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Improving Labor Relations Performance Using A Simplified Drum Buffer Rope (S-DBR) Technique

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Abstract

The purpose of this research was to describe an implementation of Simplified Drum Buffer Rope (S-DBR), a scheduling methodology under Theory of Constrains (TOC), in service operations of US military operations in the southern U.S. In doing so, this research contributes in two ways. For practitioners, this research is the first to show how S-DBR methodology can be utilized to improve the performance of labor relations. For academicians, this research is one of only a few to address the how and why questions of S-DBR use in a service context.

Key Words: Simplified Drum Buffer Rope (S-DBR), DBR, TOC, Service Operations
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1.0 Introduction

The United States Congress established the Base Realignment and Closures (BRAC) commission to make recommendations for optimizing military installations. BRAC evaluates military bases on their competitiveness such as delivery, quality, and labor (relations); and makes recommendations for base closures and realignment (Ewing, et al. 2006). In fact, the past five rounds of BRAC recommendations have resulted in a total of 119 base closures and realignment of 87 infrastructure functions (Otal and Melhuish, 2013). Through the tool of public law, the United States Congress is likely to mandate the next BRAC in the year 2017. Given the real possibility of closures, it is imperative for each military base to justify their value and efficiency to the defense of the U.S. A key determinant is the labor relations efficiency of base operations.

Due to their recent annual reviews, a military base in the southern region of the U.S. – hereafter referred to as the “Base” – was aware that its labor performance was historically worse than bases located in the western and northern parts of the country. Specifically, the Base’s employee/management conflict resolution time, part of its labor relations performance measures (e.g. time to resolve grievance issues and execute disciplinary decisions) was not competitive when compared with similar bases. The Base’s performance averaged 30 days over the 12 months of FY 2013, while several similar bases in the north and west were achieving between 10 and 20 days. In order to increase competitiveness, the Base tried many improvement ideas from various internal and external sources since 2010. All of the programs had either worsened performance or achieved marginal success of a few days improvement. A program began in January 2014, based on a Simplified Drum Buffer Rope (S-DBR) control system finally led to improved performance from a mean of 30 to 10 days. This made the Base one of the best in the system for labor conflict resolution time.

S-DBR is one scheduling methodology developed under Theory of Constraints (TOC) principles that emphasizes the control of execution or job release into the system as a control mechanism to improve performance (Schragenheim, et al., 2009). The purpose of this research is to
describe how and why the S-DBR implementation led to improve labor relations performance.

This extends the use of S-DBR to a new service area and application not in extant literature. It is unique in that while many researchers have conceptually argued that S-DBR is a viable option for a variety of service or manufacturing operations (Chang and Hwang, 2011), there is a paucity of research answering how or why it works in services. In doing so, this research contributes in two ways. First, for practitioners, this research describes how S-DBR can be implemented in service operations, specifically to improve labor relations. Second, for academicians, this research answers the how and why questions important to extending theory to a new area.

In the next section, we provide a brief literature review of TOC principles and S-DBR characteristics. In section three, we provide a description of the methodology for S-DBR implementation. In section four, we write our implementation experience and, in section five, we provide results of the implementation. In section six, we provide implications of our implementation experience and conclusions from this study.

2.0 Literature Review

2.1 Theory of Constraints (TOC) Principles

More than 30 years ago TOC was a controversial development by Eli Goldratt as theoretical underpinnings for his Optimized Production Technology (OPT) software which he used as a shop floor control mechanism. TOC gained popularity after the publication of two books namely - “The Goal” (Goldratt and Cox 1984), which delineated the basic principles of TOC and, subsequently, “The Race” (Goldratt and Fox 1986), which described the DBR methodology. Over the years an interest in applying DBR have steadily grown among researchers that helped define the contexts in which is most successful (e.g., Umble and Srikanth, 1990; Darlington, et al., 2014). Simplistically, TOC works by identifying an internal constraint (or Capacity Constraint Resource – CCR) in a process and then uses a DBR control methodology to manage work flow through the process based on the capacity of the constraint. An important concept in DBR is the presumed existence of a constraint on which to optimally manage the work flow. However,
Rahman (1998) finds that not all processes contain internal constraints on which to base DBR. For these organizations the constraint on throughput is external, i.e. customer demand. For these situations, Schragenheim and Dettmer (2000) proposed Simplified -DBR, which is a variation of DBR, but still anchored in TOC principles. See Schragenheim (2010)’s work for an extensive discussion of the differences between DBR and S-DBR methodologies.

2.2 Simplified Drum Buffer Rope (S-DBR)
The application of S-DBR is intended to control process flows in systems where there is no internal bottleneck, but instead the constraint is external customer or client demand. This differentiates it from DBR which assumes an internal constraint. While many authors (e.g., Schragenheim, et al., 2009) have conceptually described S-DBR, there is a paucity of research empirically testing real-world implementations for how and why it works. For this reason, Goldratt (2006) developed a Strategy and Tactics (S&T) tree to guide S-DBR implementation (Figure 1).

