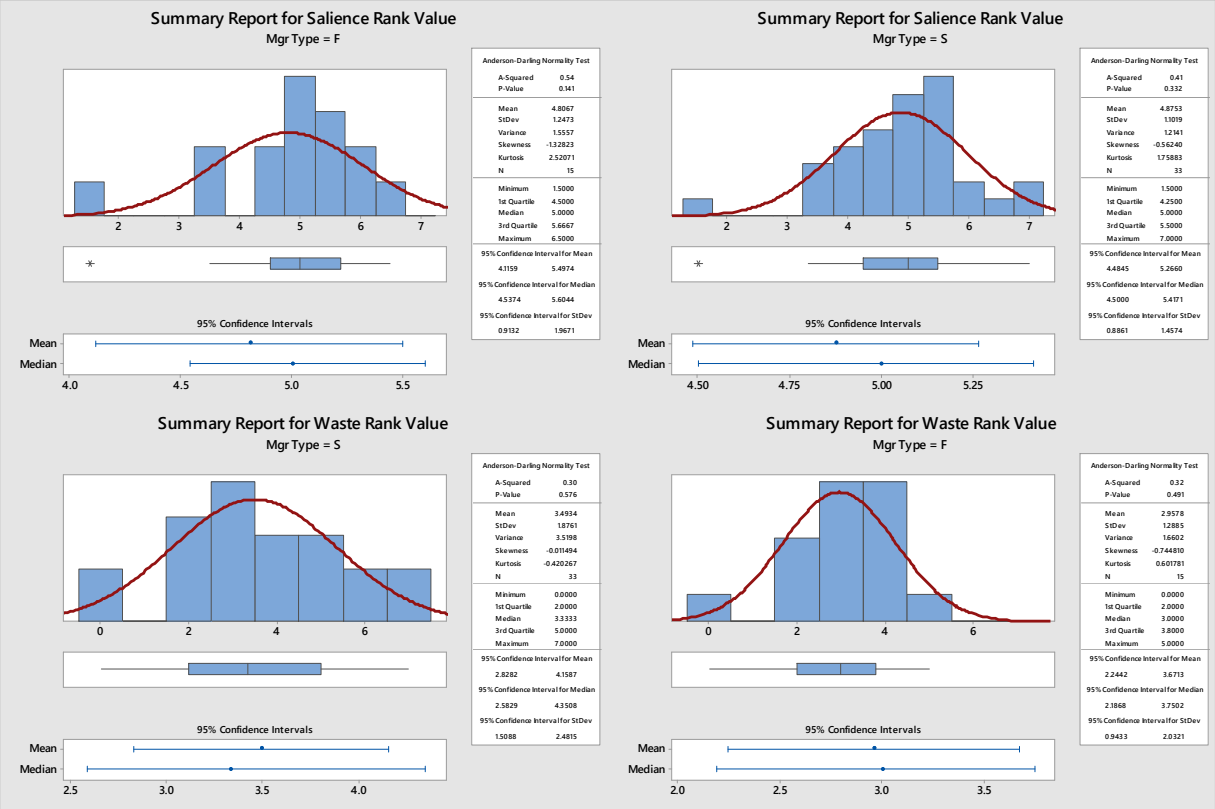


Salience Rank Value versus Mgr Type

```
Method
Null hypothesis         All means are equal
Alternative hypothesis  At least one mean is different
Significance level      α = 0.05
Equal variances were assumed for the analysis.

Factor Information
Factor    Levels  Values
Mgr Type       2  F, S

Analysis of Variance
Source    DF   Adj SS   Adj MS  F-Value  P-Value
```

```
Mgr Type    1   0.0485  0.04851     0.04    0.849
Error      46  60.6322  1.31809
Total      47  60.6807
```

