DESIGN AND APPLICATION OF A CONTINUOUS PROCESS IMPROVEMENT MODEL

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EXECUTIVE SUMMARY

The purpose of this document is to identify methods and techniques to improve business performance in companies. The paper includes reference to the culture of globally competitive companies to better understand the environment and reasoning of the company environment.

The focus of the paper lies in identifying methods to improve process performance and to be more competitive to gain a larger market share percentage in the industry. Thus the way a customer perceives value and quality and why a customer might chose a certain company as their supplier because the customer believes the value to be greater.

The paper addresses business process improvement and why changing business processes might have a dramatic impact on the business. A design to implement an improvement plan for processes is designed to reduce cycle time, eliminate/reduce non-value adding activities and eliminate/reduce human error and problems within processes is also discussed in this paper.

The conceptual design of this project focuses on the methodology that will serve as a process improvement framework and final design is used to illustrate and apply the first cycle of the methodology.

TABLE OF CONTENTS

1.INTRODUCTION AND BACKGROUND OF THE COMPANY AND THE PROJECT

Essilor International is a world wide company with headquarters in France. The South African branch of Essilor international reports directly to Asia Pacific. Essilor international has very high standards and is one of the major competitors around the world in the optical industry.

The company specializes in the manufacturing of lenses as well as the fitting of lenses to frames. They have advanced technology in the optical industry and this is one of their major strengths.

Essilor Johannesburg produces a variety of lenses; the lens material is either glass or plastic. Both of these types of lenses go through manufacturing processes to produce either lenses that are surfaced; surfaced and given hard coating; or surfaced, given hard coating and anti reflective coating.

The requirements that were set to them by the international head quarters are to complete:

RX = 95% of all incoming jobs that require only surfacing must be completed in 24 hours

RX + HC =95% of all incoming jobs that require surfacing and hard coating in 48 hours

RX + HC + ARC =95% of all incoming jobs that require surfacing, hard coating and anti reflective coating in 72 hours

E.g. From the time an order is received for lenses that only require surfacing they have 24 hours to finish and dispatch the specific job, and they have to do this with 95% or more accuracy.

In the past 2 months they were not achieving this accuracy; the time from arrival until dispatching on average is greater than the required time by Essilor international. This means that on average orders were taking longer to reach the customer. Currently they are meeting the required accuracy set by Essilor international, due to major changes implemented such as training, gaining more enthusiastic and motivated intellectual personnel, changing shifts and hiring temps.

Since the project proposal, Essilor South-Africa dramatically increased their accuracy in achieving these requirements.

Past 2 months	**Current Accuracy**
RX =94.66%	RX=95.6%
RX+HC =81.82%	RX +HC=93.1%
RX +HC +ARC =68.57%	RX+HC+ARC=97.5%

Essilor Johannesburg is a striving organization and they have a customer orientated strategy. In South Africa Essilor is competing with two other international companies in the same industry. Essilor Johannesburg strives to be the leading company in the optical industry in South-Africa and they constantly try to gain a greater market share.

There are three areas in which they have defined customer quality, these are the time it takes to process the order and deliver the item, the accuracy of the promised time and the reliability that an order will be correct.

2.PROJECT AIM AND RATIONALE

The aim of the project is to improve the companies business processes. This includes the design or application of a process improvement methodology that addresses the following:

- The improvement of order cycle time.
- The Elimination or reduction of errors/problems within processes.
- The modification of processes with the goal to improve performance.

These general objectives will improve performance, lead to increased customer satisfaction and better process control.

3. PROBLEM ANALYSIS/PROJECT SCOPE

The project scope consists of identifying processes within the system which are problematic in the sense that they consume a lot of unnecessary time.

The work done on this project will focus on internal improvements rather than external such as the customer and the supplier. The scope of the project lies in analyzing each process for possible improvements in the search for reduction of the total internal time a customer order spends in the company from order entry until the point of order dispatch.

The project will only address the three types of orders RX, RX+HC and RX+HC+ARC thus excluding any processes that these activities do not undergo.

The scope also includes analysis of errors that occur in the system with the goal of minimizing or eliminating these errors, as well as the investigation, identification and reduction or elimination of non-value adding activities inside of processes and the improvement of value adding activities.

4. LITERATURE REVIEW

4.1 INTRODUCTION

In the following section different methodologies and approaches to business process improvement will be discussed. The aim of the literature review is to examine and analyze possible methods for process improvement and to use the literature to design a model for process improvement for Essilor.

The review looks at methods, used by companies around the world, to improve processes and to sustain a competitive advantage in the industry. In the competitive business world a company needs to be prepared for change and increasing competition , the review looks at ways of achieving greater process performance and sustaining a competitive advantage in the market.

The methodologies discussed in this section is limited to quality management, Total quality Management, Business process re-engineering and Business process management.

4.2 QUALITY MANAGEMENT VS TOTAL QUALITY MANAGEMENT

Modern quality control makes use of statistical methods, known as statistical process control (Dudek-Burlikowska, 2005). Control charts check the existence of variance within processes, and are useful tools for data presentation and to indicate if a process is out of control.

The types of control charts used are depended on the process variables being measured and the system on which it is applied. Control charts only provide information on variance in the system, and are no solution by itself.

It is up to management to identify the cause of special variation and to take corrective measures to ensure that the problem is solved, thus identifying special variance, identifying the problem and solving the problem using diagnostic tools and techniques (Gitlow, Oppenheim, Oppenheim, & Levine, 2005).

Statistical Quality Control is the most popular method used today in manufacturing to monitor Process capabilities and to try and maintain the processes to fixed targets. This is done to estimate or calculate the process capability, with measurements such as standard deviation, process average and upper and lower control limits (Dudek-Burlikowska, 2005).These measurements can be used to compare the process capability to the customer requirements and determine if the process can meet the requirements set by the customer.

In E.W Deming's Thesis he stated that statistical process control relies on continuous improvement of process capabilities (Dudek-Burlikowska, 2005). In modern day global competition companies should not only strive to meet customer requirements, but to continuously strive to improve the process regardless of customer requirements.

Edwards defined the term Quality assurance (Gitlow, Oppenheim, Oppenheim, & Levine, 2005). Edwards said that good quality results from planned activities of all aspects of an organization. The objective of quality assurance he said, is to eliminate 'hunch' factors and make an effective quality policy to direct the actions to be taken and to place responsibility in the correct areas. This involves the concept to rather prevent than to correct, and can be done through efficient management.

Dale (1990) identifies the quality levels of management in the following historical order: inspection, quality control, quality assurance, quality management and total quality control (Stuart, Mullins, & Drew, 1996). Though the movement from inspection to TQM, culture moved from shifting to a focus of employee involvement, problem solving, relations with suppliers and getting it right the first time (Stuart, Mullins, & Drew, 1996).

Traditional organizations with functional divisions had divisions function separately, which resulted in barriers between divisions. Total quality management focuses on cross functional activities providing for total company quality management and not quality management only per division.

There are three keys to achieving Total Quality Management (Stuart, Mullins, & Drew, 1996). Organizational structure is the first key; this consists of collaboration, integration, communication, teamwork and cross functional activities between departments or divisions.

The second key is management leadership. A corporate culture is needed in which management place trust and responsibility. Managers need to develop a view for the company and spread the view across the whole company. They have to delegate authority and power though the company to move from a vertical to horizontal view of management. Thus every one in the company becomes involved in improving the company and processes to be more competitive and have a higher standard of quality.

Customer Orientation is the third key. This involves internal and external customers. External customer needs should be met and exceeded and the company should also monitor customer satisfaction. Internally the next process in the system should also be seen as a customer and the previous department or division should strive to supply the next process with utmost quality of product and service ensuring that no defects continue to the next process.

Deming argued that TQM practices if implemented right will lead to less waste, fewer reworks and inevitably lower costs while Ishikawa argued that TQM reduces costs in the long term but not in short-term (Chong & Rundus, 2004). They both also argue that the most important factor of TQM is customer focus and customer satisfaction, which is the primary goal of an organization.

In conclusion, the modern view of quality management is that a company should be integrated in all functional aspects and all members of the company should have their role and responsibility to continuously improve the quality of the process, product and the view of the company.

It can be said that quality control techniques are only there to identify and monitor variance in processes, and SPC cannot solve problems and cannot identify the root causes of problems. It is up to management to identify problems inside a system and to correctly take action not in a corrective way, but rather in a preventive way.

4.3 BUSINESS PROCESS RE-ENGINEERING

A large part of a company's costs and time are used by work-activities. Eliminating a work activity eliminates a cost (Barrett, 1995) and saves time. This procedure is referred to as process improvement or process re-engineering. Modern companies are realizing that traditional cost reduction methods does not have a major impact and definitely do not make them more competitive in the industry (Carr & Johansson, 1995) but rather a customer focused organization is needed with a market driven structure. The core differences between BPR and TQM according to Carr & Johansson(1995) are the type of change, the scope of change and the Method.

TQM seeks for a better way to be competitive while BPR is a new way of doing business (Carr & Johansson, 1995)

BPR challenge business processes and their reason for existence while TQM tries to add value to existing processes (Carr & Johansson, 1995)

TQM focuses on the whole business enterprise where BPR focuses on a few core processes. (Carr & Johansson, 1995)

There are various reasons for embarking on BPR and in a study from Carr & Johansson(1995) they found that 49% of company reasons to implement BPR was to reduce cycle time and the force that led them to the decision in 64% of cases were competition and to be more competitive.