Figure 1: S-DBR Implementation Elements

The S-DBR implementation consists of five elements and they are: (1) Choking the Releases, (2) Managing the Priorities, (3) Dealing with Capacity Constraint Resource (CCR), (4) Load Control, and (5) Process Of On Going Improvement (POOGI) – i.e. systematically improving flow. For
additional discussion on TOC thinking process and S&T tree, please to refer to Scheinskopf (2010)’s work. S-DBR methodology utilizes Buffer Management (BM) concepts, which divides the time buffers into three regions namely Region I, II, and III. According to Chakravorty (2001), consumption of buffer in Region III is considered to be normal and no specific action is necessary; consumption of buffer in Region II implies jobs are somewhat late, monitoring is necessary, and consumption of buffer in Region I indicates that jobs are late and expediting is necessary. Limited in the service literature, Huang et al. (2011) demonstrates the S-DBR implementation in production operations. This study is unique because it is the first to examine an S-DBR implementation in the context of service operations to improve labor relations performance. This extends the use of S-DBR to a new area to solve a unique problem.

3.0 Methodology

3.1 Case Study and Field Experiment
Since S-DBR has not been previously applied to improve labor relations performance, and labor relations conflict time is a key indicator of Base labor performance used by BRAC (Wright, et al, 2006), a field experiment examining the possible effects under controlled conditions is appropriate. A field experiment is conducted by the authors at a single office with one labor specialist at the Base to estimate the effects of the S-DBR implementation on labor relations resolution time before recommending system-wide implementation. A system-wide implementation can be costly, and due to the variety of improvement program failures since 2010, Base commanders needed evidence that the S-DBR technique can work before approving its implementation.

After completion of the successful field experiment, a case study describes the six-month implementation of S-DBR to answer how and why it worked to improve labor relations performance in a service context. While many conceptual, simulation, and analytical studies describe what S-DBR is and model where and when it works, none describe how and why it works in a service context to improve the labor relations process. According to Childe (2011) case studies are appropriate for extending theory or application to a new context. Childe also
emphasizes the need for research to be practical, which requires explanation of how and why a theory works to practitioners. In this case, S-DBR is important because poor labor relations performance can contribute to the Base’s higher risk for closure, with a corresponding loss of jobs and economic vitality for the region.

3.2 The Base
The Base has over 18,000 unionized employees and military personnel working in two departments, Maintenance and Support, performing various vehicle, general equipment, and electronics maintenance functions for a variety of military operations. The Maintenance department is divided into, a) vehicle maintenance group (AMXG), b) commodities maintenance group (CMXG), and c) electronics maintenance group (EMXG). The Support department is responsible for directing essential base operations such as security, vehicle management, fuel, and plant services. A majority of the Base’s employees are described as “skilled” workers and are represented in collective bargaining by the American Federal Government Employees (AFGE) Union – hereafter referred to as the “Union”. As part of the collective bargaining agreement, the Base maintains three labor relations offices that collect and process conflicts between the Base command structure (management) and labor. The offices house labor relations specialists who handle a variety of conflicts.

3.3 Data Collection
The field experiment was conducted and measures collected by the authors with assistance from the labor relations supervisors. The data for the case study was collected in a participant-observer manner (Yin, 2013), where the researchers not only observed each activity in the study but also led the early stages of the S-DBR implementation system-wide, before being assigned to the supervisors. First, the organizational structures for the Maintenance and Support departments are diagrammed, with descriptions and job titles of all personnel involved in the labor relations process. This shows the chain of command and string of approvals necessary to complete a labor action. Second, a spaghetti-diagram is used showing the work flow and documentation involved in the process. Third, descriptive statistics are collected on
the flow-time data for processing and completing a labor grievance case under both experimental conditions and eventual performance results for the case study. Fourth, a partial Value-Stream Map (Figure 2) showing only the relevant activities in the labor relations process is included. Only relevant processes are shown since the full VSM spans six pages, and some of the activities are considered proprietary by the Base commanders.

3.4 Labor Relations Process

The Base employs two types of specialists to handle three categories of labor issues involving employee/management conflicts; namely Labor Relations (LR) specialists who handle only grievance cases, and Employee Relations (ER) specialists who handle only disciplinary cases, and some miscellaneous cases (e.g., Congressional Inquiries or Inspector General Complaints).

