

Case Study: Improving Employee Engagement and Utilization of the Service Engineering Workforce

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ABSTRACT

The traditional service engineering organizational model, developed through specialization, has led to repeatable, high-quality results, a highly focused workforce, and a dependable knowledge base. However, this model also limits career development, restricts employee engagement, and fails to optimize resource allocation to the changing business needs of the customer.

By implementing principles of lean to break down silos across the organization, it is possible to transform an engineering organization, offer a wider knowledge base among resources, more effectively utilize the engineering staff to meet high- and low-volume workload demand, and increase employee engagement.

Employee engagement is important for the aforementioned reasons, but there is an additional element that should be a focus for strategic resource planning and implementation. A key benefit to increased employee engagement is the link to productivity. This paper will explore a case study for improving productivity and employee engagement congruently. The case study was successfully piloted in an aviation service engineering organization, and results over a one-year pilot project are shared. As a result, a tangible way to develop staff, elevate morale, improve productivity, and increase throughput of deliverables is possible.

Keywords

Employee Engagement, Leadership, Lean, Productivity, Team Building

1. INTRODUCTION

1.1 Introduction

Organizations widely recognize the importance of improving employee engagement. Employee engagement is defined as "...those who are involved in, enthusiastic about and committed to their work and workplace" (Gallup 1). James Harter & Amy Adkins report that "Less than one-third of Americans are engaged in their jobs in any given year" (Adkins 1).

So why is employee engagement important? What factors are contributing to a low percentage of the workforce feeling engaged in their work? Are there solutions to this dilemma? This paper seeks to ask these questions, apply some lean tools to explore root cause and find solutions to the problem. Evidence of how important this topic is to companies can be found by analyzing the level of focus organizations are putting on understanding this topic better. In the *Harvard Business Review*, Chief Executive Officer of Virtuali, Inc. Sean Graber says, "Each year, companies are spending nearly three-quarters of a billion dollars in an effort to improve employee engagement" (Graber 1).

1.2 Background

The service engineering sector of industry is a key to success in any manufacturing organization. Functions performed can vary from design, project engineering, program management, qualification and certification analysis, operations / production support, and many more. Traditionally, service engineering firms have developed expertise in these disciplines to provide excellent quality, provide focused resources, and demonstrate dependable knowledge base to the customer. Specialization is analyzed for any potential contributing factors leading to low employee engagement. Three engineering functions were the subjects of this study, each serving in an aviation company. These teams serve within functions concerning qualification analysis, certification analysis, and an operations engineering support group.

1.3 Problem Definition

Specialization in an engineering service organization is known to develop repeatable and high quality results, a highly focused workforce, and dependable knowledge base for each discipline. However, when asked for ideas on what contributes to low employee engagement, the teams expressed frustration with working in what they termed silos, defined by performing tasks without knowledge of how it fit together with other pieces across the organization. The team in this aviation service engineering organization identified three problems. They described specialization as having a negative impact on the business as a result of it preventing an optimized resource allocation to where the business need is at any given point and time. The team also explained that specialization masks inefficiencies within the organization, finally and most importantly, that it had been limiting career development across the organization. The team expressed these as reasons for low employee engagement.

1.4 Project Objective(s)

- Perform a root cause analysis of the three problems associated with specialization's impact on low employee engagement in this service engineering organization
 - Develop proposed solutions to the probable root causes
- Perform pilot program to test the solutions proposed
 - Improve employee engagement across the three engineering functions
 - Improve productivity ratio across three engineering functions
 - Increase throughput of deliverables across three engineering functions
- Develop a method that can be used for improving employee engagement and utilization of the service engineering workforce

2. LITERATURE REVIEW

The sources used in this study focus on the exploratory nature of this project. Gallup, Inc. is one of the few organizations that have gained an understanding of how to measure employee engagement, but even they have few answers to make positive change. Evidence of this gap over time reveals employee engagement is a relatively low and flat trend of between 28% and 34% that Gallup cites over a four year timeframe (Adkins 1).

Companies continue to invest millions of dollars into understanding where employee engagement is needing improved, and yet it is difficult to find examples of clear progress as a result of specific actions taken. Therefore, the citations and literature reviewed are important information to establish historical acknowledgements and findings related to the topic of interest in this paper.

The life of Charles Franklin Kettering serves as an example of how diversity and greatness can go hand in hand. Arguably the highest honor among Mr. Kettering's many recognitions was being esteemed with the Franklin Medal in 1936. The diversity of knowledge and success he realized in a myriad of industries included automotive, aviation, engine development, farming, fuel, missile technology, communications infrastructure, and contributions to education (Boyd 4-158). A key component in this study is that of cross-training to achieve improved employee engagement. Charles Franklin Kettering in Figure 1, even though having a core education in electrical engineering, was a prolific inventor of some 186 patents across different industries (Simmons 1).

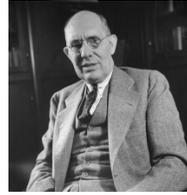


Figure 1: Charles F. Kettering

Image Credit: Bernard Hoffman-Time Life Pictures/Getty Images; <http://kids.britannica.com/comptons/art-58592>

“Better than most of his peers, Kettering recognized that in his modern roles as entrepreneur, salesman, public relations expert, and manager, the engineer needed the broad experience of the old-fashioned inventor” (Leslie 609). A development program for members of an organization that seeks to grow is more effective for both the organization and individual if the program builds skills and competencies beyond the current and specific role each staff member (Shipton 71).