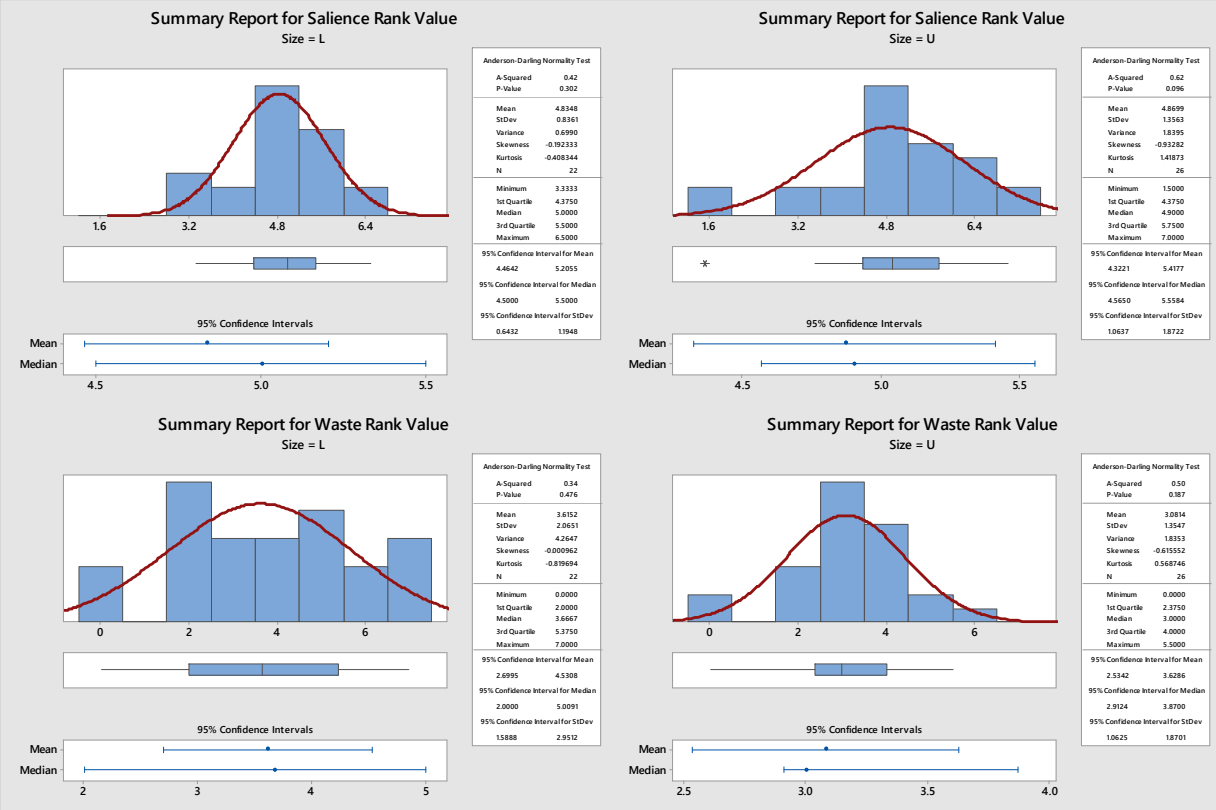
Charts combining Senior and Middle Level Managers



Waste Rank Value versus Mgr Type

```
Method
Null hypothesis         All means are equal
Alternative hypothesis  At least one mean is different
Significance level      α = 0.05
Equal variances were assumed for the analysis.

Factor Information
Factor    Levels  Values
Mgr Type       2  F, S

Analysis of Variance
Source     DF   Adj SS  Adj MS  F-Value  P-Value
Mgr Type    1    2.959   2.959     1.00    0.322
Error      46  135.878   2.954
Total      47  138.837
```

One-way ANOVA: Salience Rank Value versus Size & One-way ANOVA: Waste Rank Value versus Size



Salience Rank Value versus Size

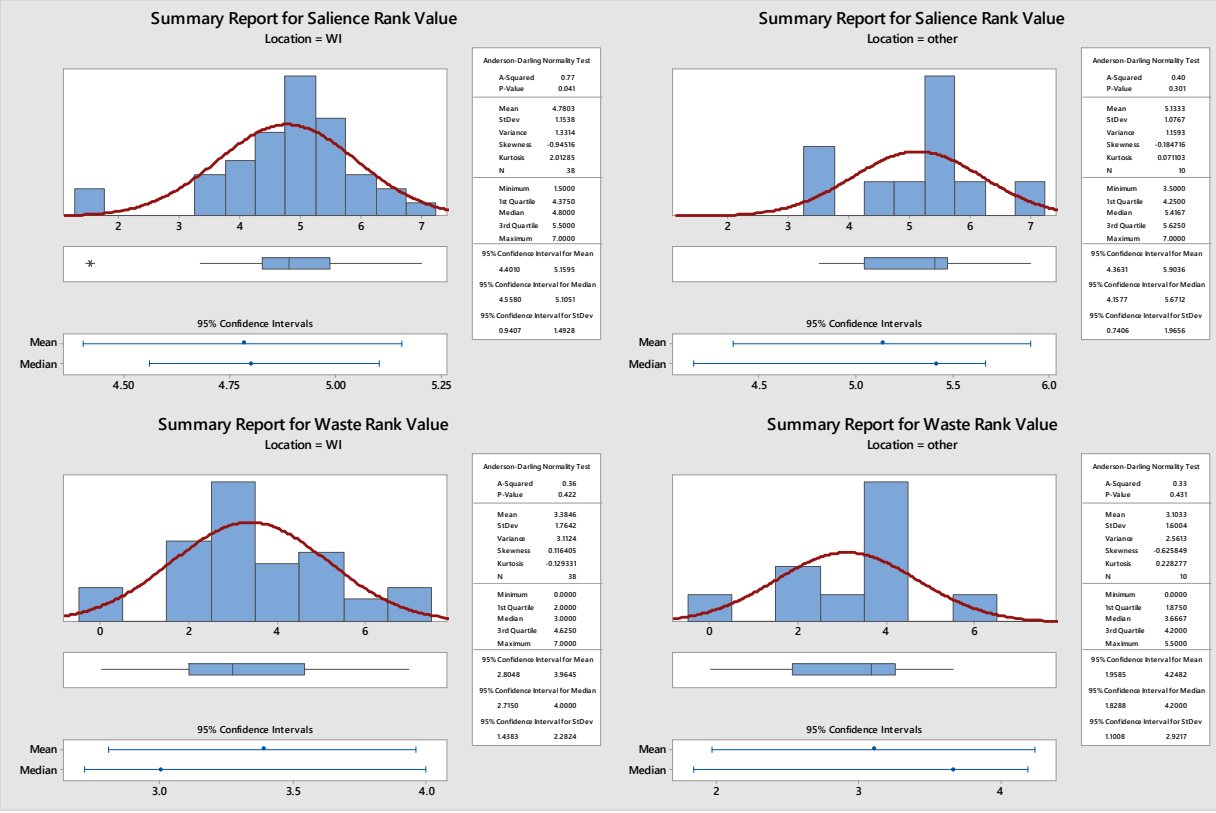
```
Method
Null hypothesis         All means are equal
Alternative hypothesis  At least one mean is different
Significance level      α = 0.05
Equal variances were assumed for the analysis.

Factor Information
Factor  Levels  Values
Size         2  L, U

Analysis of Variance
Source  DF   Adj SS   Adj MS  F-Value  P-Value
Size     1   0.0146  0.01462     0.01    0.917
Error   46  60.6661  1.31883
Total   47  60.6807
```