Simplistically, a grievance is an employee complaint of unfair treatment, a breach of collective bargaining agreements, a misapplication of law, or a condition-of-employment violation. Generally, disciplinary action is seen primarily as a corrective measure, aimed at preventing further misconduct or poor performance. The most common types of disciplinary action are warnings, and in serious cases, dismissal; however, disciplinary action can sometimes mean suspension from work, or the removal of certain privileges, or, in rare instances, demotion. To be lawful, disciplinary action or dismissals must be fair and reasonable (with limited exceptions). The partial labor relations VSM is shown in Figure 2.
3.5 Labor Relations Challenges

The Base processes labor relations grievance claims using a process this study refers to as Scenario 1. Scenario 1 represents the current labor case practice where a LR or ER specialist handles multiple cases at once, working on as many four-five cases simultaneously, with an additional 20 or so in queue. The Base has many challenges when trying to execute grievance and disciplinary cases using Scenario 1, which include a complex organizational structure, convoluted work flow, and inefficient work handling. Complex organizational structures include physically separate buildings for basic functions (Figure 3). Under the Maintenance Group Commander, there is a Civilian Personnel Office (CPO) which maintains two separate offices in different locations to perform identical LR and ER activities. Under the Support Group Commander, there is a single Management Support (MS) office, which handles both LR and ER cases. Also, the MS office assigns management representatives, known as Designated Management Official (DMO), to different groups such as AMXG or CMXG. With two commanders and layers of management in between, with three supervisors; it is a difficult environment for sound and timely labor conflict resolution. The situation is further
exacerbated because the three offices are physically located in three different buildings. For the most part the specialists working in these offices work independently with little or no interaction, creating a propensity to make locally optimal decisions that benefit one office, in deference to the others. There is no encouragement to cooperate to seek globally optimal decisions which can benefit the Base as a whole. In addition, there is no interactive learning (or “cross-pollination”) among LR and ER specialists, which in the long run harms their career or promotion opportunities because they are unaware of activities in other departments.

Figure 3: Organization Structure

After a grievance or disciplinary case is filed, they are processed in a convoluted work flow, meaning that there is little standardization in completing virtually identical tasks. A spaghetti diagram showing representative work flow is shown in Figure 4. The diagram shows, for example, at AMXG the DMO typically receives disciplinary or grievance cases first. Immediately, the disciplinary case is forwarded to the ER office and a grievance is forwarded to the MS office. At times, DMO may instead forward the case to LR office (to begin step 1). While coordinating with AFGE, the LR office may send the case back to the DMO. At other times, the LR Office, after completing step 2, sends the case back to MS. As the diagram shows, there is no apparent benefit to having different work flows or a lack standard routing to accomplish the same task. Instead documents are handled multiple times through the same office, and often returned and rerouted after no action is taken. As the work flow varies among the different offices some cases are lost, causing significant delays in case resolution, and then
more delays in executing the decision. Significant delays can be very costly, frustrating the employees who must show daily progress, embarrassing to the Base through poor labor relations, and more importantly harming their case resolution time. In addition, the labor relations with the LR and ER specialists are also affected because the convoluted work flow distributes work unevenly among the offices. In other words, one set of specialists may have too many cases and thus struggle to make, deliver and execute decisions, while other specialists have little to do. Since the offices are physically separate, there is no cross-training or visibility of workload to commanders or supervisors thus making it difficult to fairly balance workload among the offices even when the opportunity arises.

![Work Flow Diagram](image-url)

Due to the multiple "touches" required by each specialist and office, inefficiency in handling cases is created. In Scenario 1 in which LR or ER specialists are assigned cases as soon as they arrive to the office – clogging their inboxes with an average of 20 cases per specialist in queue at any given time (Mean = 19.8, Std Dev = 4.5 cases, Range = 0 - 35). This creates the need to multi-task across cases to show progress on each one, which further reduces efficiency (Lindbeck and Snower, 1996) and inhibits a commander’s ability to track progress on any case. This delays their ability to render a decision and thus harms the Base’s labor relations performance.

### 4.0 Field Experiment

A proposed new work flow based on S-DBR that the researchers refer to as *Scenario 2* provides
the stimulus for the field experiment. Based on the controlled-release concept of TOC and S-DBR, supervisors release the next case to be processed from an S-DBR buffer and only release one case to each specialist. The LR or ER works on only one case at a time until it is complete. To control for confounding variables, the baseline Scenario 1 data was collected first, (reported in previous section) then training was provided to the participants in the experiment, but all other practices, policies, and personnel remained unchanged in the departments during application of the experimental stimulus - Scenario 2. With the assistance of the supervisors, the researchers executed Scenario 2 by selecting cases from the buffer based on two S-DBR criteria; 1) cases expedited by a commander, 2) the earliest date since submission to the labor relations department. Expedited cases were released first then those cases that were in the buffer the longest time since submission were released next, in date order.