The *Harvard Business Review* has embraced the topic of employee engagement and a few articles published from this journal are referenced.

For establishing the basis for the problem solving techniques and deriving solutions, Lean Six Sigma techniques were used. In a book entitled, *Lean Six Sigma Pocket Toolbook*, Michael George, David Rowlands, Mark Price, and John Maxey, utilizing the Define-Measure-Analyze-Improve-Control (DMAIC) philosophy of analysis technique is described, and then expounded upon throughout the length of textual and visual graphic content (George 1). As with most Lean Six Sigma projects, not all tools are utilized. Several lean analysis tools were selected for use as will be described in the following pages of the capstone paper.

The first step in to any problem or need in an organization is to understand the voice of the customer. Howard Lester, former leader of the consumer retail company Williams-Sonoma, operated within seven guiding principles. According to Lester, “Customer metrics are far more important than company metrics. Without customers, nothing else matters” (Zenoff 69). A series of questions were asked to the customer within this capstone study in a workshop. Represented in the workshop, were team members from design, program management, a technical writing department, engineering qualification, and a key supplier. In the workshop, the customer expressed an interest in receiving agile feedback during course of projects, receiving consistent high value of effort, clear and consistent communication in modes of verbal and written format, delivering on time (DoT), delivering on quality (DoQ), delivering on cost (DoC), and performing with skilled resources and reproducible processes.

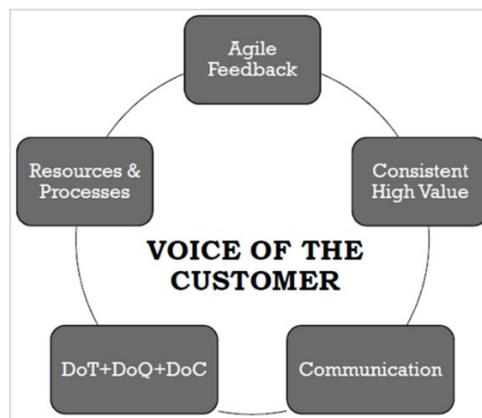


Figure 2: Voice of the Customer

When studying employee engagement and link to productivity, it is just as important to gain the voice of staff members. Internal to the subject team, questions were asked by the manager in the beginning of the study that included topics of customer needs and expectations from the staff member’s viewpoint. Other questions focused on what the team is doing well, and what could be improved upon. Two questions the manager needs to be especially willing to

ask when seeking to improve employee engagement is that of the interests of the individual and how they as the manager can serve the team better.



Figure 3: Voice of the Staff

In the traditional model of service engineering, there are multiple customers the firm must satisfy. Historically, engineering firms have developed into departments of specialization to satisfy their customer base. By offering a greater variety of opportunities within scope of each staff member's responsibilities, a feeling of more meaningful and integrated contribution to the purpose of one's job is developed (Whittington, 106). In the example project undertaken, a service engineering organization of an aviation company is considered. The service engineering organization studied that shall remain confidential, consisted of engineers in specializations of certification, operations analysts, qualification, and design. These areas of specialization were organized in four unique groups to support four separate sets of deliverables. Although these separate groups support common end products as Figure 4 represents, the focus of this study will target specialization responsibilities and related activities.

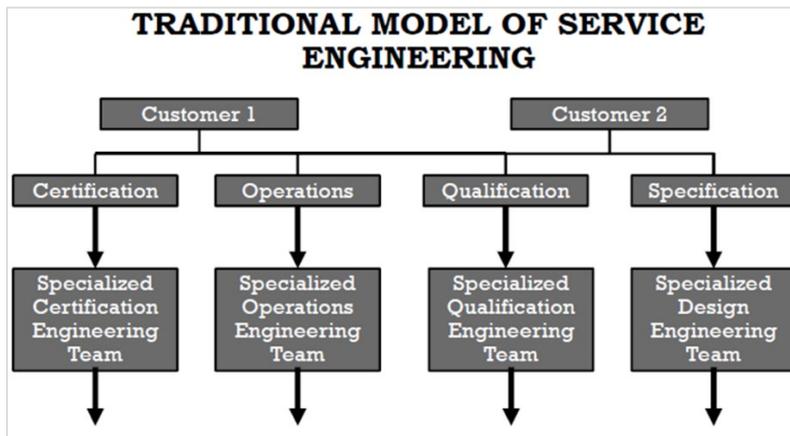


Figure 4: Traditional Model of Service Engineering

Specialization has played an important part in delivering repeatable and reproducible deliverables in order to meet customer demand. Specialization also leads to a highly focused workforce as well as establishing a dependable knowledge base that is needed for reliable customer service. "Specialization is a key to progress" (Konz 140). Konz and Johnson go on to say, "Use special-purpose equipment, material, labor, and organization. Seek the simplicity of specialization; thereafter distrust it, but first seek it" (140). So, why did the organization studied identify a key problem with employee engagement was within the model of specialization? Within the aviation industry company being studied within this paper, a glimpse of what the customer airlines are beginning to understand is important. In the book entitled *Up in the Air*, Southwest Airlines report, "Relational coordination has enabled greater aircraft

productivity, greater employee productivity, fewer customer complaints, fewer lost bags, and fewer flight delays” (Bamber, 179).

