



IS304 Process Modelling and Solutions Blueprinting

Final Report

Prepared for:

Prof. Rafael J. Barros

Ms. Chua Hong Ngoh

Done by: G4T3

Lee Zhi Tao (Team Leader)

Jorden Seet (Log Manager)

Anmol Dhanesh Chugani

Nur Amalina Liang Hui Fang

Yeo Hong Yuan

Xiao Weikun

Date: 11th November 2017

TABLE OF CONTENTS

Company Introduction	4
Purpose of BPE Team	4
Process Redesign Goals, Management Decisions/Policies & Performance Targets	4
Summary of static analysis and dynamic analysis of As-Is business process.....	6
Static Analysis of As-Is business process.....	6
Dynamic Analysis of As-Is business process.....	6
Recommended Initiatives and Rationales	7
To-Be business process scenario, users involved and IT applications used	7
To-Be Collaboration Model	9
To-Be business process Workflow Diagram	9
Summary of Dynamic Analysis of To-Be business process	10
Analysis of To-Be business process Vs. As-Is business process	10
Comparison of To-Be business process (20 PR per day) with As-Is business process (20 PR per day)	10
Future Demand Analysis of To-Be business process (50 PR per day)	11
Concept Solution Blueprint	11
(i) Solution Overview Model	11
(ii) Function Model.....	12
(iii) Application Model.....	13
Application of Data Analytics to the To-Be business process.....	13
Description of Business Challenges.....	13
Data Needed	14
Statistical Measures	15
Analytics Questions.....	15
Discussion of analytics questions that addresses business challenges completely or partially	16
Proposed justification and conclusion.....	18
Appendix A: As-Is business process scenario, users involved and IT applications used.....	19
Appendix B: As-Is process static analysis with both RCI and RCR models	21
RCI table	21
RCR table	23
Appendix C: Dynamic Analysis of the As-Is business process with rectification from Interim Report	26
Appendix D: Step by step description of To-Be business process	32
Appendix E: Data settings for To-Be business process simulation	34
Appendix F: Dynamic Analysis of To-Be business process	35

Appendix G: IT Solutions Requirements Definition for proposed To-Be business process	37
(i) Use Case.....	37
(ii) Use Case to Function	38
(iii) Non-Functional Requirement	38
Appendix H: Align statistical measures to analytics framework	39
Appendix I: Embed analytic questions into To-Be business process.....	40

COMPANY INTRODUCTION

A leading packaged and canned food manufacturing company in Singapore, Treats Food carries around 95 different products in 9 different categories and has a good customer base of around 90 wholesale dealers and distributors, who in turn resell them to retailers or supermarkets.

However, Treats Food has been losing market share due to their production plants not being able to respond to urgent customer orders. From the various reasons given by the different departments (Material Requirements Planning Department, Procurement Department and Warehouse Department) in the case study, we can gather that the **Procurement Process** is currently not optimised to solve its inefficiencies. The Procurement process consists of a few major sub-processes, (1) Purchase Requisition to Purchase Order (PR-to-PO), (2) Shipping, (3) Receiving and (4) Payment. Treats Food has decided to focus on the **PR-to-PO sub-process** which is both labour-intensive and complex.

PURPOSE OF BPE TEAM

1. To interview the stakeholders in the PR-to-PO subprocess, understand how each department functions and identify key parameters and details.
2. To understand the relationship or involvement that each department has with regards to the whole PR-to-PO subprocess.
3. To perform As-Is Business Process Modelling of the PR-to-PO subprocess.
4. To perform Dynamic Analysis of As-Is process results using simulation and data settings for simulation run
5. To propose recommended initiatives and rationales and suggest a scenario to tackle any bottlenecks or issues found in the As-Is process.
6. To formulate the To-Be proposed scenario by integrating the recommended initiatives to deal with the issues found in the As-Is process.
7. To perform To-Be Business Process Modelling of the PR-to-PO subprocess.
8. To perform Dynamic Analysis of the To-Be Process and compare the results with the As-Is Analysis and note any improvements of how the proposed To-Be business process can be of value to Treats Food.
9. To provide a Concept Solution Blueprint for the proposed To-Be process with a Solution Overview, Function and Application.
10. To apply data analytics to the To-Be process for further analysis of business challenges or opportunities present.
11. To justify the proposed solution and tie in with Treat Food's performance targets.