Business process re-engineering by definition (Johansson, McHugh, Pendlebury, & Wheeler, 1993) is the means by which radical change in performance can be achieved. This is measured in cost, cycle time, quality and service by the application of tools and techniques that focus on the business as a set of customer orientated core business processes instead of a set of organizational functions.

A core business process is a set of link activities that address the need and expectation of the marketplace (Johansson, McHugh, Pendlebury, & Wheeler, 1993). Re-engineering takes place when a core business process is transformed to give the company a competitive advantage. Through thorough evaluation of core business processes and their ability to increase the customer's perception of value, market share for the company will increase as result of the customer's perception of increased value.

BPR requires only four performance indicators (Johansson, McHugh, Pendlebury, & Wheeler, 1993) quality, lead-times, cost and service. Note that these indicators are aligned with what consumers view to be quality. Key characteristics of BPR (Miltenburg & Sparling, 1996) include performing tasks in a logical order and location, the combination of activities, delegating responsibility to workers, the change of organizational structure to facilitate new processes and using IT to support activities.

The definition of a process (Johansson, McHugh, Pendlebury, & Wheeler, 1993) is a set of linked activities that transforms an input into an output, and ideally a process should add value to the input. Cost cuts will naturally occur by removing non-value-adding activities from the processes, thus ideally all activities inside a single process should add value to the service or product.

BPR attempts to reduce cycle time and/or costs (Miltenburg & Sparling, 1996) the outcome depends on the specific company in question but the following usually holds for all companies.

Overlapping of activities will reduce cycle time, overlapping activities can reduce cycle time and the cost of associated with the activities and grouping of functional activities will usually alter the business structure.

Three reasons or possibilities exist for undertaking Business Process Redesign (Johansson, McHugh, Pendlebury, & Wheeler, 1993), cost reduction, renewed competitiveness or competitive dominance.

Non-strategic processes are processes that are invisible to the market but when eliminated or streamlined they still have long-term implications such as cost effectiveness. BPR focuses on the few core business processes that create value by the capability it gives a company for competitiveness. These are the processes which are valued by the customer and are critical to get right (Johansson, McHugh, Pendlebury, & Wheeler, 1993). These are required for success in the industry and they should be aligned to the businesses strategy as processes critical to excel at in order to be better or match their competition. Each core business process by definition has a specific effect outside the organization.

Core business processes can be thought of as a set of activities, and activities can be reduced to a set of tasks (Johansson, McHugh, Pendlebury, & Wheeler, 1993) that together transform an input into an output and is usually connected to a source outside of a company.

4.3 BPR AND TQM A SYMBIOTIC APPROACH

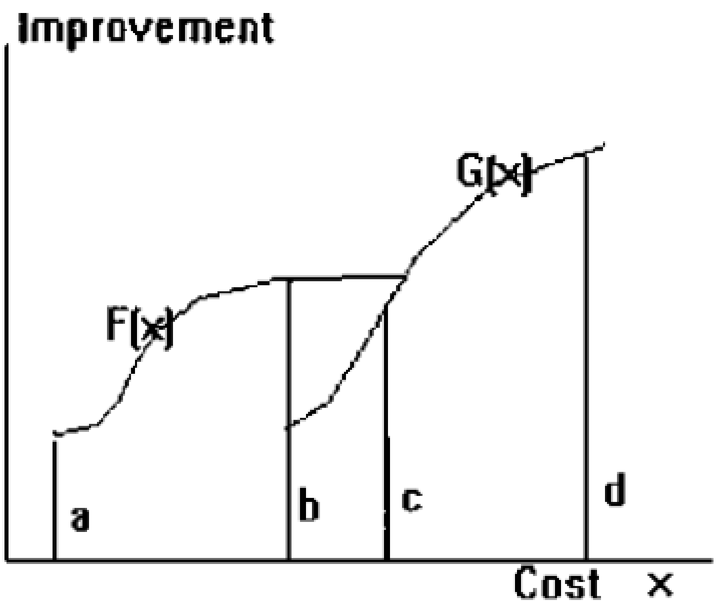
In the previous section BPR and TQM are discussed as two different and separate methodologies, but these can also combine in a joint effort for better results. TQM and BPR are essentially different methodologies but they both share a common goal, the goal of process improvement (Lee & Asllani, 1997).

The symbiotic application of TQM and BPR suggests that a radical improvement, by means of BPR, should be made only when necessary and the process redesigned should be improved continuously, by means of TQM.

A Re-engineering program or radical improvement should address the process that needs the most improvement first, while a continuous improvement effort supports the process re-engineered (Lee & Asllani, 1997). The question is how long should TQM be applied to a process before embarking on the next re-engineering effort, the answer found from literature states that a new radical improvement effort should be made when continuous improvement on a process cannot achieve a competitive advantage any longer (Lee & Asllani, 1997).

In Figure 1 it can be seen that at point A a radical improvement (F(x)) was made and supported by a continuous improvement effort up to point C. Note that from point B to point C there were no significant improvement made by the continuous improvement effort, thus between point B and C, a new radical improvement was made (G(x)).

FIGURE 1: IMPROVEMENT VS RE-ENGINEERING COSTS



SOURCE 1:ADOPTED FROM(LEE&ASLLANI, 1997)

In conclusion it can be seen that a combination of BPR and TQM methodologies can deliver better process improvement results than only one methodology alone, it can be concluded that these two methodologies compliment and support one another.

4.4 BUSINESS PROCESS MANAGEMENT

Business process management (BPM) is a structured approach to analyzing and continuously improving fundamental activities (Zairi, 1997). In general BPM is a management principle applied by companies to sustain their competitive advantage (Houy, Fettke, & Loos, 2010)

Figure 2 shows the different definitions of BPM through the years 1990 up to 2008 (Houy, Fettke, & Loos, 2010), through the years the fundementals of BPM have stayed the same, and a general BPM life-cycle model is preposed in Figure 3

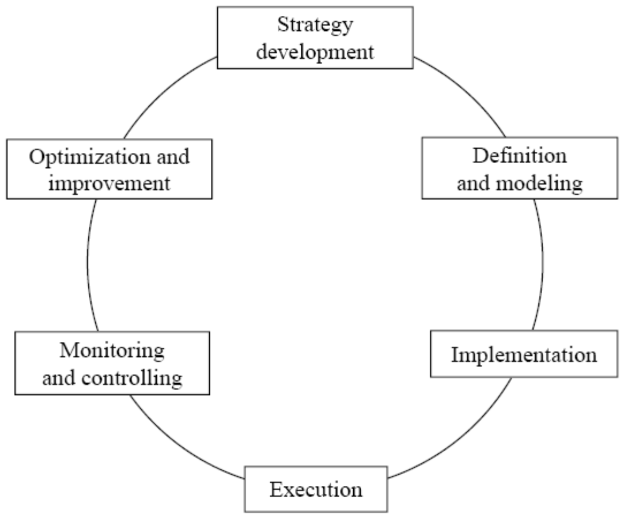
FIGURE 2: DEFINITIONS OF BPM

Davenport and Short (1990)	van der Aalst *et al.* (2003)	Netjes *et al.* (2006)	Zur Mühlen and Ho (2006)	Hallerbach *et al.* (2008)	Kannengiesser (2008)
Identifying processes for innovation	Process design	Design	Organizational analysis	Modeling	Process design
Identifying change levers	System configuration	Configuration	Specification and modeling	Instantiation/ selection	Process implementation
Developing process visions	Process enactment	Execution	Workflow modeling and implementation	Execution	Process enactment
Understanding existing processes	Diagnosis	Control	Workflow execution/ run time	Optimization	Process evaluation
Designing and prototyping the new process		Diagnosis	Warehousing/controlling/ process mining		
			Business activity monitoring		

SOURCE 2: ADOPTED FROM (HOUY,FETTKE,&LOOS,2010)

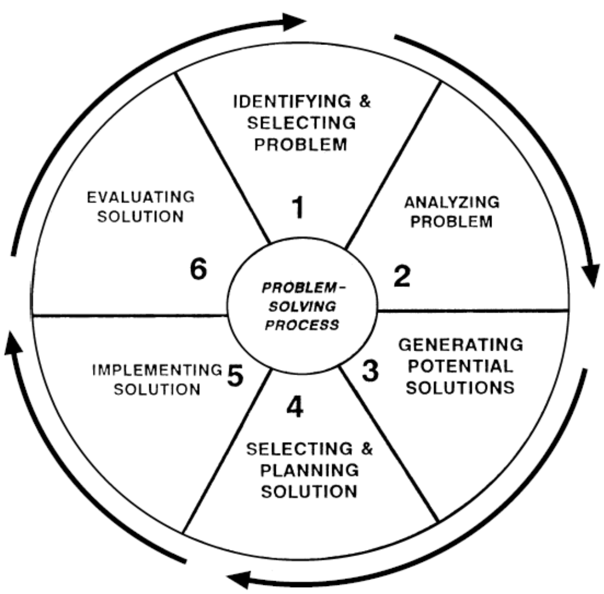
Zairi (1997) discusses two models which relate to the project. The first model is a problem solving process and can be seen in Figure 4, the second is a quality improvement process and can be seen in Figure 5