The first activity of the experiment is to choose a senior LR specialist who typically works 8 hours/day (not including lunch and breaks). A specialist was randomly selected from a group of volunteers solicited by the authors. This week during the experimental period, she received 4 cases on Monday (labeled case 1, case 2, case 3, and case 4). Based on data collected 90 days prior to the experiment, a senior LR can complete a typical case with an average of 8 hours of handling time (Mean = 7.75 hours, Std Dev = 3.25 hours). The departmental commanders had an un-written policy that the LR and ER specialists should show daily progress on as many cases as possible so they appear more responsive to labor issues. We asked the specialist to process cases as usual with the policy in-mind so she felt pressure to perform at least one activity per day on several cases to please her supervisors. The results of the specialist working on four cases at-a-time were that by the end of Monday only 25% of each case (e.g., case 1 = 2 hours/8 hours) is complete. By the end of Tuesday, 50% of each case (e.g., case 1 = 4 hours/8 hours) is complete. Likewise, at the end of Wednesday, 75% of each case is complete, and finally all cases are completed on Thursday - i.e., average flow-time per case is 4 days.

Applying the experimental stimulus during the following week, Scenario 2 – S-DBR, i.e. performing the same tasks without multi-tasking, the researchers release one case at a time to
the LR specialist who starts and completes a case before moving on to the next case. At the end of Monday of week 2, case 1 is complete; on Tuesday, case 2 is complete; and so forth until all four cases are completed by Thursday. In other words, case 1 took eight hours and “0” queue time (flow-time = 1 day); case 2 also took eight hours but was in the queue one day (flow-time = 2). In the similar manner, case 3 has 3 days, and case 4 has 4 days. This translates to an average of 2.5 \(\{(1+2+3+4)/4\}\) days flow-time for Scenario 2, a reduction of 37.5% over Scenario 1, with all other experimental conditions held constant. Since this was a single experiment with one specialist, without replication, there is insufficient data to calculate descriptive statistics on the flow-time reduction. The only policy change for the field experiment in Scenario 2 is that the Base eliminated the policy that the LR show daily progress on each case. In short, the field experiment provided evidence that multi-tasking negatively impacts the performance of LR/ER specialists, as it has shown to do in other contexts (e.g. Lindbeck and Snower, 1996), causing delays in completing a labor relations case.

5.0 The S-DBR Implementation - Case Study

Based on the results of the field experiment, the Base agreed to implement the S-DBR mechanism. It is important to note here that the Base tried many techniques over the years to improve labor relations performance, but were unsuccessful in either achieving improvement or sustaining the improvement after a few weeks. Some popular approaches they tried include basic TOC/DBR, Lean, and Six Sigma, among others. Please refer to Womack and Jones, (2003) for a detailed description of Lean tools and Pyzdek and Keller (2009) for Six Sigma tools. Some reasons for the failure of these programs are not directly applicable to the S-DBR experiment or full implementation but some relevant findings are discussed later in this study. One issue with previous efforts that weighed in the Base’s decision to perform a full roll-out of S-DBR include the commanders had never tried a unified effort across all three offices; instead various improvement tools were tried by individual offices, at different times, and consequently the offices rarely worked together to integrate efforts. One objective of the implementation is to try the same S-DBR method across all offices and specialists at the same time so that synergy can develop and specialists can support and learn from each other.
5.1 Specialists & Office Reconfiguration to Support S-DBR

The implementation progressed in four distinct phases. In the first phase, the focus was on the training of the ER and LR specialists on the Scenario 2 method and the basics of S-DBR. In the second phase, the workflow was analyzed and a new process and cellular configuration was developed to process cases to support the S-DBR. In the third phase, the three offices were physically relocated to a single location to support a cell structure for the specialist’s work flow. In the fourth phase, the S-DBR mechanism was implemented to control workflow to the cells. At first, the researchers managed the release of cases to the service cells, then the supervisors took over and the researchers only observed the process and results.

In the training phase, much of the statistical and analytical components were excluded because the authors found that the majority of the specialists did not possess the background or the academic preparation to fully understand such tools. Instead, the authors used many training techniques including illustrations, examples, and interactive simulation games to provide practice in the basics of the S-DBR process that have shown to be effective by other researchers (e.g. Chakravorty and Verhoeven, 1996). Essentials of the training program included the five focusing steps of TOC, DBR, and Buffer Management, concept of the 7-wastes, process and value-stream mapping, and applying a five-step scientific method of problem-solving including: a) identify the problem, b) gather and analyze information, c) generate alternative solutions, d) prioritize and implement the best solutions, and e) follow-up to ensure it worked. This approach is similar to Six Sigma’s approach of define, measure, analyze, improve, and control; and Lean’s plan, do, check, act; among others. During the training, specialists interacted for hours, developing strategies (e.g., ideas to eliminate multi-tasking) to improve their simulation performance, and then the authors discussed how these strategies are applied to improve their labor relations performance.