Before we answer this question, in any continuous improvement effort it is important to document how the current process is operating. How the process operates may be different from what the published documented process is. A key component of a value stream map (VSM), is important for “...capturing process data on (...setup time, processing time/unit, error rates, idle time, etc) as well as flow” (George 34). George also writes, “[The VSM is a] Mandatory tool for all teams whose mission is to speed up the process and eliminate non-value-add cost” (34).

Due to honoring the confidentiality of this project desired by the subject company, details of the value stream map are not able to be shared in this study. Generally though, a value stream map captures every step in the process, including non-value added moments that could be considered waiting, as well as logistics. In the case of service engineering, logistics could even include the time for which information is passed to one member of the team and engaged in by the receiver. The goal of a VSM in this case was to find a bottle neck in the process by which could be exploited. A bottle neck is defined as “a condition or situation that retards or halts free movement and progress” (Merriam-Webster 171).

The following pages will attempt to describe how specialization can be respected for the benefits of developing and maintaining a strong foundation, while at the same time offer a method to engage the technical staff member into a wider scope of skills and competencies. Dennis Flanagan, a 37 year editor of *Scientific American*, believed in these values. Mr. Flanagan espoused, “In an age of specialization people are proud to be able to do one thing well, but if that is all they know about, they are missing out on much else life has to offer” (Rennie 1).

3. METHODOLOGY

The strategy of Lean Six Sigma and use of related tools was used as the methodology of understanding what sources to target for a successful outcome to this project. Lean tools were used throughout the root cause analysis process, exploration of solutions and confirmation phase. The Ishikawa diagram was utilized for brainstorming initial causes for the problem of low employee engagement. A 5 Why analysis was used with each potential cause in order to drill down into probable root cause, which ultimately pointed back to issues stemming from specialization. Other strategies and tools were utilized to better understand the voice of the customer and the voice of the manager’s staff, a Supplier / Input / Process Step / Output / Customer (SIPOC) analysis, the value stream map (VSM), affinity diagram for brainstorming solutions, pilot testing of potential solutions, and finally a survey at end of project.

The following process was utilized during the project to first understand the voice of the customer (VoC), but also the staff member (VoS) within the team. The team then documented the as-is process through a SIPOC and VSM. Once in the analyze phase, the team began the root cause analysis through use of Ishikawa and 5 Why assessment. The paper will discuss reasons for the need of creating capacity, which in this project enabled the necessary solutions to be implemented and assessed. Figure 5 shows the steps of the method tested in the project to improve employee engagement and utilization of the service engineering workforce.

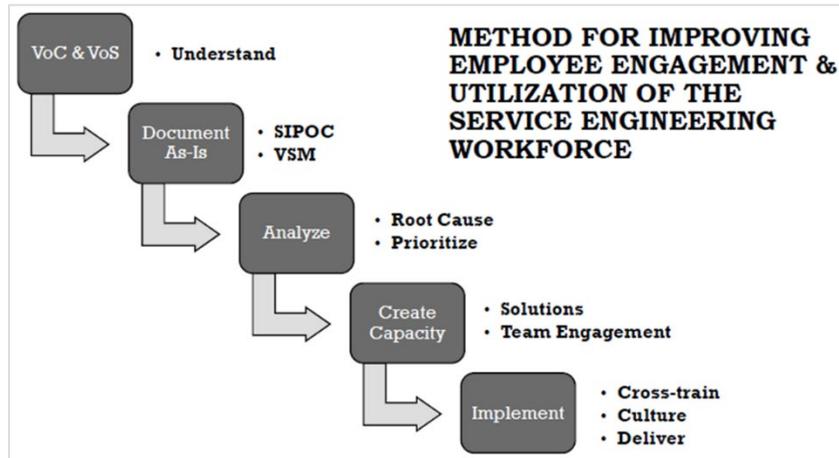


Figure 5: Method for Improving Employee Engagement & Utilization of the Service Engineering Workforce

3.1 Project Population

The targeted project population were individuals serving in an engineering capacity, across differing functions. The individuals for which the project drew samples from consisted of well diversified nationalities, age range, and gender. Sampling in this study consisted of nine participants across three unique engineering functions, accounting for 75% of the total department population. Demographics consisted of five males, four females, and five nationalities. One male in the study was 40-50 years, originally from Pakistan. The other four male participants were 25-30 years old, one originally from Panama and three that were native Malaysians. Representing the five females were two in the 50-60 years of age range from the Philippines and United States, two others also from the United States in the 30-40 year range, and one American intern 20-25 years of age.

Links between employee engagement and productivity have been cited by Gallup, Inc. in the past, but no specific methods for improving employee engagement specifically through intent of cross-training and targeting productivity as a desired output have been documented. During this study, leadership was interviewed from departments outside of the sample size within the same company who manage areas of specialization. A lack of time to cross-train was the main obstacle in accepting this model being explored due to the demand of maintaining on time schedule of deliverables and fear of reduced quality from their team.

As this paper will demonstrate, the method developed and tested, presents a way for the engineering manager to confidently find the time for the team to cross-train. The method also presents results from the study by which to build confidence that not only will the deliverable schedule be met, but also an increased volume of deliverables can be accomplished along with an increase of employee engagement realized among team members.