FIGURE 3: BPM CYCLE FOR CONTINUOUS BUSINESS PROCESS IMPROVEMENT



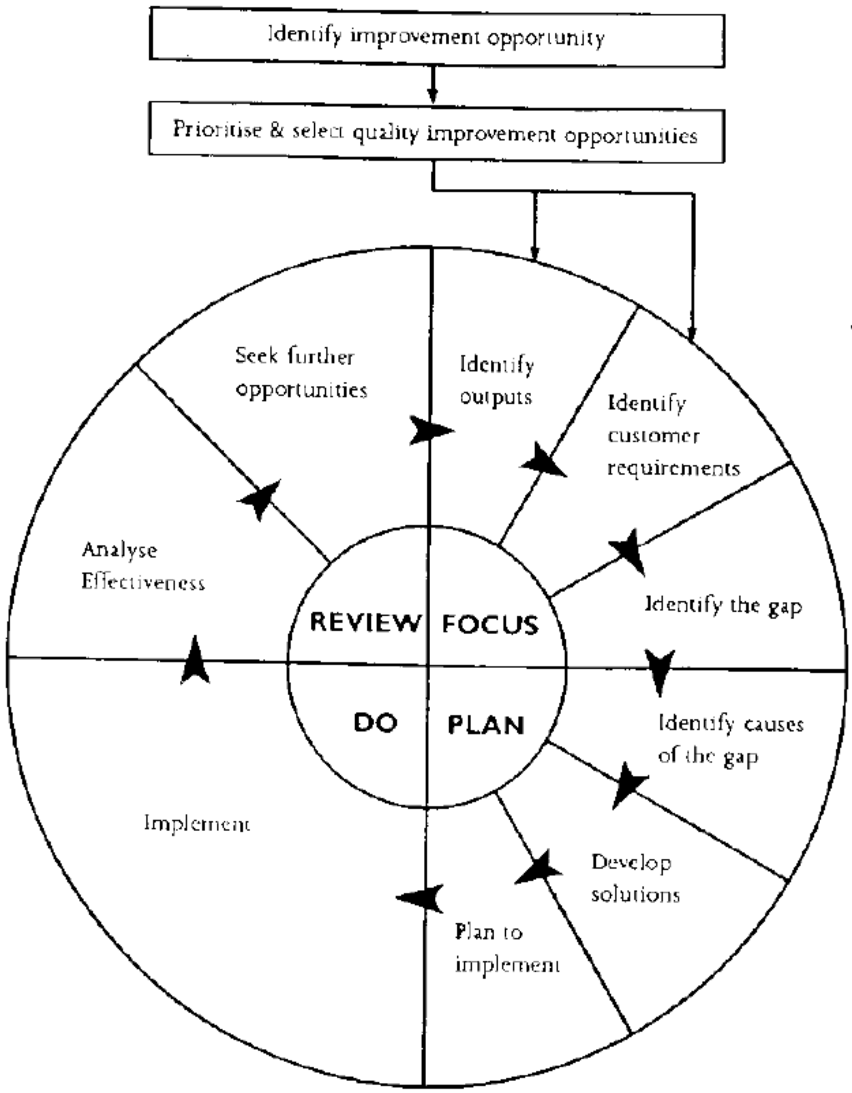
SOURCE 3: ADOPTED FROM (HOUY,FETTKE,&LOOS,2010)

FIGURE 4: PROBLEM-SOLVING PROCESS



SOURCE 4: ADOPTED FROM (ZAIRI, 1997)

FIGURE 5: QUALITY IMPROVEMENT PROCESS



SOURCE 5: ADOPTED FROM (ZAIRI, 1997)

In conclusion it can be seen that BPM shares many similarities with TQM, both are continuous improvement plans, although BPM is much more process orientated.

4.5. TOOLS USED IN THE PROJECT

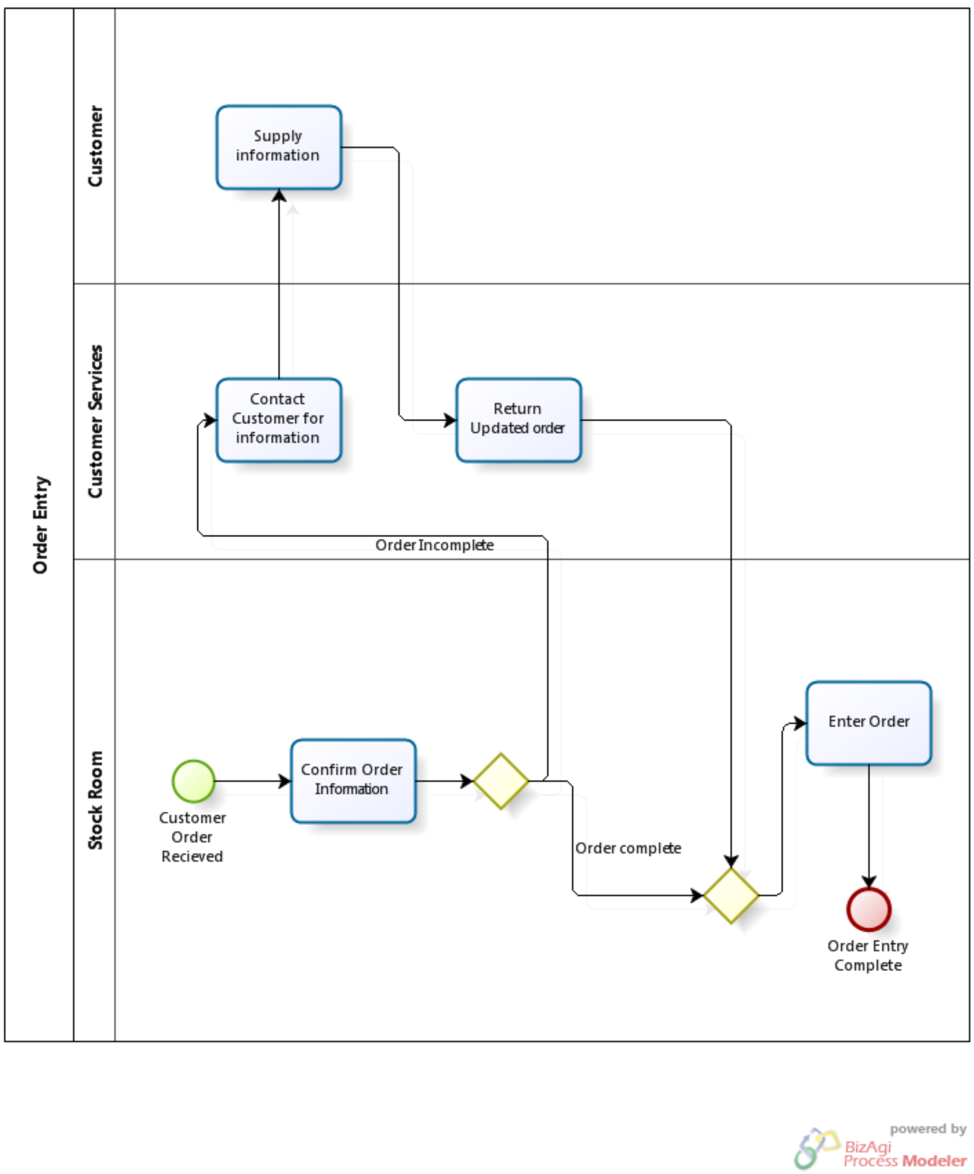
4.5.1 TOOL: BIZAGI PROCESS MODELER

DESCRIPTION: A powerful tool for modeling business processes inside an organization.

PURPOSE: To create documentation of business processes and their relationships with other processes inside departments and business functions. BizAgi uses BPMN to standardize process modeling in order for universal understanding in all functions (Management, IT, etc.).

EXAMPLE: See Figure 6.

FIGURE 6: BIZAGI EXAMPLE



4.5.2 TOOL: ARENA 10.0

DESCRIPTION: Arena is a powerful simulation tool that can be used to simulate business scenarios with the purpose of evaluating defined performance metrics such as resource utilization, throughput time, event occurrences etc.

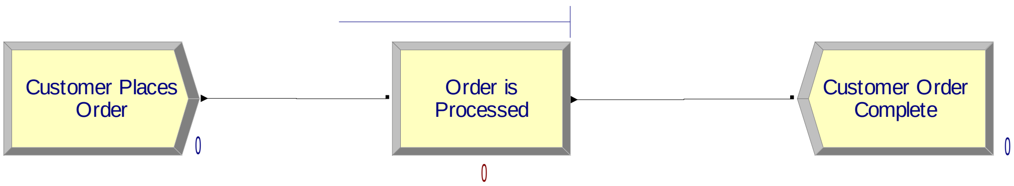
PURPOSE:

This simulation tool can be used to measure defined performance metrics, change processes for the current business model to evaluate proposed process changes at minimal costs.

EXAMPLE:

A customer places an order, the order is then processed in X min and Z human resources are available.

FIGURE 7: ARENA EXAMPLE



After simulation, reports on resource utilization, throughput, etc. are generated.

By modifying the order processing process, the resource utilization may decrease or the order can be completed faster. The analyst now simulates different scenarios to view the impact of process changes at a minimal cost and minimal risk.

Simulations are not necessarily 100% accurate, after simulation the process must first be validated to show the same results.

4.6 CONCLUSION

Following the review, it can be seen that all the methodologies discussed have some common goals, the improvement of business processes, the improvement of product/service quality and the increase of customer satisfaction.