In the second phase, process and value stream maps were developed on current work flows and loads using the data from January to September 2013 (See Figure 2 for partial VSM). The analysis showed that based on the workload there was no internal constraint, and therefore the
S-DBR implementation was justified. The analysis revealed that approximately 75% of the workload consisted of grievances/discipline cases, and about 25% of the remaining workload consisted of miscellaneous cases, such as Congressional inquiries or Inspector General (IG) complaints that were often expedited. A key recommendation in the S-DBR literature is the use of process “cells” (similar to manufacturing cells) to accomplish tasks. In the Base, a cell was developed to handle the grievance and disciplinary cases called a “service cell” and the second cell was developed to handle the miscellaneous cases called a “specialized cell.” Each service cell included one LR specialist and one ER specialist so that all cells can handle grievance and discipline cases. The intent is for the specialists to cross-train each other so that over-time the cell can improve flexibility, where either LR or ER specialists can perform both duties and thereby enhance their career opportunities. In addition, once cross-trained, they can help each other to manage peak workload. Considering the existing workload and expertise of individuals in the three offices, 10 service cells are required. One larger specialized cell with three-five specialists can handle all of the typical miscellaneous cases. Figure 5 shows the cell organization.

In the third phase, after receiving Base and specialist comments and approval, the physical office relocations were made in a cellular configuration that supported the model in Figure 4. All LRs and ERS were relocated from three to one central building, and then the two specialists were chosen for each cell based on skills and seniority. This move was difficult because some construction and relocation of other functions was necessary to accommodate all 11 cells and the 30 specialists in one location.

Figure 5: Service and Specialized Cells
In the fourth phase, the S-DBR control was implemented. In preparing for the change the organizational structure is simplified by narrowing and flattening the reporting functions - and include only those individuals needed to complete the tasks. The structure is narrowed by reducing the number of supervisors from three to two. The two who were selected had previously worked as successful LR and ER specialists and had received supervisory training at the Base. The third supervisor is no longer needed since all specialists are in the same office. The structure is then flattened so that the supervisors report directly to the Deputy Commander of the Support department; who reports directly to the Commander. The old structure included individuals that are in the chain only for “information purposes” and not approvals, but because the workflow in Scenario 1 is sequential, cases are delayed waiting for mere notification sign-offs, and not for value-added activities such as approvals or content reviews.

S-DBR also requires a buffer management system, which is typically managed in manufacturing through information technology. A range of options for information technology was considered; however, the high cost and the long lead time for cutting-edge, fully-automated technology made this option impractical. Subsequently, the specialists suggested using
Microsoft Excel, which required some human interface. A decision was made to designate an individual specialist responsible for managing the buffer with daily input from the supervisors. The S-DBR implementation followed five of the following elements.

5.1.1 Choking the Release

To prevent multi-tasking the Base eliminated its policy of specialists to work on each case daily. Instead of relying on the specialists to choose which of the 20 cases they will work on next—which encourages multi-tasking, the S-DBR system requires input control—where a single case is assigned to a specialist until it is complete—as tried in the experimental stimulus Scenario 2. This is called controlled release, versus a non-controlled release as seen in Scenario 1 where cases pile-up in specialists inboxes as they arrive.

Controlled release requires four steps. First one is setting the buffer size. The average time to complete grievance/disciplinary cases is 30 days. To avoid consequences of missing deadlines, specialists artificially added slack to each intermediate step of grievance/disciplinary process. This ensured that the deadlines were not tightened which would make the specialists jobs more difficult. With no historical data to guide them, the commanders arbitrarily set a buffer size of 50%, meaning that with typical demand, where no buffer was consumed, a case should be complete in 15 days. This is considered an aggressive and somewhat impractical target, because the number of submitted cases can vary widely from day-to-day and in lower demand periods it will be impossible not to consume the buffer, given existing capacity of the new cells. As discussed before, a key performance measure is the time to resolve labor conflicts, which is correlated with the cost and resources involved. Because of this, it is essential that the Base decrease the time to deliver and execute resolutions. Relative to the other facilities in the North and West that may be considered for closure, the Base commanders needed to resolve labor issues in much less than 30 days.

The second step in controlled release involves generating a release schedule of cases to maintain the targeted buffer sizes. Generally, the release follows a First-In-First-Out (FIFO)
priority rule; however, supervisors frequently assign higher priority to some cases that potentially have high impacts. For example, some labor issues affect only one worker, while other disputes may affect a whole department.

The third step in controlled release is enforcing the release schedule. LR and ER specialists can circumvent the S-DBR system for their own benefits if not constrained. For example, if left to their personal preferences, employees can choose the easier cases to work on (a.k.a. cherry picking), instead of following FIFO. Supervisors can also circumvent the system through favoritism, by assigning easier or more visible cases to preferred specialists instead of fairly balancing the workload across service cells. Some service cells can get overloaded, causing unnecessary delays in completing the grievance/disciplinary cases, while others become starved of work and waste capacity.