3.2 Data Collection

A combination of qualitative and quantitative data was collected during the course of the study. Because the project objectives involve both improving performance and improving the relationship between the employee, their work, and the organization for which they are a part of, both analytical data output (quantitative analysis) as a result of changes made within process and an approach to better understand any improvement to the relationship (qualitative analysis) were used.

Considered as baseline data for quantitative analysis were performance metrics taken from the first 36 weeks of the 2015 calendar year prior to project. After root cause analysis and potential solutions were discovered during project, cross-training ensued during fourth quarter of 2015. Once the members had demonstrated basic competency of new skillsets, performance was measured for the first 36 weeks of the 2016 calendar year.

3.3 Limitations of the Study

One limitation was found to be of note in this study. The limitation acknowledged was a small sample size of participants. In this study, three different functions were involved. There were a total of twelve members across these teams, of which nine voluntarily participated in the project. An attempt to offset this limitation in the study was two-fold. First, none of the participants knew the entire scope of the project’s goals. They knew they wanted more engagement, better access to skills and competency growth, and they actively participated in communicating the problems faced and pursued cross-training as a possible solution to the problem.

A delimitation of the project was that participants were purposely not made aware of the entire scope of project goals. A key goal not shared with participants was that of productivity ratio. Evaluating this metric before and after the study, without their knowledge, was made in effort to understand if a positive correlation existed between change in employee engagement and the productivity ratio, extending to resultant throughput delta. Productivity ratio is defined as hours spent per deliverables.

4. ANALYSIS

In this study, a workshop was performed with members of design, qualification engineering, a specification technical writing team, the parts supplier, and program management. In this workshop, every process step and information logistics transition was documented, with time captured for each. The largest bottleneck found in the VSM exercise was identified as an opportunity, if remedied, to create a potential for 14.6% efficiency improvement. Based on historical data dating back two years earlier, the average qualification project equaled 300 hours of qualification engineering effort. The team found that there would be potential for eliminating 43.8 hours from the process.

Table 1: SIPOC Diagram

(S)upplier	(I)nput (resource added)	(P)rocess Step	(O)utput (resource that is result)	(C)ustomer
(Requestor) - Design or Procurement	Request for Qualification	1) Initiated Need	Request formatted into network database tool	Qualification Team
Qualification Team	Assessment of Request	2) Analysis of Initiated Need	Assessment of Qualification Activities, Cost, and Timing	All Stakeholders
Requestor, Technical Writing Group, Program Mgt, & Procurement	Approval or Rejection of Activities, Cost, and Timing assessed by Qualification Team	3) Approval of Initiated Need Analysis	Approval of assessment. If rejected, then back to Step 2.	Qualification Team and Requestor
Qualification Team	Qualification Project Kickoff Meeting Hosted	3) Launch Project	Timelines of Activities Agreed	All Stakeholders
Technical Writing Team	Author Specification	4) Specification Development	Draft or revision of specification confirmed	Qualification Team, Design and/or Supplier
Supplier & Qualification Team	Develop Qualification Test Plan	5) Qualification Test Plan	Qualification Test Plan published	All Stakeholders
Supplier & Qualification Team	Test and develop Test Plan Report	6) Qualification Test Report	Qualification Test Report published	All Stakeholders
Qualification Team	Assemble project documents	7) Qualification Approval	Qualification documentation package	All Stakeholders

As the Supplier-Inputs-Process step-Output-Customer (SIPOC) analysis will demonstrate, in a service engineering process a subject typically considered as a supplier can turn quickly into a customer depending on the exchange of information and direction of information flow. The SIPOC brings the team together, including outside actors, in order to have an understanding of how their activities feed into and flow out of others. Table 1 provides example of a SIPOC

describing the big picture process flow within the qualification engineering function, for which the largest bottleneck was discovered and targeted for improvement. Confidential details are withheld.

In the Ishikawa Diagram, the problem / effect, is stated in the right-hand box of the chart. The Ishikawa Diagram, otherwise known as the fish bone diagram because of the shape it takes after, then is drafted with six different categories of potential causes (George 147). The team then brainstorms potential causes within these categories of manpower, methods, machine, materials, measurement, and environment. After the team is satisfied with the ideas for cause raised, they vote on the top three. Figure 6 represents in Ishikawa Diagram format, the team’s opinion on leading causes of low employee engagement within the organization.