The methodologies discussed in the literature review seem to integrate into the single methodology of business process management, the latest in management approaches which combines aspects of both TQM and BPR thus the conceptual and final design will be a continuous improvement approach to improving business processes.

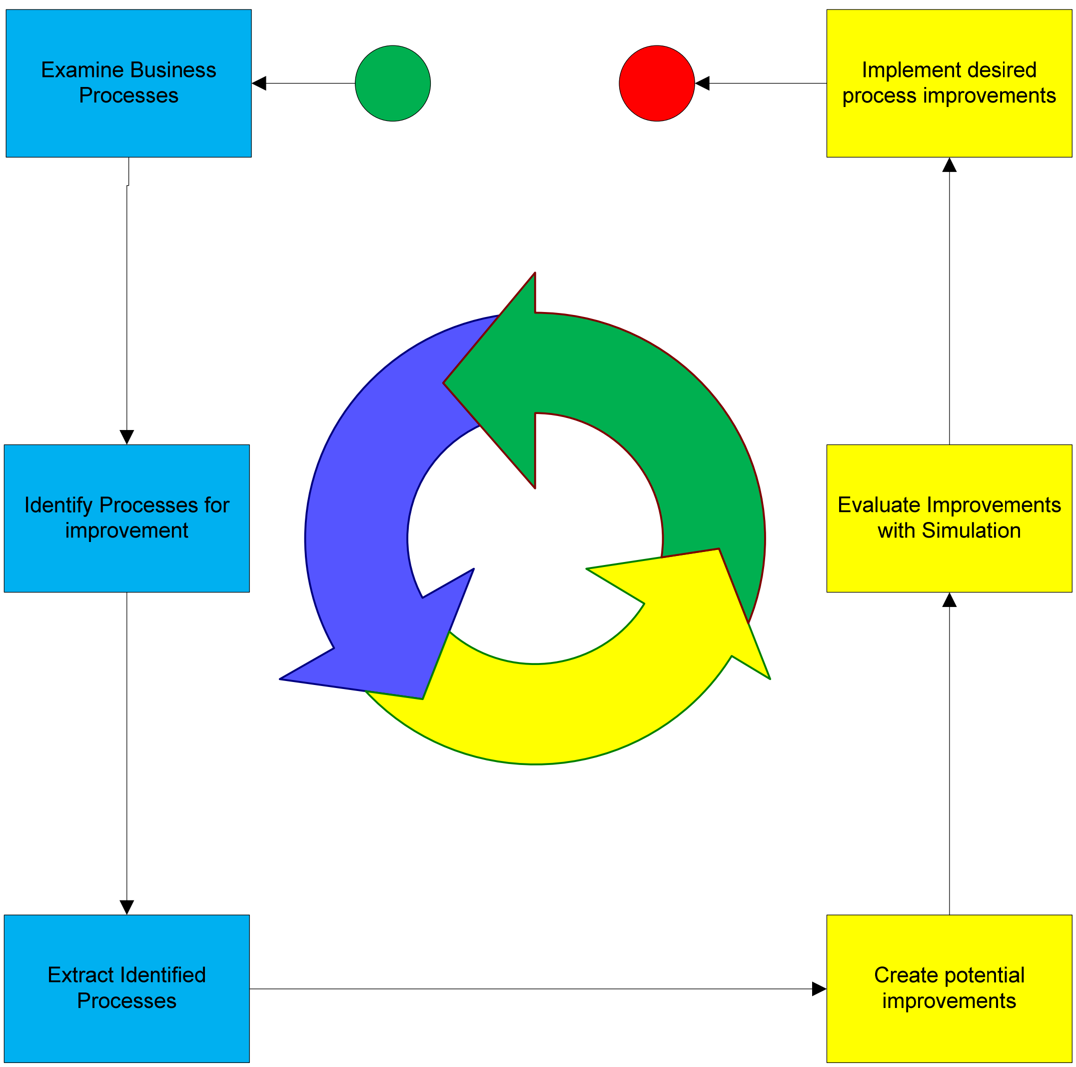
5. CONCEPTUAL DESIGN

5.1 METHODOLOGY: CONTINUOUS IMPROVEMENT CYCLE

Description: A modified approach working in iterations for continuous process improvement.

Purpose: The purpose of the methodology is to improve business processes continuously by analyzing static business processes, simulating the effect of process change and implementing desired changes.

FIGURE 8: THE CONTINUOUS IMPROVEMENT CYCLE

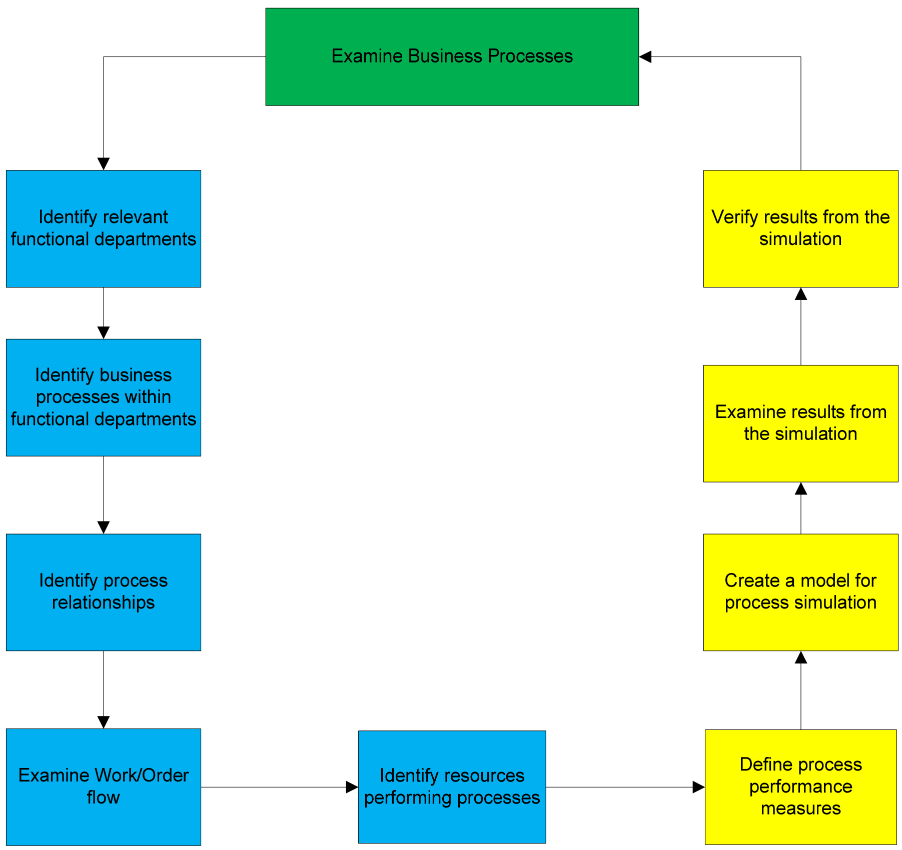


5.2 PHASE 1: EXAMINE BUSINESS PROCESSES

DESCRIPTION: A phase used to extract processes from the business and to create an initial model of processes.

PURPOSE: With the use of Arena 10.0 the processes will be modeled to create a static and dynamic model of the processes to simulate the workflow inside of processes and between departments. Certain criteria will be analyzed to determine the validity of the model. The simulation will be created to identify bottle necks within the system as well as problems/errors inside of the system.

FIGURE 9: PHASE 1, EXAMINE BUSINESS PROCESSES

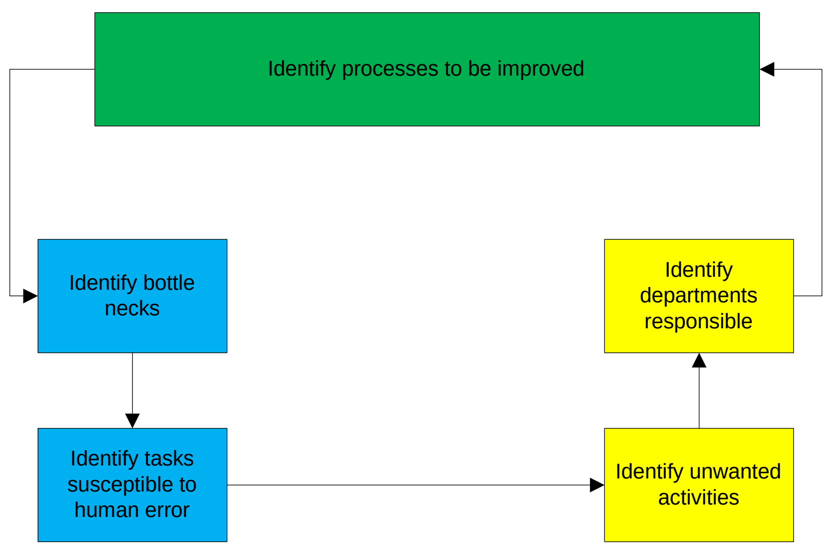


5.3 PHASE 2: IDENTIFY PROCESSES TO BE IMPROVED

Description: This phase used to identify the process that needs improvement

Purpose: In this phase criteria is used to identify the process that needs current attention. The relevant process departments and the relationship between departments are defined here.