Waste Rank Value versus Size

```
Method
Null hypothesis         All means are equal
Alternative hypothesis  At least one mean is different
Significance level      α = 0.05
```

```
Equal variances were assumed for the analysis.

Factor Information
Factor  Levels  Values
Size         2  L, U

Analysis of Variance
Source  DF   Adj SS  Adj MS  F-Value  P-Value
Size     1    3.395   3.395     1.15    0.289
Error   46  135.442   2.944
Total   47  138.837
```

One-way ANOVA: Salience Rank Value versus Location & One-way ANOVA: Waste Rank Value versus Location



Salience Rank Value versus Location

```
Method
Null hypothesis         All means are equal
Alternative hypothesis  At least one mean is different
Significance level      α = 0.05
Equal variances were assumed for the analysis.

Factor Information
Factor    Levels  Values
Location       2  other, WI

Analysis of Variance
Source    DF   Adj SS  Adj MS  F-Value  P-Value
```

```
Location   1   0.9869  0.9869     0.76    0.388
Error     46  59.6938  1.2977
Total     47  60.6807
```

Waste Rank Value versus Location

```
Method
Null hypothesis         All means are equal
Alternative hypothesis  At least one mean is different
Significance level      α = 0.05

Equal variances were assumed for the analysis.


Factor Information

Factor    Levels  Values
Location       2  other, WI


Analysis of Variance

Source    DF   Adj SS  Adj MS  F-Value  P-Value
Location   1    0.627  0.6265     0.21    0.650
Error     46  138.210  3.0046
Total     47  138.837
```

One-way ANOVA: Salience Rank Value versus Lean Experience & One-way ANOVA: Waste Rank Value versus Lean Experience

Salience Rank Value versus Lean Experience

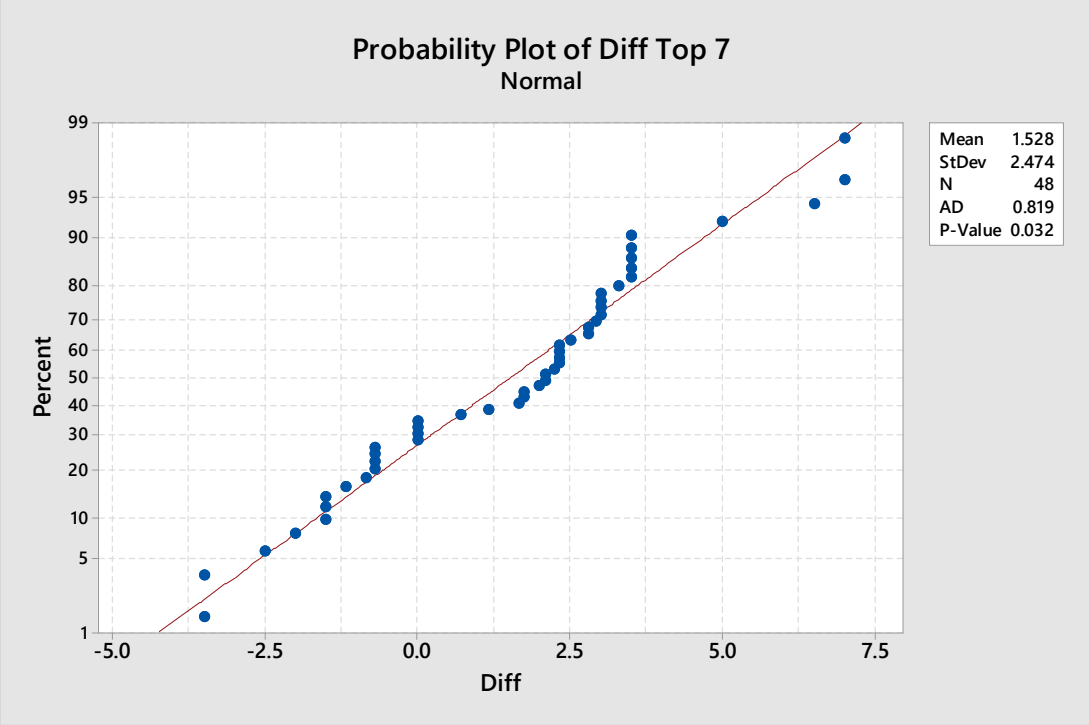
```
Method
Null hypothesis         All means are equal
Alternative hypothesis  At least one mean is different
Significance level      α = 0.05
Equal variances were assumed for the analysis.

Factor Information
Factor           Levels  Values
Lean Experience       2  E, I

Analysis of Variance
Source           DF   Adj SS  Adj MS  F-Value  P-Value
Lean Experience   1   0.6806  0.6806     0.52    0.474
Error            46  60.0001  1.3043
Total            47  60.6807
```