The fourth step is freezing excessive WIP (limiting cases in process) to prevent clogging the system. It is possible that supervisors can release cases early ahead of schedule to fill available capacity during low demand periods – when some cells aren’t busy. But when released early the queues fill quickly, and once demand picks up the cells again become congested with incomplete cases. Case resolution time again increases and labor relations performance drops, forcing the specialists to again multi-task to show progress. To prevent this in S-DBR, cases must be released only on schedule to ensure that multi-tasking and load imbalance does not occur. This decision was received by the service cells with mixed feelings. Traditionally overloaded specialists are pleased that their workload will decrease, but under-loaded specialists are apprehensive because their workload will likely increase. Now that service cells have both LRs and ERs, any cell can process virtually any case.

5.1.2 Managing the Priorities
Managing priorities refers to the sequencing of cases to be released to the cells. Both the FIFO and expedited cases must be tracked and released according to established priorities. The Base accomplished the objectives of managing priorities in two steps. First step was to establish
buffer zones to implement priorities. That was accomplished by dividing the 15 day buffer into three regions from low, medium, and high priority – typically labeled Region III, Region II, and Region I. In order to update the buffer, the supervisors held a buffer meeting at 9:00 AM daily. The supervisors released the highest priority cases to the cells first, then the cases with the earliest submission dates. Only then were the lower cases released – still one-at-a-time. This ensures that the workload is reasonable and fair and as a result the method used to evaluate specialist’s performance was revised. Under Scenario 1, specialists were evaluated on criteria that had no relationship to the labor relations resolution time used for the Base. Instead, they were evaluated based on trivial items such as the number of mistakes on paperwork (mostly minor in nature), their tardiness and lateness records, etc. These criteria were not only unrelated to the resolution time performance, but also harmed the moral of the units – actually causing some of the LR and ER specialists themselves to file labor grievances. For example, even though all service/specialized cell members worked a full eight hours/day, the supervisors spent most of their time tracking and documenting trivial infractions. This includes being 10 minutes late to work or taking an extra 13 minutes for lunch, etc. Once incurred, the specialists were consistently reminded of these infractions. Even when there was a lower case load, specialists were afforded no job flexibility; however, when their case load was higher thus requiring them to work through breaks or lunch - supervisors gave no credit toward their performance. Under the buffer management system, they should have greater flexibility when case load is lower, and they no longer lose lunch or break periods on non-priority cases.

The second step is sustaining management by the new buffer protocols. There is a propensity among the supervisors to revert back to the old system – to flood the cells with non-priority cases to keep specialists from being idle. They exhibited a bias toward idle specialists that assumes that supervisors aren’t doing their job and workers are less productive if workers don’t stay constantly busy – a traditional concept long refuted by Deming (1986) and Goldratt and Cox (1986). This frustrated the cell members and seriously harmed moral. The Base commanders had to openly support the new buffer protocol and consistently reinforce it with the supervisors. They began participating in many of the service/specialized cell activities and
finally developed operating principles for managing the cells. After two months, the situation gradually improved and supervisors strictly followed the buffer rules. If a case is placed in Region I, implying that it is late or immediate action is necessary, the supervisor can shorten breaks, schedule overtime or, contact other departments for temporary assistance. Occasionally, since the supervisors had ER and LR experience, they directly provided necessary assistance to the service cell and expedited the completion of the case. Otherwise, they were flexible with work schedules and did not penalize the specialists for minor infractions.

5.1.3 Dealing with CCR

In the TOC literature, a temporary bottleneck called a Capacity Constraint Resource (CCR) can develop. A CCR is harmful because it's a short-term bottleneck that inhibits flow that is difficult to detect a priori. A CCR requires immediate corrective action or performance can quickly deteriorate. In this S-DBR implementation the legal department is the CCR. An analysis revealed that during heavy case loads the legal department, who had to approve all labor resolutions, backed up. Traditionally, the staffing of legal department at the Bases was determined based on the average yearly requirements of legal assistance instead of peak periods, and cases processed based on FIFO. Since the buffer schedule to the service cells does not consider the variety in legal requirements, from case-to-case, the FIFO priority rule did not work well. The legal department got overwhelmed with cases and reached out to their counterparts in other bases for temporary assistance. The Base decided to modify the release schedule for all the cases to include the legal requirement. During the morning meetings the supervisors estimated the demand on the legal department and began considering it in the priority schedule. For typical cases, the FIFO rule was employed for the legal department, but not for expedited cases. Simplistically, for each case with a high level of legal involvement, three low levels of cases were released. This balanced the work load in the legal department and caused the Base to add two additional legal experts.
5.1.4 Load Control

In order to implement a successful S-DBR implementation the work load needs to be constantly monitored and caseloads adjusted each morning to ensure the cells are working on the highest priority cases, and not congested with lower priority cases. The purpose is to ensure that the system is not overloaded and resolution time is maintained. Due to the seasonality in case loads, supervisors had some visibility of peak demand. For example, following the labor appraisals in January, there is an increase in the number of grievance cases filed in February and March by workers who feel that they are unfairly treated. During the daily buffer meetings in March 2014 however, the supervisors discovered that there was an unusually large increase (about 35%) in grievance cases which could not be handled with the existing level of service cells. The Base decided that a small team consisting of commanders, supervisors, and union members visit bases in the North and West to discover how these bases maintained their labor resolution time through unexpected demand spikes in grievance cases.