FIGURE 10:PHASE 2: IDENTIFY PROCESSES TO BE IMPROVED

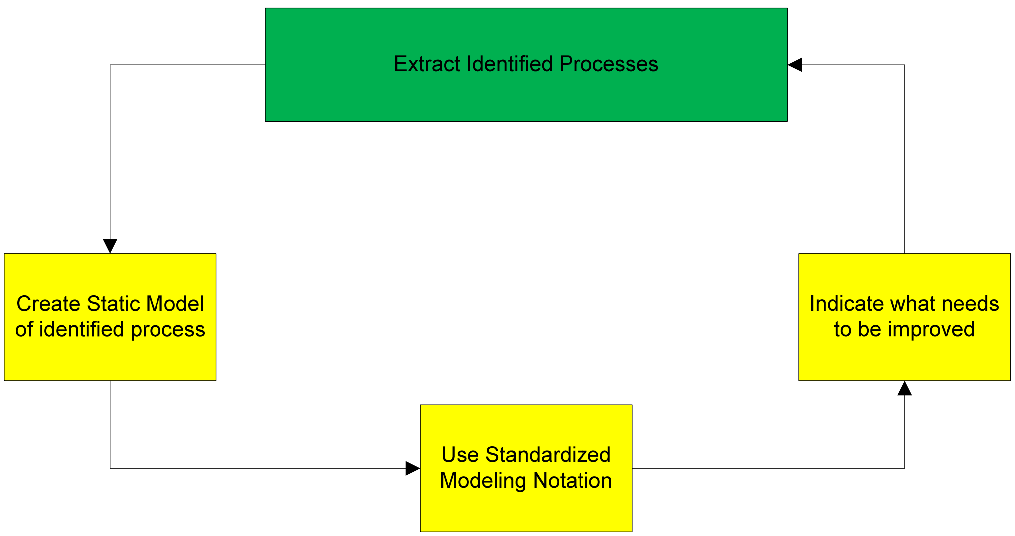


5.4 PHASE 3: EXTRACT IDENTIFIED PROCESSES

Description: In this phase the identified process under consideration is extracted and decomposed into activity/task form

Purpose: This phase allows for process extraction and decomposition with the use of BizAgi Process Modeler. After the creation of the static process model process problems/errors will be indicated on the static model extraction.

FIGURE 11: PHASE 3: EXTRACT IDENTIFIED PROCESSES

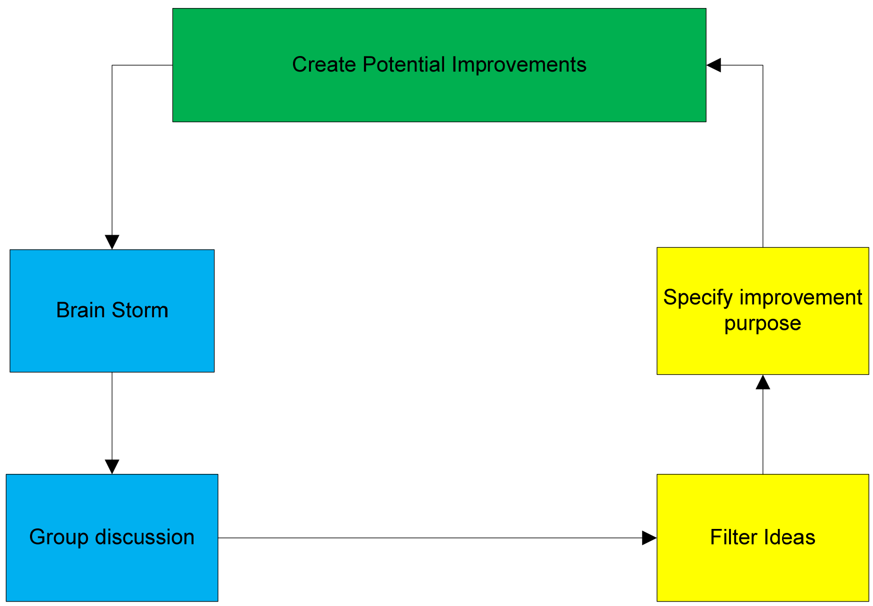


5.5 PHASE 4: CREATE POTENTIAL IMPROVEMENTS

Description: This phase is an idea generation process of possible improvements that can be incorporated into the extracted process.

Purpose: The purpose of this phase is to generate ideas on process task/activity modifications or improvements to reduce error/problems and increase process cycle time.

FIGURE 12: PHASE 4: CREATE POTENTIAL IMPROVEMENTS

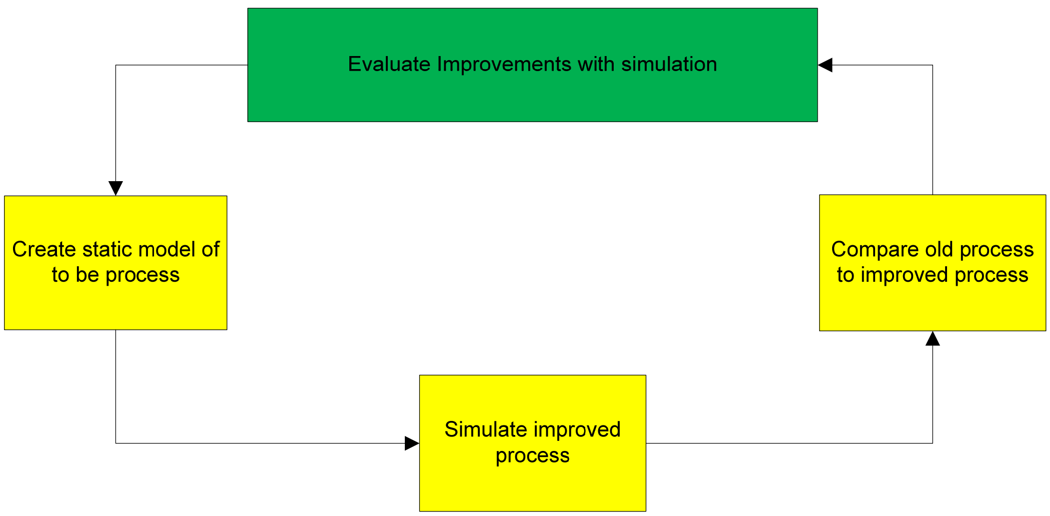


5.6 PHASE 5: EVALUATE IMPROVEMENTS

Description: In this phase the proposed improvements will be incorporated into a static model(BizAgi Process Modeler) and a dynamic model(Arena 10.0).

Purpose: In this phase the impact or effect of the change will be examined and analyzed for feasibility and implied improvement.

FIGURE 13: PHASE 5: EVALUATE IMPROVEMENTS



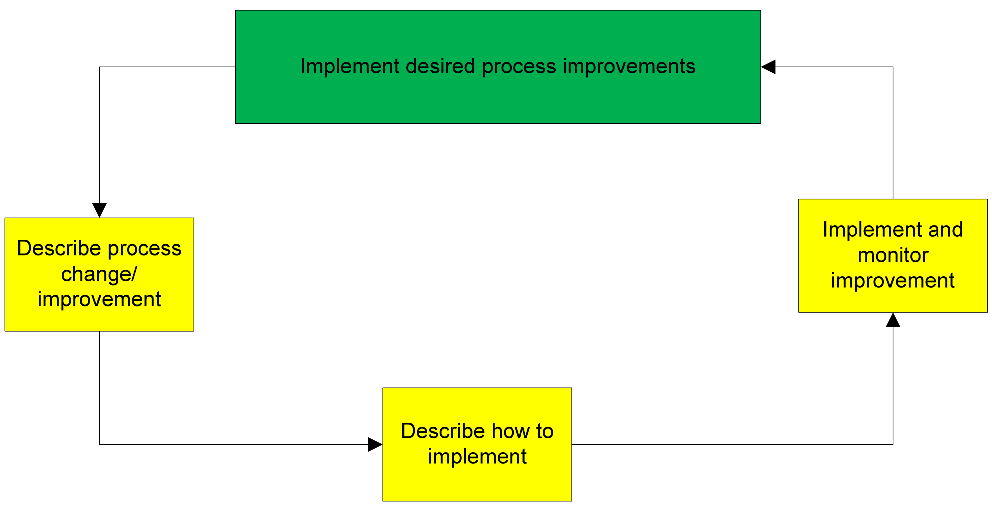
5.7 PHASE 6: IMPLEMENT CHANGES

Description: In this phase improvements will be implemented and monitored.