Waste Rank Value versus Lean Experience

```
Method
Null hypothesis         All means are equal
Alternative hypothesis  At least one mean is different
Significance level      α = 0.05
Equal variances were assumed for the analysis.

Factor Information
```

```
Factor           Levels  Values
Lean Experience       2  E, I

Analysis of Variance
Source           DF   Adj SS  Adj MS  F-Value  P-Value
Lean Experience   1    1.856   1.856     0.62    0.434
Error            46  136.980   2.978
Total            47  138.837
```

Paired T-Test and CI: Salience Rank Value, Waste Rank Value




```
Paired T for Salience Rank Value - Waste Rank Value
                      N   Mean  StDev  SE Mean
Salience Rank Value  48  4.854  1.136    0.164
Waste Rank Value     48  3.326  1.719    0.248
Difference           48  1.528  2.474    0.357

99% CI for mean difference: (0.569, 2.486)
T-Test of mean difference = 0 (vs ≠ 0): T-Value = 4.28  P-Value = 0.000
```

Additional "F-test" for ANOVA Independent Variables

Test and CI for Two Variances: Waste Rank Value vs Organization type

```
Method
Null hypothesis         σ(M) / σ(N) = 1
Alternative hypothesis  σ(M) / σ(N) ≠ 1
Significance level      α = 0.05

Statistics
```

```
Organization                          95% CI for
type           N  StDev  Variance      StDevs
M             37  1.835     3.365  (1.490, 2.385)
N             11  1.036     1.074  (0.558, 2.341)
                     Test
Method  DF1  DF2  Statistic  P-Value
Bonett    —    —          —    0.068
Levene    1   46       3.17    0.081
```

Test and CI for Two Variances: Waste Rank Value vs Mgr Type

```
Method
Null hypothesis         Variance(F) / Variance(S) = 1
Alternative hypothesis  Variance(F) / Variance(S) ≠ 1
Significance level      α = 0.05

Statistics

Mgr                           95% CI for
Type   N  StDev  Variance     Variances
F     15  1.289     1.660  (0.731, 4.987)
S     33  1.876     3.520  (2.363, 5.925)

                     Test
Method  DF1  DF2  Statistic  P-Value
Bonett    —    —          —    0.122
Levene    1   46       3.18    0.081
```

Test and CI for Two Variances: Salience Rank Value vs Mgr Type

```
Method
Null hypothesis         Variance(F) / Variance(S) = 1
Alternative hypothesis  Variance(F) / Variance(S) ≠ 1
Significance level      α = 0.05

Statistics

Mgr                           95% CI for
Type   N  StDev  Variance     Variances
F     15  1.247     1.556  (0.509, 6.297)
S     33  1.102     1.214  (0.651, 2.559)
                     Test
Method  DF1  DF2  Statistic  P-Value
Bonett    —    —          —    0.677
Levene    1   46       0.05    0.830
```

Test and CI for Two Variances: Waste Rank Value vs Size

```
Method
Null hypothesis         Variance(L) / Variance(U) = 1
Alternative hypothesis  Variance(L) / Variance(U) ≠ 1
Significance level      α = 0.05

Statistics
                              95% CI for
Size   N  StDev  Variance     Variances
L     22  2.065     4.265  (2.781, 7.882)
U     26  1.355     1.835  (1.014, 3.886)
                     Test
Method  DF1  DF2  Statistic  P-Value
Bonett    —    —          —    0.032
Levene    1   46       6.56    0.014
```