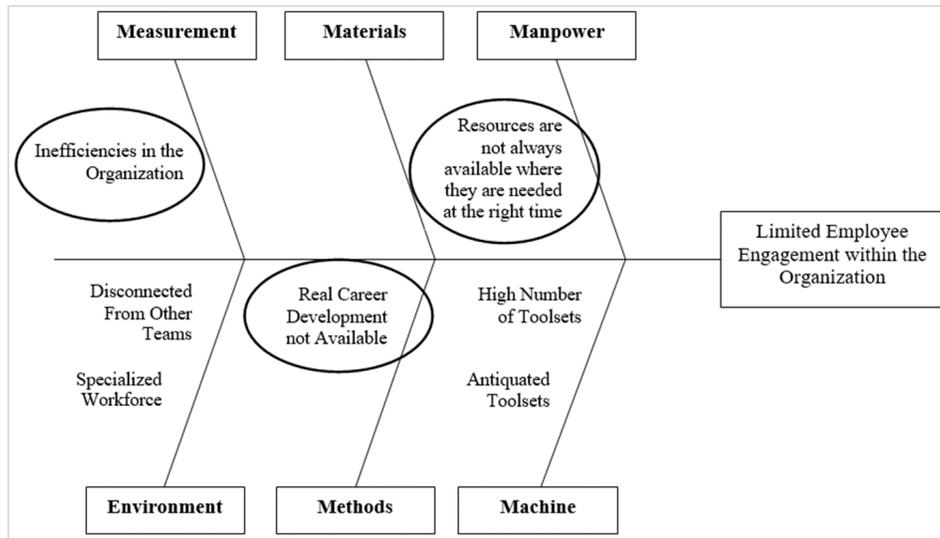


Figure 6: Ishikawa Diagram

Once potential causes are identified, vetting of these are necessary. Utilizing the 5 Why exercise to explore potential causes at a deeper lever, enables probable root cause(s) to be uncovered (George 145). This is a simple, yet effective method of asking why five times to each answer given, starting with each potential cause identified in the Ishikawa Diagram. Once an answer is agreed to without leading to another after asking why, probable root cause(s) can then be tested. Figures 7, 8, and 9 below, represent the team’s exercise of reaching decision of probable root cause, built upon the findings in Ishikawa Diagram in Figure 6.

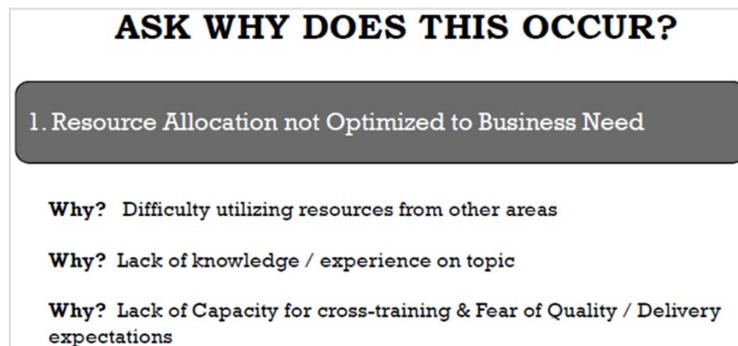


Figure 7: 5 Why of a Probable Root Cause – Resource Allocation not Optimized to Business Need

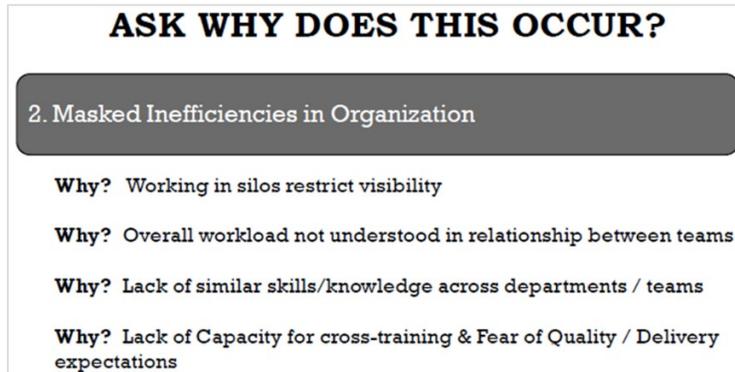


Figure 8: 5 Why of a Probable Root Cause – Masked Inefficiencies in Organization



Figure 9: 5 Why of a Probable Root Cause – Real Career Development Not Available

One common theme taken from each of the 5 Why exercises were that of a lack of capacity within schedule to cross train in effort to develop skills and competencies in new topics. The other common theme between two of the 5 Why exercises were a fear within the organization to utilize cross-training due to expectation of a reduction in on time delivery and quality of work. Therefore, these two themes are important for the team to consider as solutions are developed in a brainstorming session.

The purpose of an affinity diagram is “to organize facts, opinions and issues into natural groups to help diagnose a complex situation or find themes” (George 30). A summary is given below in Figure 10 of solutions brainstormed that the team agreed would be the most practical and effective toward resolving the two problems of lack of capacity and the organization’s fear of reduced quality and on time delivery.

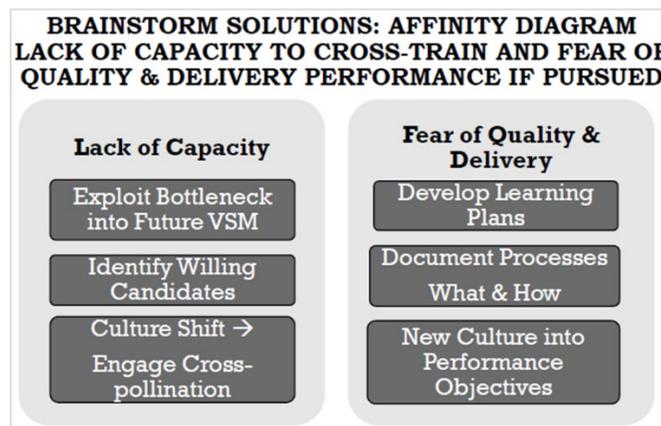


Figure 10: Affinity Diagram

A key to enabling the solution of career development was to exploit the bottleneck in the process by creating capacity versus the workload available. In essence, by creating idle time, the team members would overcome the first obstacle toward growing career development. Yet, there must be an answer to the second obstacle toward this development, being the fear by management of quality and on time delivery suffering as a result. Therefore, the team developed a plan to document the new process with bottleneck exploited. The team developed learning plans for colleagues who would be cross-training in order to document their progress and reproduce it in the future. To enable buy-in, individual performance objectives were updated to include cross-training activities for those interested staff members. Incorporating the additional objective of participation in cross-training demonstrated buy-in from management of the employee development that would result, and at same time communicated an expression of commitment from the employee that on time delivery and quality would be maintained in parallel with the opportunity. The value stream map was updated, often called the future value stream map.