Purpose: This is the final phase of the cycle and the process changes/improvements will lead to one or more of the following:

- Reduction of errors/problems
- Reduction of process cycle time

FIGURE 14: PHASE 6: IMPLEMENT CHANGES

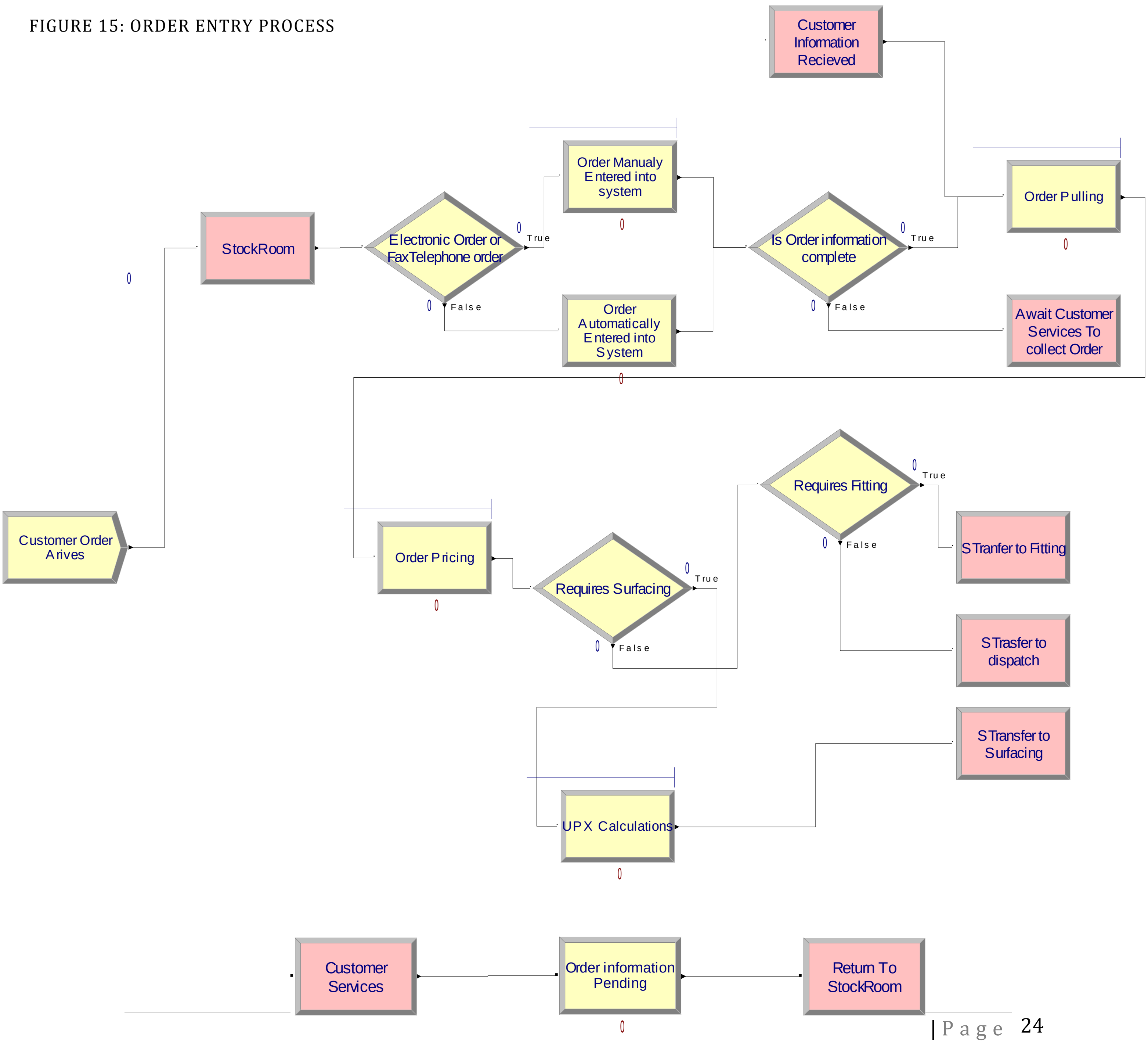


6. FINAL DESIGN

6.1 PHASE 1: ARENA 10.0 MODEL FOR PROCESSES

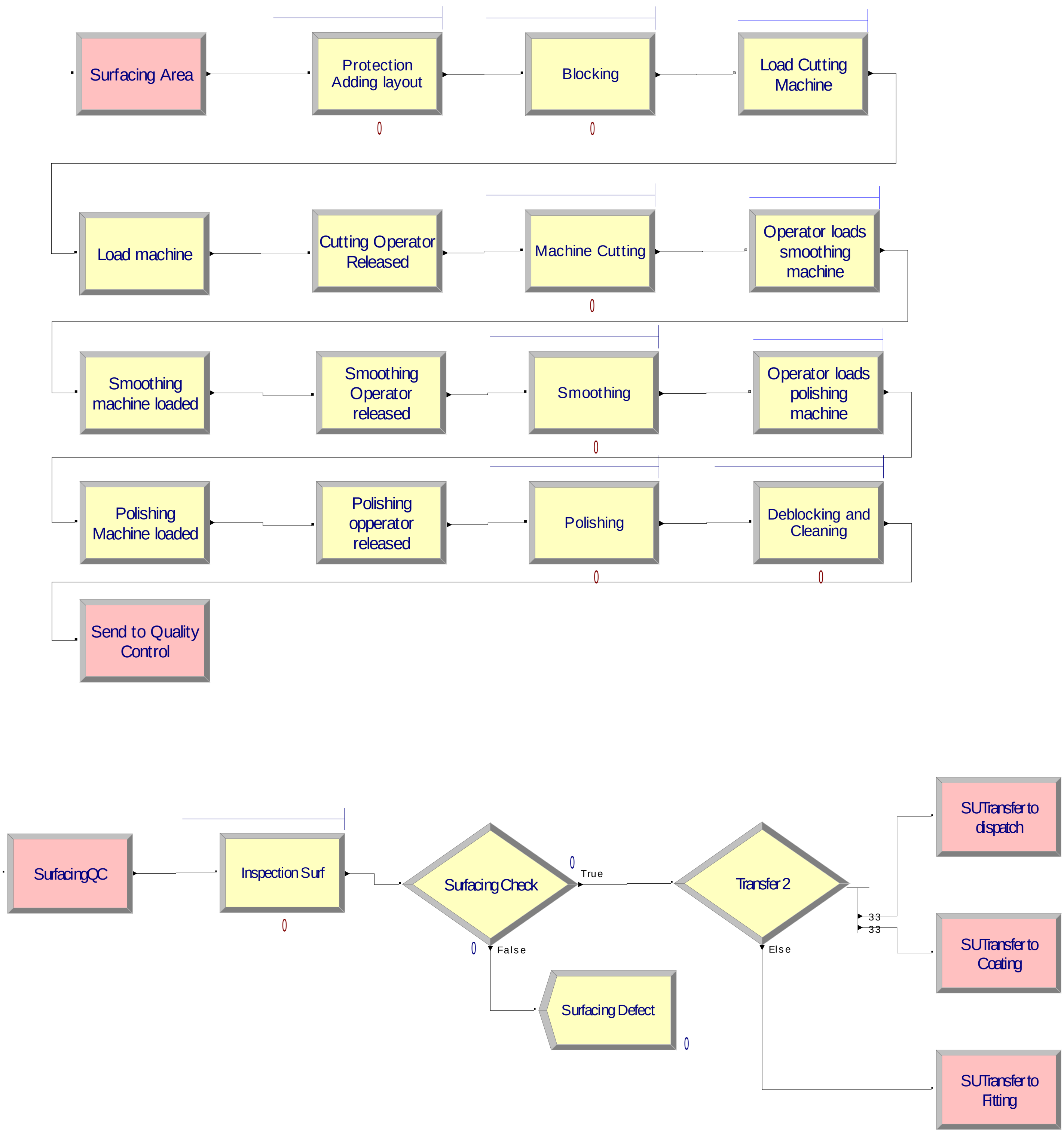
6.1.1 ORDER ENTRY PROCESS

FIGURE 15: ORDER ENTRY PROCESS



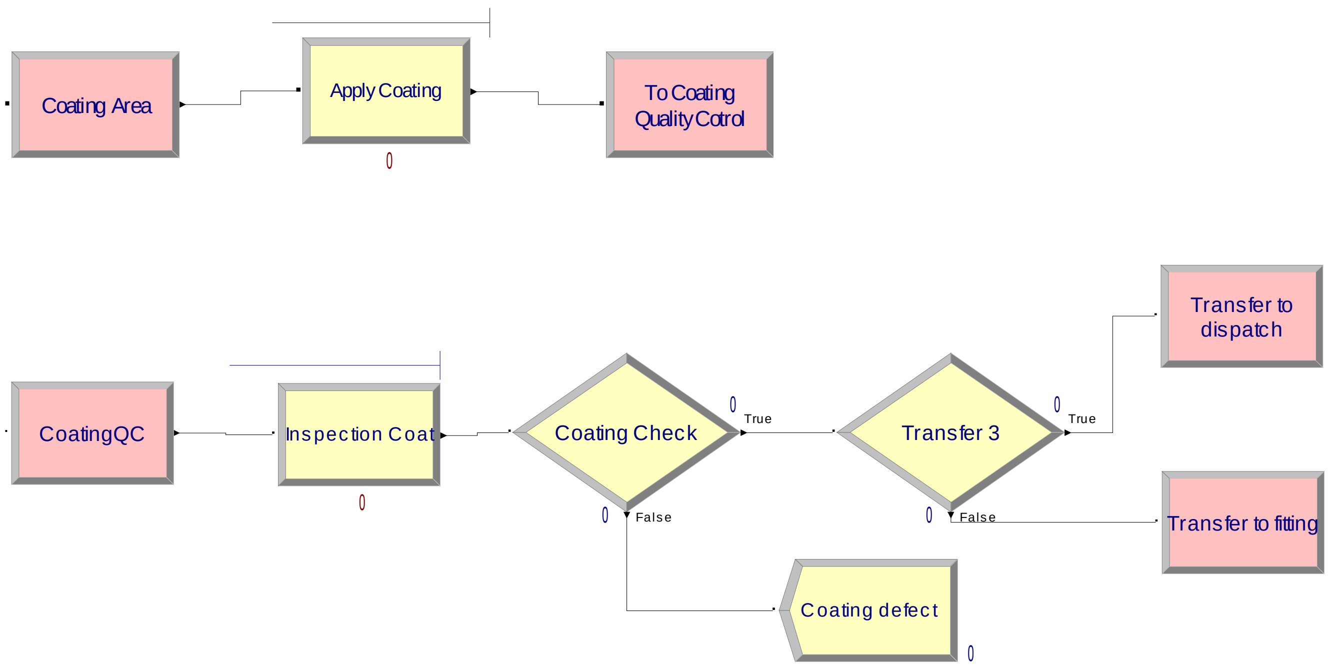
6.1.2 SURFACING PROCESS

FIGURE 16: SURFACING PROCESS



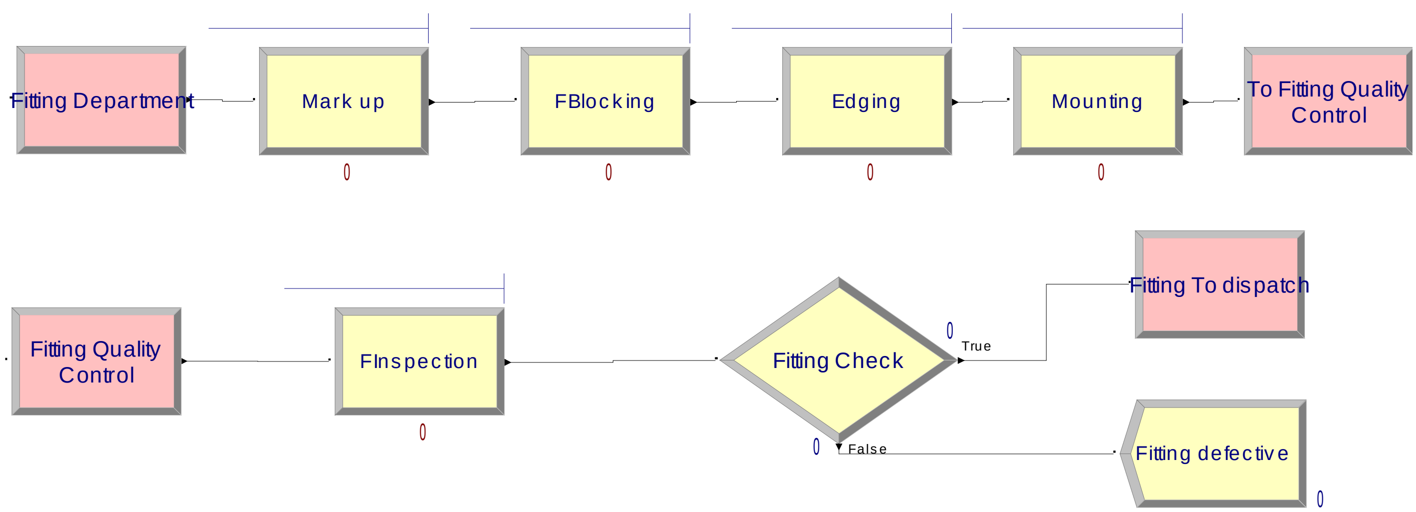
6.1.3 COATING PROCESS

FIGURE 17: COATING PROCESS



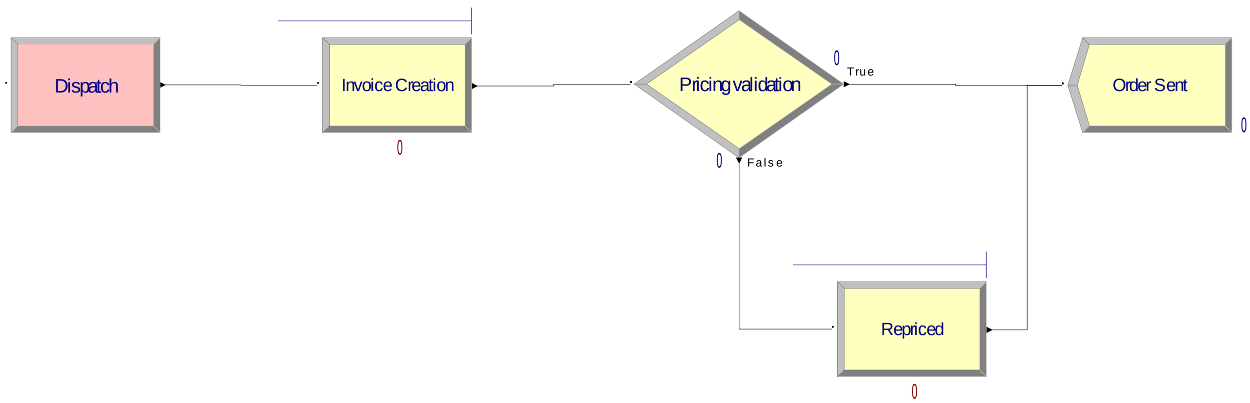
6.1.4 FITTING PROCESS

FIGURE 18: FITTING PROCESS



6.1.5 DISPATCH PROCESS

FIGURE 19: DISPATCH PROCESS



6.2 PHASE 2: IDENTIFICATION OF PROCESS TO BE CHANGED/IMPROVED

PROCESS IDENTIFIED: Order Entry Process

REASONS: Customer order information missing frequently, frequent incorrect pricing and UPX calculations is defined as a bottleneck.

See Figure 20 & 21 for Arena results.

FIGURE 20: ARENA RESOURCE USAGE RESULTS

Usage

Scheduled Utilization	Value
Blocking Machine	0.5774
Coating Inspector	0.2668
Coating machine	0.04387699
Cutting Machine	0.0963
Fitting Inspector	0.7195
Operator resposible for polishing	0.1444
Operator resposible for smoothing	0.1444
Person Blocking	0.5774
Person Calculating UPX	0.4338
Person deblocking and cleaning	0.1442
Person dispatching	0.8830
Person entering Orders	0.2627
Person Fitting	0.4753
Person Pricing	0.9893
Person Protecting	0.2890
Person Pulling	0.1897
Person Responsible for cutting	0.2313
Polishing machine	0.2888
Protective Coating Machine	0.2890
Smoothing Machine	0.1444
Surfacing Inspector	0.8727