Test and CI for Two Variances: Salience Rank Value vs Size

```
Method
Null hypothesis         Variance(L) / Variance(U) = 1
Alternative hypothesis  Variance(L) / Variance(U) ≠ 1
Significance level      α = 0.05

Statistics
                              95% CI for
Size   N  StDev  Variance     Variances
L     22  0.836     0.699  (0.425, 1.385)
U     26  1.356     1.839  (0.911, 4.342)
                        Test
Method  DF1  DF2  Statistic  P-Value
Bonett    —    —          —    0.105
Levene    1   46       2.04    0.160
```

Test and CI for Two Variances: Waste Rank Value vs Location

```
Method
Null hypothesis         Variance(other) / Variance(WI) = 1
Alternative hypothesis  Variance(other) / Variance(WI) ≠ 1
Significance level      α = 0.05

Statistics
                                  95% CI for
Location   N  StDev  Variance     Variances
other     10  1.600     2.561  (0.934, 10.862)
WI        38  1.764     3.112  (2.077,  5.186)
                        Test
Method  DF1  DF2  Statistic  P-Value
Bonett    —    —          —    0.749
Levene    1   46       0.22    0.645
```

Test and CI for Two Variances: Salience Rank Value vs Location

```
Method
Null hypothesis         Variance(other) / Variance(WI) = 1
Alternative hypothesis  Variance(other) / Variance(WI) ≠ 1
Significance level      α = 0.05

Statistics
                                 95% CI for
Location   N  StDev  Variance     Variances
other     10  1.077     1.159  (0.470, 4.419)
WI        38  1.154     1.331  (0.715, 2.757)
                        Test
Method  DF1  DF2  Statistic  P-Value
Bonett    —    —          —    0.863
Levene    1   46       0.02    0.880
```

Test and CI for Two Variances: Waste Rank Value vs Lean Experience

```
Method
Null hypothesis         Variance(E) / Variance(I) = 1
Alternative hypothesis  Variance(E) / Variance(I) ≠ 1
Significance level      α = 0.05

Statistics

Lean                               95% CI for
Experience   N  StDev  Variance     Variances
E           32  1.635     2.673  (1.655, 4.902)
```

```
I           16  1.899     3.607  (2.004, 8.431)
                     Test
Method  DF1  DF2  Statistic  P-Value
Bonett    —    —          —    0.457
Levene    1   46       0.81    0.372
```

Test and CI for Two Variances: Salience Rank Value vs Lean Experience

```
Method
Null hypothesis         Variance(E) / Variance(I) = 1
Alternative hypothesis  Variance(E) / Variance(I) ≠ 1
Significance level      α = 0.05

Statistics

Lean                                 95% CI for
Experience   N  StDev  Variance     Variances
E           32  1.115     1.243  (0.655, 2.677)
I           16  1.196     1.430  (0.509, 5.216)
                     Test
Method  DF1  DF2  Statistic  P-Value
Bonett    —    —          —    0.809
Levene    1   46       0.01    0.919
```

APPENDIX F: LITTLE RAPIDS STAKEHOLDER IDENTIFICATION

Stakeholder	What is the stake (interaction)?	Interest (attitude)	Power	Legitimacy	Urgency	Part of a Strong Network	Preliminary Sub-Total
Planning	Supplier	M	M	M	M		4
Trainee	Supplier	M		M	M		3
Management	Customer	M	H	M	H	M	7
Engineering	Contributor			M		M	2
Information systems	Contributor			M		M	2
Trainer	Contributor	M		M		M	3
Accounting	Overseer		M	M			2
Quality	Overseer			M			1
Safety	Overseer	M	M	M		M	4
Total							28
Comments on the priority		Trainee has the most impact on interest / attitude	Management is the most powerful Accounting has weak implicit power				

APPENDIX G: LITTLER RAPIDS STAKEHOLDER POTENTIAL WASTE

Stakeholder	Task performed for or with this stakeholder
Trainee	develops a training plan
	prepares training materials
	reviews material already learned
Production Planning	schedules trainees
	schedules trainers
	calls away trainers
Design Engineering	develops training materials
	uses old material
Operators Trainers	teaches training skills
	monitors training progress
	evaluates training based upon personal preference
	keeps training on schedule
	makes training engaging
Information Systems	software to store materials
	hardware to help train
Manufacturing	produces trained employees
	attends meetings
	posts operating notices
Safety	reviews material for safety
	special safety training
Quality	materials comply with qual. sys.
	special quality training
Accounting	accounts for trainee time
	special accounting system entries