While keeping their respective specialty a priority, each participant committed to dedicate up to 25% of their time each week to cross-training in one new area of work scope. Within three months, the team was demonstrating a level of competency satisfactory for initiating performance measurement over the next 36 weeks.

Figure 11 represents the possibility of how cross-training can open up many new lanes in the highway toward meeting deliverables in shorter time frames, increase value of individuals to the organization, and elevate employee engagement through a new sense of belonging and career growth. With careful planning to avoid conflicts of interest and maintaining highly ethical practices, it is possible for cross-training to occur between organizations such as operations support, qualification, and certification functions. Operations engineering, for the purpose of this study is defined as a team who is within engineering that supports the manufacturing organization.

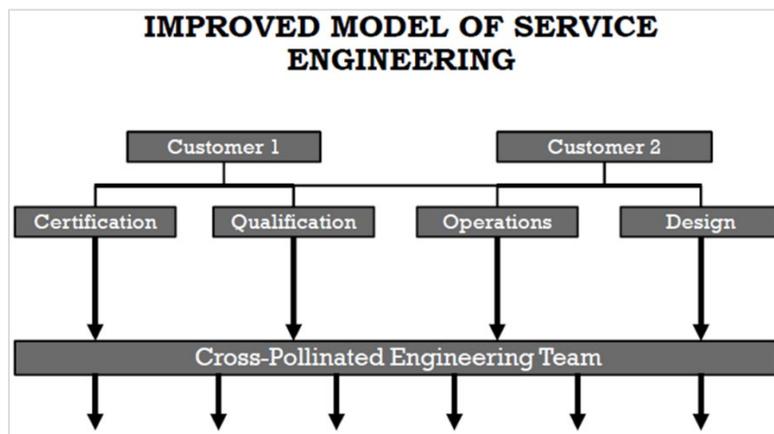


Figure 11: Improved Cross-Pollinated Model of Service Engineering

After nine months of collecting data on the newly aligned organization, performance output of capacity, productivity ratio, throughput, on time delivery, and quality were measured. Table 2 reports the deliverables accomplished each year in between the training phase of three months. Throughput of deliverables per employee is an important metric to consider in addition to productivity ratio. Throughput and productivity ratio don't necessarily have a linear relationship. If throughput is not tracking upward when applying this method, there is a problem to root cause. In the study performed, throughput increased 13.2% while productivity ratio rose 13.7%.

Table 2: Throughput vs. Productivity Ratio - Actual Worked Hours

Year	Participants	Deliverables Accomplished	Throughput per Person	% Increase Throughput (Del/Employee)	Hours Worked	Productivity Ratio (Hrs / Deliv)	% Improvement Productivity Ratio (Hrs/Deliv)
2015 CW1-36	8.25	1059	128.4	13.2%	10,816	10.2	13.7%
2016 CW1-36	8.25	1199	145.3		10,570	8.8	

If we were to keep productivity ratio of 8.8 hours / deliverable as a constant, and at the same time equalize the number of hours worked in 2016 project to that of what was worked in 2015, the accomplished deliverables could be presumed to reach 1,227. As Table 3 shows, with effort being equal, it can be confidently projected that throughput would increase to 15.9%, with productivity ratio of course remaining the same at 13.7%.

Table 3: Throughput vs. Productivity Ratio - Equal Hours Presumed

Year	Participants	Deliverables Accomplished	Throughput per Person	% Increase Throughput (Del/Employee)	Hours Worked	Productivity Ratio (Hrs / Deliv)	% Improvement Productivity Ratio (Hrs/Deliv)
2015 CW1-36	8.25	1059	128.4	15.9%	10,816	10.2	13.7%
2016 CW1-36	8.25	1227	148.7		10,816	8.8	

Once solutions were identified, in order to effectively cross-train, capacity or idle time needed associated with the biggest bottleneck in the process of system. The bottleneck was discovered in the qualification process, identified through the VSM exercise, and was sizeable enough to provide opportunity for career development. After thoroughly evaluating the as-is value stream map, and understanding the contributing factors toward the inefficient steps in the process, 43.8 hours were forecasted in savings per project. After cross-pollinating the organization, 41.1 hours of the 43.8 forecasted hours were returned to the company. This value was calculated by taking the 13.7% productivity improvement and multiplying it by the average time taken on a single qualification project before the project began, or 300 hours as Table 4 shows.