The visiting teams found that the other Bases were more proactive in preventing labor conflicts from becoming formal grievances. For example, when maintenance workers are dissatisfied with their annual appraisals they can file an informal grievance with Human Resources (HR). The maintenance supervisor has 10 business days to respond to the grievance and either satisfy the worker without further action or allow a formal grievance to proceed. If the employee is satisfied, then their complaint does not become a formal grievance. No harm is done to labor resolution time performance. If the employee is not satisfied, only then does the complaint become a legitimate grievance case, and required to be forwarded to a service cell. Some Bases acted more proactively by establishing personal relationships between HR, management, and labor representatives thus preventing many disputes from becoming grievance cases.

5.1.5 POOGI – Systematically Improving Flow

The POOGI improvement program was implemented with the buffer management system. Every two weeks, the supervisors performed Root Cause Analysis (RCA) (Pyzdek and Keller, 2009) to pinpoint improvement opportunities. Root Cause Analysis is a traditional method used
in many programs to discover the cause of an observed phenomenon - for the purpose of controlling/influencing the phenomenon. The concept is based on the idea that you can’t improve an outcome, like labor resolution time, unless you know what causes it.

A Value Stream map from Figure 2 is used to identify and analyze the causes of downstream delays in the grievance process. For example, for processes consuming too much of the buffer, a group of service cells developed a VSM of disciplinary cases. The longest non value-added activity is in the legal department, where the cases are placed in queue until an attorney is available to review and make a recommendation. During peak periods when the legal department was a CCR, the time in queue represented 80% of the total process time.

In addition to TOC and S-DBR, over time, a variety of tools were taught to managers, supervisors, and service cells, including Six Sigma (Pyzdek and Keller, 2009), and Lean Methods (Deming, 1986). Several specialists earned their Six Sigma Green Belt. The supervisors along with service cells applied a common Lean tool - Statistical Process Control (SPC) - to the throughput of cases, and found two cells that were under performing. The results of a Cause/Effect diagram found that these service cells were unhappy with the changes and were subsequently moved to another office.

6. Results of S-DBR Implementation

Tangible Benefits to Industry

The concept of effective controlled release can save lives. In early 2014, many U.S. veterans died waiting for medical care because the Veteran Administration (VA) Hospitals administrators failed to release critical cases for urgent medical care (Cooper, 2014). While our case study is not life-threatening, it does effect employment for thousands of workers through improved labor relations. Our initial field experiment with S-DBR demonstrated a 37.5% decrease in the time to process a labor resolution case. Following the S-DBR implementation across all specialists, the timeline to render decisions on discipline/grievances cases dropped from an average of 30 days to 10 after the first six months, a drop of 66.7%. The monthly standard
deviation is 4.5 days. This suggests that S-DBR can improve operations in similar contexts. There are two primary reasons explaining why the improvement in labor resolution time; first, the S-DBR allowed supervisors to control the work flow, to sequence cases to the specialists based on submission date or case priority. Releasing cases based on FIFO logic from the buffer limited the cherry-picking opportunities, the buildup of cases at the specialists work stations, and the unbalanced work flow. Supervisors can track progress on each case to ensure they are processed in a timely manner and specialists can focus their efforts on a single case until it is resolved. Second, an unexpected result is that after six months of implementation the number of grievance cases dropped by 22%. This effect was not seen in the field experiment. Follow-up interviews gave three primary reasons for the drop in cases; first, the S-DBR effort and its possible benefits to keep the Base open increased the attention given to the labor relations process, i.e. the Base leadership signals they care about improving labor relations. Second, the faster grievance resolution time improved overall labor satisfaction, where there is less informal, i.e. grapevine, conversation centered on the long resolution time. This is important because BRAC, the board that recommends base closures, evaluates a decrease in the number grievance cases as an improvement in organizational health. Third, due to the unbalanced work load on the specialists, they filed their own labor grievances. The improved control by the S-DBR had all but eliminated the workload imbalance and only two grievances from specialists had occurred during the six months. This contributed to the improved probability that the Base in the South can compete with the North and West if future closures occur.