APPENDIX H: LITTLER RAPIDS ASSESSMENT OF VALUE-ADDED ACTIVITIES

Stakeholder	Task performed	Stakeholders who share value with the task directed stakeholder									Total VA
	for or with this stakeholder	Trainee	Prod. Plan.	Engr.	Trainers	I.S.	Mfg.	Safety	Quality	Account.	
Trainee	develops a training plan				?		X				1
	prepares training materials				X			X	X		3
	reviews material already learned										0
Production	schedules trainees										0
Planning	schedules trainers						X				1
	calls away trainers										0
Design	develops training materials				X			X			2
Engineering	uses old material										0
Operators	teaches training skills	X									1
Trainers	monitors training progress						X	X	X		3
	evaluates training based upon personal preference										0
	keeps training on schedule		X							X	2
	makes training engaging	X									1
Information	software to store materials										0
Systems	hardware to help train							X			1
Manufacturing	produces trained employees	X	X								2
	attends meetings										0
	posts operating notices										0
Safety	reviews material for safety						X				1
	special safety training	X									1
Quality	materials compy with qual sys.						X				1
	special quality training										0
Accounting	accounts for trainee time	X									1
	special accounting system entries										0

APPENDIX I: LITTLE RAPIDS STAKEHOLDER CONFIRMED WASTE

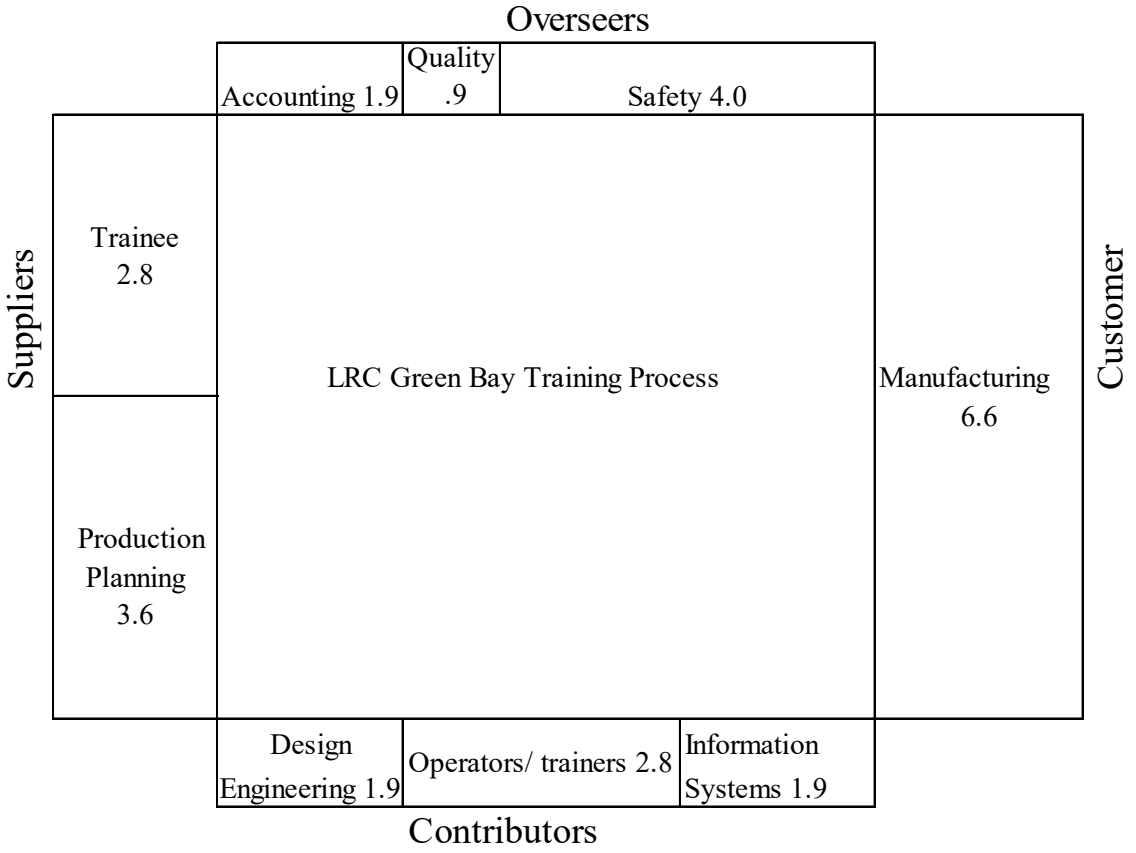
Stakeholder	Over-production	Delay	Transportation	Over-Processing	Inventory	Motion	Defects	Comments on how the waste is demonstrated in the interaction with the specific stakeholder
Planning		X		X				Delay = Trainer called away to do another job. Over-processing = scheduling trainee
Trainee				X				Too much time spent on reviewing the skills already possessed.
Management						X		Requirement to attend meetings and write/post operating notices not related to training.
Engineering							X	Out of date drawings cause trainee to activate the wrong part.
Information systems					X			The need to keep old systems because they have tools that have not been integrated into a new system.
Trainer				X				Operator doing training has personal ideas of what should and should not be trained. Hence, extra unnecessary training is done.
Accounting			X					Requirements to enter data into special accounting software not compatible with training software.
Quality	X							Over emphasis on how to react to each specific defect, not categories of defects.
Safety								
Comments on the waste		Major waste because people often forget if too much time has elapsed.	Less significant waste in terms of time spent.	Trainee and trainer waste is trainer dependent.		Significant amount of time, check sheet for May		