Table 4: Capacity Analysis

Year	Average Hrs per Qualification Project	Forecasted Opportunity per Project (Hrs)	Result of Exploited Bottleneck per Project (Hrs)	Number of Qualification Projects 2016	Capacity Forecasted (Hrs)	Capacity Filled by Exploiting Bottleneck (2016 Hrs)	Forecasted Exploited Bottleneck	Capacity Filled by Exploiting Bottleneck
2015 CW1-36	300	43.8		30	1314		14.6%	
2016 CW1-36			41.1			1232		11.7%

The team executed very well over a nine month project, returning 93.8% of the capacity created by improving productivity ratio as shown in Table 4 where 1,232 hours were given back compared to the 1,314 hours of capacity created. A tertiary benefit of this improvement came shortly after calendar week (CW) 36 of the project timeline. At that time, a customer approached the team for an opportunity in the fourth quarter of supporting an estimated 500 hour

project. Since the team had given back over 1,232 hours into the system in a nine month timeframe, averaging 137 hours each month (410 hours in a theoretical three month forecast), the new project was accepted without adding staff or having to perform the work on overtime. The investment made by the project participants, as well as management, resulted in benefits not only in efficiency to the organization, but also enabled additional revenue at an 82% profit margin (410 hours / 500 hour project).

Quality and on time delivery was an important factor to consider going into the project launch. At the end of the project, on time delivery (OTD) across all functions resulted in 90.7%, exceeding the objective (team objective setting confidential). Quality across functions resulted in a first time right (FTR) rate of 95.7%, which also exceeded expectations set forth in objectives.

The project teams improved performance, exceeded OTD and FTR objectives, but what about employee engagement? Once the project was completed, the team participated in a short, three question survey. In the past, the company had participated in a Gallup survey twice, but results of these assessments are not able to be shared in comparison to the results of this project due to confidentiality. So, in turn the three questions developed were considering their status prior to the pilot study, compared to after the pilot study:

- 1) Do you feel a higher sense of engagement within the team?
- 2) Do you feel more valued as a staff member?
- 3) Do you feel like your skills and competencies are being better utilized as an engineer?

Question one was straight forward. Answers to choose from were less engaged, no difference, or more engaged. The approach of question two was strategic since it was being addressed to engineers. Answers to choose from in this powerful question were less valued, no difference, or more valued. The third question addresses one of the likely root causes for low employee engagement by asking the engineer where they stand now in terms of their career development. Choice of answers were yes or no. Figures 12, 13, and 14 provide the summary of answers to the three questions, given by participants.

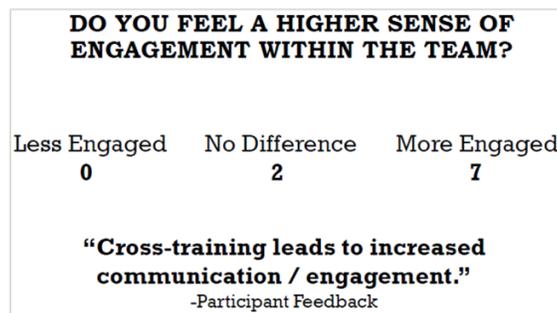


Figure 12: Survey Question One

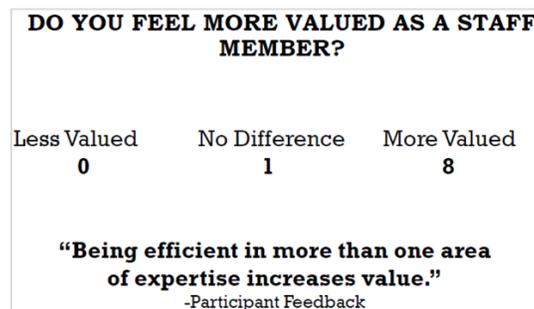


Figure 13: Survey Question Two

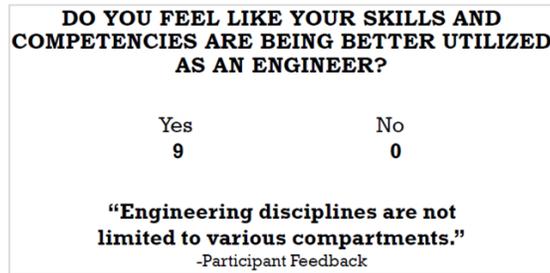


Figure 14: Survey Question Three

5. CONCLUSIONS AND RECOMMENDATIONS

5.1 Conclusions

Gallup has collected years of data that reveals a flat 30-34% employee engagement of workers. Companies are reported to spend millions of dollars to learn and improve this metric, without much historical success, presumed by the data collected from Gallup, Inc. Yet, if a careful look at the problem from the team level is taken, allowing the staff themselves to explore root cause and develop solutions to address the problem unique to their organization can not only yield improved employee engagement, it can benefit the bottom line and offer opportunity for business growth. In fact, Amy Adkins of Gallup says, “Employee engagement is a leading indicator of future business success, and Gallup has discovered close ties between engagement and outcomes such as turnover, profitability, and productivity” (Gallup 1). Inviting staff members to have an integral part in the effort toward improving employee engagement, and allowing them to define what it means within their organization to be engaged and how to improve it is a take away from this project analysis. Wide ranging benefits to the organization likely will result by following the steps of the method prescribed in this paper. The reader can take this developed method, study for applicability, and apply it across industries for improving employee engagement and optimizing utilization of the service engineering workforce.