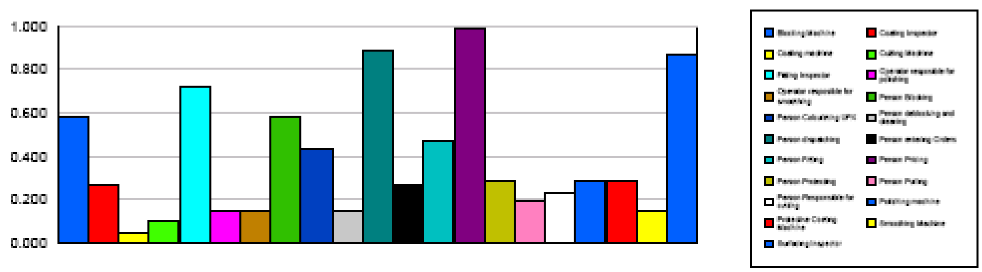


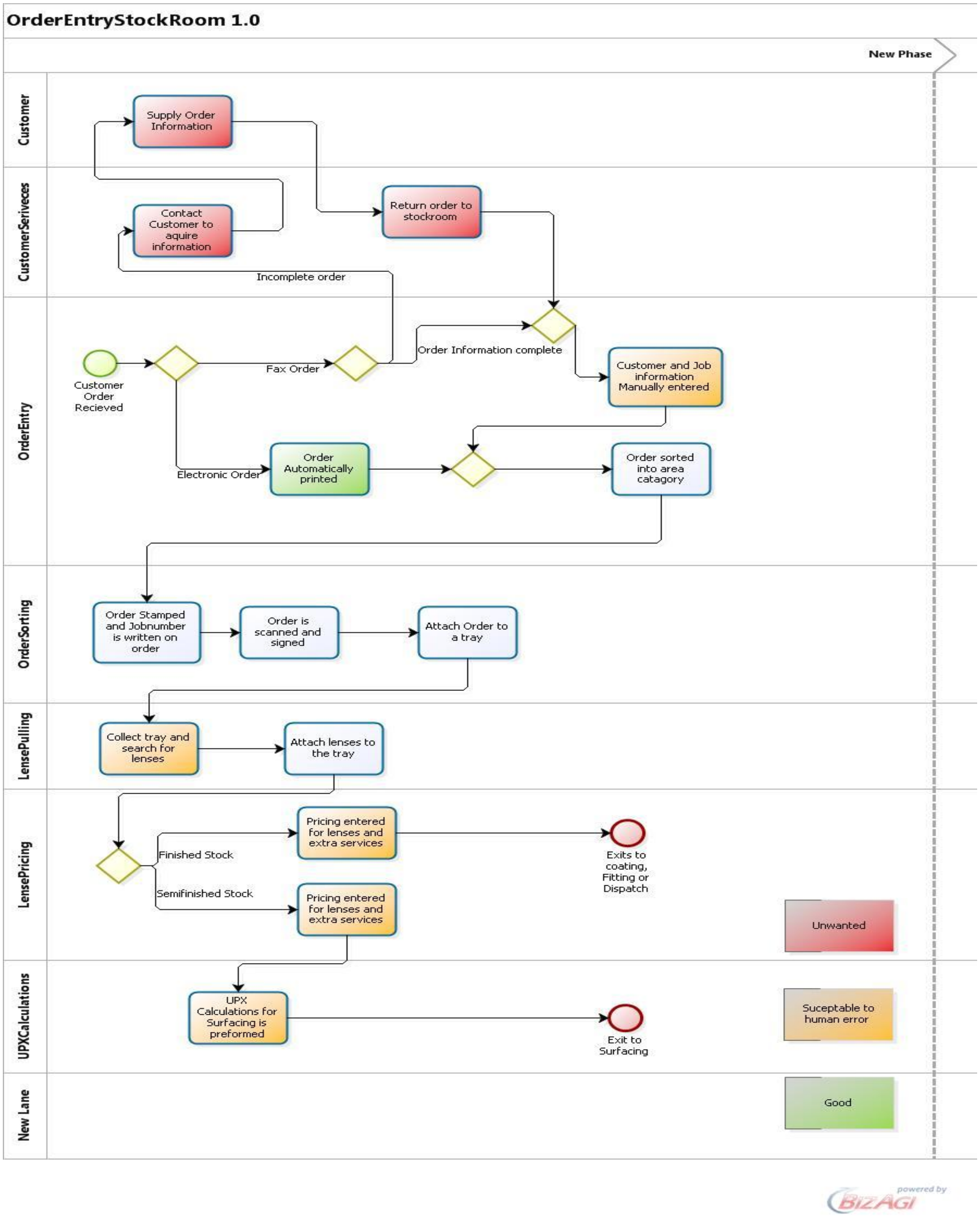
FIGURE 21: ARENA ERROR RESULTS

Counter

Count	Value
Missing information	776.00
Repricing	74.0000

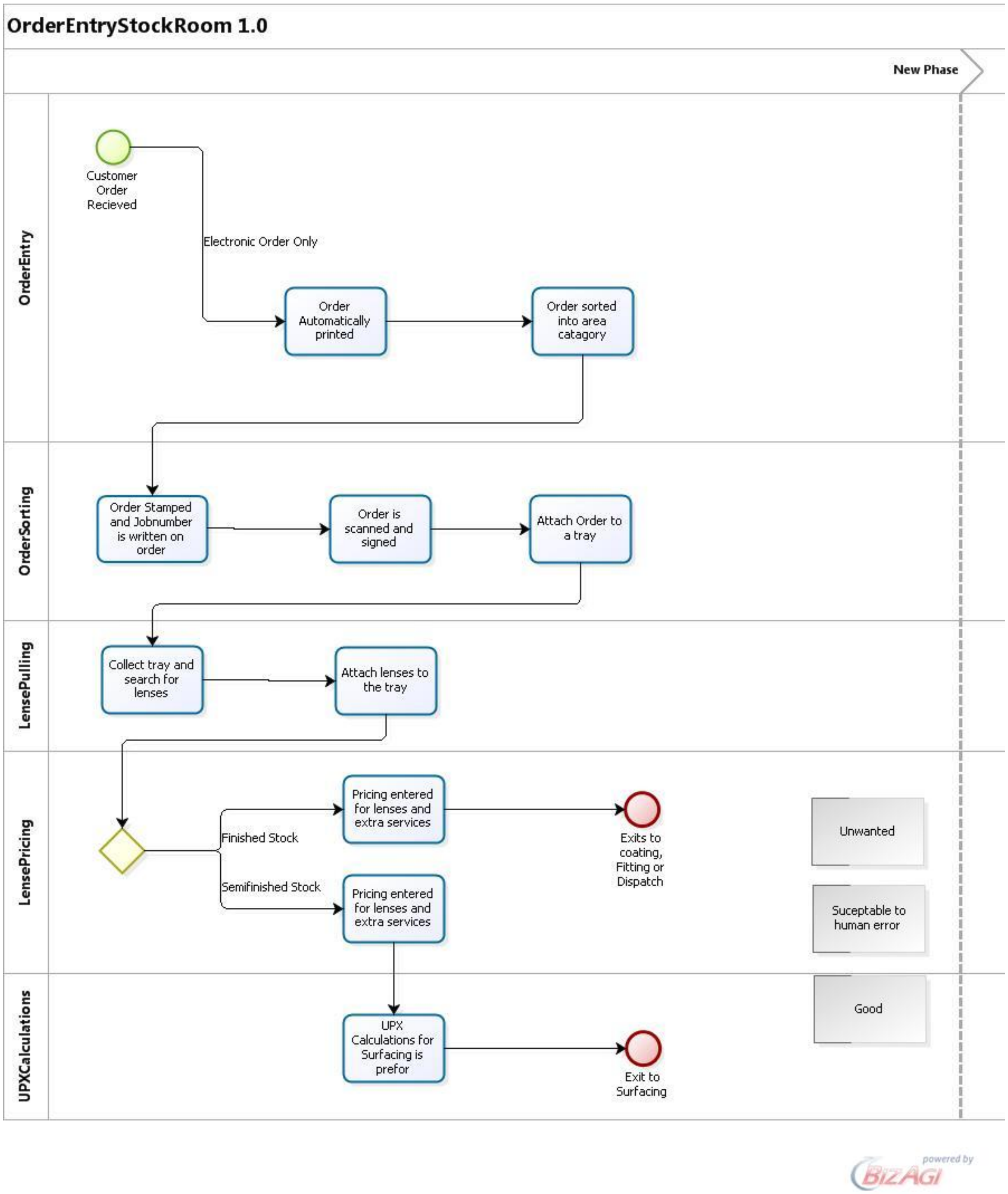
6.3.1 PHASE 3: EXTRACTION OF IDENTIFIED PROCESS

FIGURE 22: BIZAGI ORDER ENTRY PROCESS



6.3.2 PHASE 3: PROCESS TO BE

FIGURE 23: BIZAGI ORDER ENTRY PROCESS TO BE



6.4 PHASE 4: CREATE POTENTIAL IMPROVEMENTS

IMPROVEMENT SUGGESTIONS

- Customer orders should only be accepted electronically, this forces the customer to supply all the needed information and manual order entry will be eliminated. This will reduce order processing time and order entry errors, but customers who are not trained with online ordering or do not have access to the internet might be dissatisfied.

- Customers should use a standardized format for placing orders, this will help employees as they will be familiar with the format structure and the relevant location on the order for the needed information. This will require communication of a new standardized order format to the customer and might include the distribution of standard order forms.

- Customers should be aware precisely what information is needed by the company and why the information is needed, this will help the customer understand his role in completing a successful order and that it is critical for quality service.

- Employees should be certain about information and not make any assumptions, this will prevent defective orders, thus saving time and value for the upstream operations.

- Employees should be trained and updated on current promotions, this will prevent or reduce pricing errors, reducing customer returns and enhancing customer satisfaction.

- A barcode system can be used for the purpose of pricing, this will eliminate some of the human error and reduce activity time.

SUGGESTIONS ARE MADE BASED ON THE FACTS THAT:

- Customer orders sent by fax are not standardized; this implies that the recipient does not always know where to look for the needed information, leading to confusion, assumptions and human error.

- Customer orders sent by fax do not always contain all the necessary information; this is the case with 30% of orders sent by fax. This implies that the order now has to be transferred to customer services; the customer must be contacted and needs to supply the missing information.

- Incorrect pricing of orders frequently happen, and the system does not recognize current promotions running, thus the person entering the order should be aware of promotions, which is not always the case. This results in customer returns and customer dissatisfaction.

6.5 PHASE 5: EVALUATE IMPROVEMENTS

IDEA EVALUATION

- The most efficient way to control customer information will be to accept only electronic orders, although this may need a lot of time and customer collaboration, otherwise the exclusion of fax orders may lead to customer dissatisfaction and loss of customers.
- Thus a solution for immediate results will be the standardization of customer order forms, a copy of the order form can electronically be sent or faxed to the customer and the customer will be responsible for duplicating the form. This will lead to reduced errors made by employees when they enter a fax order's data into the system and thus lead to less defects and better service.
- Employee training and updating sessions should be held whenever new promotions are on the market, a bill board should also be mounted near the pricing station which displays the current promotions. This will lead to higher promotion awareness and the chances of successful order pricing.
- A barcode system could be implemented to use scanning as a replacement for manual pricing, this will lead to reduced pricing errors and will definitely improve the order cycle process time.

The precise impact that this implementation will have on customer satisfaction, error elimination and cycle time reduction cannot currently be assessed or simulated because the impact cannot be accurately predicted, but a trail period is recommended to monitor the results of the changes.

7. CONCLUSION

The Final Design is based on an incremental or continuous improvement methodology of which the first iteration is done. The Conceptual design was created as part of the final design, to provide the company with the tools and phases needed for continuous process analysis, formal documentation of processes, simulation of processes and application of process changes.

By improving business processes, an automatic result will be one or more of the following:

- Cycle Time Reduction
- Error/Defect Reduction

The author believes the design should be able to address the issues discussed in the project aim, and will be able to serve as a framework for further improvements, the final design should still be tested and monitored by the company and according to the results achieved or not achieved, the model should be used again until the desired results manifest.

Eventually there will come a time when continuous improvement alone will not be able to sustain a competitive advantage and new technologies or radical improvements will need to be made, but this model will still be able to serve a continuous improvement plan to support these changes.

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