APPENDIX J: LITTLE RAPIDS STAKEHOLDER VALUATION

Stakeholder	What is the stake (interaction)?	Interest (attitude)	Power	Legitimacy	Urgency	Part of a Strong Network	Sub-Total	Over-production	Delay	Transportation	Over-Processing	Inventory	Motion	Defects	Comments on how the waste is demonstrated in the interaction with the specific stakeholder	Total Waste	Waste adj factor	Stakeholder Salience Adjusted
Planning	supplier	M	M	M	M		4		X		X				Delay = Trainer called away to do another job. Over-processing = scheduling trainee	2	0.11	**3.6**
Trainee	supplier	M		M	M		3				X				Too much time spent on reviewing the skills already possessed.	1	0.06	**2.8**
Management	customer	M	H	M	H	M	7						X		Requirement to attend meetings and write/post operating notices not related to training.	1	0.06	**6.6**
Engineering	contributor			M		M	2							X	Out of date drawings cause trainee to activate the wrong part.	1	0.06	**1.9**
Information systems	contributor			M		M	2					X			The need to keep old systems because they have tools that have not been integrated into a new system.	1	0.06	**1.9**
Trainer	contributor	M		M		M	3				X				Operator doing training has personal ideas of what should and should not be trained. Hence, extra unnecessary training is done.	1	0.06	**2.8**
Accounting	overseer		M	M			2			X					Requirements to enter data into special accounting software not compatible with training software.	1	0.06	**1.9**
Quality	overseer			M			1	X							Over emphasis on how to react to each specific defect, not categories of defects.	1	0.06	**0.9**
Safety	overseer	M	M	M		M	4									0	0.00	**4.0**
Total							28									9		

Comments on the priority	Trainee has the most impact on interest / attitude Management is the most powerful Accounting has weak implicit power	Major waste because people often forget if too much time has elapsed.	Less significant waste in terms of time spent.	Trainee and trainer waste is trainer dependent.	Significant amount of time, checksheet for May	quick waste adjustment formula… (total salience factors per stakeholder) X 1- (total waste activities per stakeholder/[2 times the total waste activities for all stakeholders])

APPENDIX K: LITTLE RAPIDS STAKEHOLDER MAP



APPENDIX L: GENERAC STAKEHOLDER IDENTIFICATION

Stakeholder	What is the stake (interaction)?	Interest (attitude)	Power	Legitimacy	Urgency	Network	Preliminary Sub-Total
Mechanics (Maint personn	Supplier or labor and skills	S	M	S		M	6
Tools Supplier	Tools used by Maintenance is supplied.			M			1
Tool Service Provider	Repairs tools used for Manufacturing		M	M	M		3
Parts Supplier	Supplies parts for equipment or other repairs.		M	M			2
Supplies Contractor	Supplies disposables used by maintenance.			M			1
Equipment Supplier	Supplies equipment used by maintenance.			M			1
I.T.	Does software or hardware support.			M		M	2
M.E. I.E			M				1
Project Mgt.	Designs work for special projects.		M	M			2
Equipment Mfgr. Contract	Special support for specific equipment.		S	M			3
Manufacturing Critical Processes							
Safety		M	S	M	S	S	8
Repair		M	S	M	S	M	7
Preventive Maint.		M	M	M	M	M	5
Project		M		M		M	3
Manufacturing Non-Critical Processes							
Safety		M	M	M	S	S	3
Routine		M	M	M	M	M	5
Project		M		M	M		3
Office Critical							
Safety		M	S	M	S	M	7
Repairs		M		M			2
P.M. or Projects		M		M			2
Office non-critical							
Safety		M	S	M	S	M	7
Repairs		M		M			2
P.M. or Projects		M		M			2
Facilities Critical							
Safety or Repairs		M	S	M	S	H	6
P.M. or Projects		M		M			2
Facilities Non-critical							
Safety or Repairs		M	M	M	M	S	6
P.M. or Projects		M		M			2
Quality	Provides oversight to insure proper repair.			M			1
Accounting	Requires reports for financial oversight.		M	M			2
Lean	Oversees process improvements.			M			1
Safety	Insures work is done safely.		M	M			2
Managers	Responsibility for achieving goals.	S	S	M	M	S	8
Total							41

APPENDIX M: GENERAC STAKEHOLDER POTENTIAL WASTES

Stakeholder	Potential waste for or with this stakeholder
Tools Supplier	Grainger does up-selling
Tool Service Provider	Delays returning tools for Production
Supplies contractor	Requires min purchases
I.T.	Project upgrades
Manufacturing Critical Processes Repairs	must review W.O. to see if valid
Manufacturing non-critical processes Repairs	Excess inventory to ensure Production tools are available
Manufacturing non-critical processes Projects	Project costing / feasibility