All three objectives of the project were met. Root cause analysis of the three problems identified with specialization within the service engineering organization was performed utilizing several lean tools used in recognized problem solving methodologies such as DMAIC. Solutions were tested by performing a pilot program, accomplishing the second objective. The final objective of the project, to develop a method that can be used for improving employee engagement and utilization of the service engineering workforce, was successfully documented, implemented into an aviation company with success, and proposed for wider use.

5.2 Recommendations and Future Studies

In this case study, improving employee engagement was achieved, demonstrating that lean tools can be an effective way in contributing to finding root cause of organizational obstacles toward this goal, and that there can be productivity may increase through similar methods utilized.

Another future study could include a deeper understanding of what criteria motivates even the engaged staff member to leave a company. Further study on key factors and levers, in this case, could be studied in understanding how the organization can increase the likelihood of retaining a high performing and engaged staff member.

Acknowledgements

Thank you to Mr. Douglas Wilson, Adjunct Professor at Southwestern College (Kansas), for the time and effort you have spent in review of this paper.

References

- Adkins, Amy. "U.S. Engagement Reaches Three-Year High". *Gallup*, 09March2015. Web. 11sep2016. gallup.com/poll/181895/employee-engagement-reaches-three-year-high.aspx.
- Bamber, Greg. *Up in the air: how the airlines can improve performance by engaging their employees*. Cornell University Press, 2009. Print
- Boyd, Thomas Alvin. *Professional Amateur: The Biography of Charles Franklin Kettering*. [1st ed.]. New York: Dutton, 1957. Print.
- George, Michael and Rowlands, David and Price, Mark and Maxey, John. *The Lean Six Sigma Pocket Toolbook*. New York: McGraw Hill, 2005. Print.
- Graber, Sean. "The Two Sides of Employee Engagement". *Harvard Business Review*, 04Dec2015. Web. 07Sep2016. hbr.org/2015/12/the-two-sides-of-employee-engagement.
- Harter, James and Adkins, Amy. "What Great Managers Do to Engage Employees". *Harvard Business Review*, 02Apr2015. Web. 07sep2016. hbr.org/2015/04/what-great-managers-do-to-engage-employees.
- Kettering, Charles F. Photograph. *Britannica Online for Kids*. Web. 01Sep2016. kids.britannica.com/comptons/art-58592
- Knox, Stephan and Johnson, Steven. *Work Design: Occupational Ergonomics*, Seventh Edition. Holcomb Hathaway, Publishers: Scottsdale, Arizona, 2008. Print.
- Leslie, Stuart William. *Charles F. Kettering 1876-1958*. Ph.D Diss 8019941. University of Delaware, 1980. Ann Arbor: ProQuest Dissertations Publishing, 1980. Web. proxy.lib.utc.edu/login?url=http://search.proquest.com.proxy.lib.utc.edu/docview/302972729?accountid=14767
- Rennie, John. "Dennis Flanagan, A Proud "Renaissance Hack"". *Scientific American*, 25Jan2015. Web. 10Sep2016. scientificamerican.com/article/dennis-flanagan-a-proud-r/.
- Shipton, Helen, et al. *Human resource management, innovation and performance*. Palgrave Macmillan, 2016, doi-org.proxy.lib.utc.edu/10.1057/9781137465191.
- Simmons, J.E., Heather. "Cranky no more: The life and legacy of Charles Franklin Kettering." *Elsevier World Patent Information*. Volume 44. March 2016: 1. Web. doi.org.proxy.lib.utc.edu/10.1016/j.wpi.2015.10.005.
- Webster's Ninth New Collegiate Dictionary*. Springfield, Massachusetts: Merriam-Webster Inc., 1988. Print.
- Whittington, J. Lee, et al. *Enhancing employee engagement an evidence-Based approach*. Palgrave Macmillan, 2017, DOI 10.1007/978-3-319-54732-9_10
- Zenoff, David B. *Soul of the organization: how to ignite employee engagement and productivity*. Apress, 2013, DOI: 10.1007/978-1-4302-4966-5

Biographies

Aaron Rubel is the Head of Aircraft Maintenance Programs Development and Intellectual Property Focal Point at the Mobile, Alabama Engineering Center of Airbus Americas. Prior to joining the aerospace business in 2009, Mr. Rubel spent 20 years in the automotive industry. Among his roles in manufacturing and design, he was lead engineer of the Chrysler Sebring and Dodge Avenger rear seat programs. Aaron Rubel earned a MS in Engineering Management through the University of Tennessee at Chattanooga where he was honored with the memorial 2018 Dr. Ron Cox Outstanding Graduate Engineering Management Student Award. Mr. Rubel also earned a BS in Engineering Technology from Lawrence Technological University and inducted into the school's College of Engineering Hall of Fame. Aaron Rubel is an inventor of two patents and a certified and practicing Lean Six Sigma Black Belt. Among Mr. Rubel's honors throughout his academic and professional career, he was recognized as a Fellow of the Industrial Engineering and Operations Management (IEOM) Society. He also serves on a College of Engineering advisory board at the University of Tennessee at Chattanooga, and previously on a K-12 school board of a private school in Fairhope, Alabama, and contributed to a Mobile County (Alabama) Public School District STEM strategic plan published in 2015.

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