**Intangible Benefits to the Base**

There were three intangible benefits from the S-DBR implementation. First, as service cells (LR and one ER specialists) forced specialists to work together in close proximity by spending more time learning each other’s job tasks and expertise. Second, the workload is now fairly balanced across the different cells because of the visibility through the buffer management. Third, a significant reduction in multi-tasking has resulted in a greater focus in completing disciplinary/grievance cases.
7.0 Implications for S-DBR Literature

Besides the practical benefits to the Base, the findings also have impacts on the S-DBR literature. First, this case answers how and why ‘Choking the Release’ of work plays an important role in effectively managing service operations and quantifying its effect on performance. While over the years studies using conceptual, analytical, and simulation models shows the importance of controlled release in a number of contexts under titles such as ‘input/output sequencing’, ‘input control’ (e.g., Baker, 1984; Onur and Fabrycky, 1987). Reported benefits include reduced work-in-process, resource idleness, order tardiness, and shop floor congestion, among others (e.g., Fredendall, et al. 2010; Harrod and Kanet, 2013). The problem is that there is wide variance in reported analytical and simulated benefits, making it difficult to understand how and why a real organization can benefit. There is a paucity of research testing S-DBR models in manufacturing, but this is one of the only tests in service operations.

The second implication is that, despite initial difficulties with practically applying S-DBR in services, this study shows that it is important not to violate the buffer rules. Violating the buffer rules leads to less visibility for work loads, inhibits a supervisor’s ability to track progress, and allows congesting the work space with unresolved cases. The buffer rules require the visible and consistent support from top management. Field studies (e.g., Liker, 2004) point out that leadership’s commitment, and their routine participation, is necessary for sustained improvements. According to Schragenhiem and Ronen (1991), priorities based on the buffer rules synchronize various activities of operations, which improve their reliability performance. They view reliability as the degree to which current status becomes an accurate predictor of future performance. Recovery actions initiated based on prioritizing demand through buffers can be effectively utilized to protect performance of operations from unexpected uncertainties.

The third implication is that while a few studies (e.g. Lenort and Samolejova, 2007) show that effective management of the CCRs is important to effective S-DBR, our study demonstrates how to recognize and deal with CCR in a service context. The Base case shows that CCRs are not
only important but critical for S-DBR to succeed in services, perhaps more critical than in manufacturing. Lawrence and Buss (1994) suggests that providing protective capacity at the non-bottlenecks is the “best hope” for improving the performance of such operations. Our study finds that CCRs can also be managed in services by making processes more flexible. By creating service cells that can handle any typical case, thereby enabling work load balancing across all resources, CCRs can be prevented. But, more case studies are necessary to understand CCR’s effect and how to effectively manage it to improve the performance of operations.

The fourth implication is that the load control function of S-DBR is more important than previously reported. With the 22% reduction in case load created by the residual benefits of the implementation in the Base, the capacity of the service cells increased. In this service application the success of S-DBR actually prevented overloading of the system. While prices, etc. (e.g., Moodie, 1999) have been shown to control load in simulations, this is the first service study to demonstrate how and why it happened in a non-consumer environment, when prices were not the driver of demand. There is a paucity of studies testing different strategies for load control to prevent overload situations in S-DBR in service operations.

The fifth implication is that POOGI was implemented for systematically improving the flow in a manner consistent with a continuous improvement process. The Base had tried other programs such as Lean and Six Sigma, but with little success to improve its labor resolution process. Lean was helpful in recognizing obvious waste activities, but the implementation was slower than expected and the required training was going to take one-year to complete, plus another year to implement. The Base needed faster results. A Six Sigma program was also attempted, but the improvements implemented by the Black Belt personnel were not sustainable. As soon as the Black Belts left the LR and ER offices, performance would deteriorate and processes migrate back to the old system within a few weeks. This suggests that the success of improvement programs may be contextual, and not a one-size-fits-all approach will achieve results. For example, Chakravorty (2011) found that in an aircraft
maintenance division that serviced landing gear, a Six Sigma implementation failed to achieve results; however, in another division that serviced interiors, Six Sigma achieved sustained improvement. The reason for an improvement program’s varying degrees of success is not fully understood, but this study supports the concept that proper sequencing and the controlled release of cases, or jobs in general, can have huge impacts on performance. In Chakravorty (2014) the C-130 PDM maintenance facility received the prestigious 2012 Secretary of Defense award, known as the Robert T. Mason Award for Maintenance Excellence. The facility leadership credited the controlled release of orders to the maintenance personnel as the key to winning the award.

References


Founded in 1892, the University of Rhode Island is one of eight land, urban, and sea grant universities in the United States. The 1,200-acre rural campus is less than ten miles from Narragansett Bay and highlights its traditions of natural resource, marine and urban related research. There are over 14,000 undergraduate and graduate students enrolled in seven degree-granting colleges representing 48 states and the District of Columbia. More than 500 international students represent 59 different countries. Eighteen percent of the freshman class graduated in the top ten percent of their high school classes. The teaching and research faculty numbers over 600 and the University offers 101 undergraduate programs and 86 advanced degree programs. URI students have received Rhodes, Fulbright, Truman, Goldwater, and Udall scholarships. There are over 80,000 active alumnae.

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