APPENDIX N: GENERAC STAKEHOLDER CONFRIMED WASTE

Stakeholder	Over-production	Delay	Transportation	Over-Processing	Inventory	Motion	Defects	Comments on how the waste is demonstrated in the interaction with the specific stakeholder
Tools Supplier				x				Grainger's insistence on "up selling"
Tool Service Provider					x			Delay returning tools for Production
Supplies Contractor					o			
I.T.						O		
Manufacturing Critical Processes: Repair		x						Mfg does not review Work requests to see if it is set up
Manufacturing Non-Critical Processes					x			Non-Critical repairs: Excess inventory to ensure Production tools are available
Routine Project						O		

Comments on the Lean waste that is necessary	Mfg does not review Work requests to see if it is set up	Supplies: Requirement to purchase 25 filters when 8 are needed	IT - Project upgrades Project costing / feasibility

APPENDIX O: GENERAC STAKEHOLDER VALUATION

Stakeholder	What is the stake (interaction)?	Interest (attitude)	Power	Legitimacy	Urgency	Network	Preliminary Sub-Total	Over-production	Delay	Transportation	Over-Processing	Inventory	Motion	Defects	Comments on how the waste is demonstrated in the interaction with the specific stakeholder	Total Non-value Added	Waste Adj. Factor	Stakeholder Mapping Factor
Mechanics (Maint personn	Supplier or labor and skills	S	M	S		M	6									0	0.00	**6.0**
Tools Supplier	Tools used by Maintenance is supplied.			M			1				x				Grainger's insistence on "up selling"	1	0.13	**0.9**
Tool Service Provider	Repairs tools used for Manufacturing		M	M	M		3					x			Delay returning tools for Production	1	0.13	**2.6**
Parts Supplier	Supplies parts for equipment or other repairs.		M	M			2									0	0.00	**2.0**
Supplies Contractor	Supplies disposables used by maintenance.			M			1					o				0	0.00	**1.0**
Equipment Supplier	Supplies equipment used by maintenance.			M			1									0	0.00	**1.0**
I.T.	Does software or hardware support.			M		M	2						o			0	0.00	**2.0**
M.E. I.E			M				1									0	0.00	**1.0**
Project Mgt.	Designs work for special projects.		M	M			2									0	0.00	**2.0**
Equipment Mfgr. Contract	Special support for specific equipment.		S	M			3									0	0.00	**3.0**
Manufacturing Critical Processes																		
Safety		M	S	M	S	S	8									0	0.00	**8.0**
Repair		M	S	M	S	M	7		x						Mfg does not review Work requests to see if it is set up	1	0.13	**6.1**
Preventive Maint.		M	M	M	M	M	5									0	0.00	**5.0**
Project		M		M		M	3									0	0.00	**3.0**
Manufacturing Non-Critical Processes																		
Safety		M	M	M	S	S	3									0	0.00	**3.0**
Routine		M	M	M	M	M	5					x				1	0.13	**4.4**
Project		M		M	M		3						o			0	0.00	**3.0**
Office Critical																		
Safety		M	S	M	S	M	7									0	0.00	**7.0**
Repairs		M		M			2									0	0.00	**2.0**
P.M. or Projects		M		M			2									0	0.00	**2.0**
Office non-critical																		
Safety		M	S	M	S	M	7									0	0.00	**7.0**
Repairs		M		M			2									0	0.00	**2.0**
P.M. or Projects		M		M			2									0	0.00	**2.0**
Facilities Critical																		
Safety or Repairs		M	S	M	S	H	6									0	0.00	**6.0**
P.M. or Projects		M		M			2									0	0.00	**2.0**
Facilities Non-critical																		
Safety or Repairs		M	M	M	M	S	6									0	0.00	**6.0**
P.M. or Projects		M		M			2									0	0.00	**2.0**
Quality	Provides oversight to insure proper repair.			M			1									0	0.00	**1.0**
Accounting	Requires reports for financial oversight.		M	M			2									0	0.00	**2.0**
Lean	Oversees process improvements.			M			1									0	0.00	**1.0**
Safety	Insures work is done safely.		M	M			2									0	0.00	**2.0**
Managers	Responsibility for achieving goals.	S	S	M	M	S	8									0	0.00	**8.0**
Total							41									4		
Comments on the Lean waste that is necessary		"S" represents a high value. "M" represents a medium value.							Mfg does not review Work requests to see if it is set up			Supplies: Requirement to purchase 25 filters when 8 are needed Non-Critical repairs: Excess inventory to ensure Production tools are available	IT - Project upgrades Project costing / feasibility					

APPENDIX P: GENERAC STAKEHOLDER MAP