PROCESS REDESIGN GOALS, MANAGEMENT DECISIONS/POLICIES & PERFORMANCE TARGETS

Process Redesign Goals	Priority
1. To achieve a more efficient PR-to-PO subprocess for all departments	High
2. To reduce the manual activities involved in the PR-to-PO subprocess so as to reduce bottlenecks and errors made	High
3. To allow Procurement Department to purchase raw materials/perishables to produce the product on time	High
4. To have an accurate and reliable Warehousing process to allow for proper material run	High

5. To sell finished products to customers as soon as possible and reduce cost since all products have expiry dates	High
6. To reduce the high percentage of maverick buys (one-time agreement) in terms of total purchases which has resulted in dissatisfaction amongst contracted suppliers	Medium
7. To properly forecast and plan for materials required by the MRP Department to allow for sufficient lead-time advice to supplier and efficient space allocation and planning	High
8. To allocate resources in an efficient and optimal manner and lighten the load of the various departments	Medium

Binding Management Decisions or Policies
1. To move towards 'e-Procurement Service' and possible online sourcing of products.
2. To seamlessly integrate with external partners such as suppliers and reduce the need for non-contract buys as sourcing is labour-intensive and time-consuming.
3. To seamlessly integrate the production, procurement and inventory systems and leverage on inventory management technologies, with appropriate adoption of technology and procurement domain standards
4. To allow the Procurement Department to manage manufacturing's expenditures by analysing cost information on product categories and non-contracted items and also ensure that suppliers are delivering quality products.
5. To have the ability to react and respond quickly to sudden customer orders or production hiccups.
6. To possibly outsource certain processes(e.g. Warehouse Process)
7. To perform a careful and balanced Risk-Cost-Benefit analysis when designing the overall solution.

Process Performance Targets	Metrics
1.To increase overall efficiency by reducing the process duration for the PR-to-PO subprocess by at least 50% %	Weighted average duration for each individual path
2. To reduce the overall cost of a PR-to-PO subprocess by at least 50%	Weighted average cost of PR-to-PO request for each individual path
3. Remove identified bottlenecks	Number of bottlenecks and the delays caused by each of them
4, Reduce manual activities	Number of manual activities

SUMMARY OF STATIC ANALYSIS AND DYNAMIC ANALYSIS OF AS-IS BUSINESS PROCESS

STATIC ANALYSIS OF AS-IS BUSINESS PROCESS

With reference to our RCI table in Appendix B, we identified several issues present in the PR-to-PO sub-process. There are several manual activities present that have led to inefficiencies and time wasted. For example, the PA has to decipher the handwritten hardcopy purchase requisition form and manually input the requested item into the PWS. The PA also has to manually search for one-time agreement suppliers through the Internet or calling. Similarly for PB, he or she has to manually check for the hardcopy contracts for the suppliers that are able to meet the delivery date time. All these manual activities lead to inefficiencies and time wasted and the root cause of this problem is due to a paper-based system and a lack of system integration.

DYNAMIC ANALYSIS OF AS-IS BUSINESS PROCESS

Path Analysis Summary

By referring to the Path Analysis Table in Appendix C, we identified 8 different paths with 2 different end points from the Purchase Requisition to Purchase Order subprocess for Treats Food. We also estimated the weighted average duration and cost to be 2557.76 mins (42 hrs 38 mins) and \$171.96 per Purchase Request.

Based on a percentage distribution method of calculating each path's distribution using the decision gateways' probabilities, we have identified the most occurring path to be Path 1, which is if existing contracts meet the required delivery date indicated in the PR and if the stock availability check tallies. Path 1 has a distribution of 48%.

We believe Path 1 is theoretically the most ideal and successful path for Treats Food. However, Path 1's average cost of \$174.38 and average duration of 2774 minutes over a period of 5 days is slightly higher than the weighted average cost of \$171.96 and weighted average duration of 2557.76 minutes respectively. This signifies that there are still numerous inefficiencies and bottlenecks present in Path 1, which again would be further identified in our bottleneck analysis below.

In addition, the next most occurring path is Path 2, which is when the existing contracts meet the required delivery date as indicated in the PR but the stock availability check does not tally. Path 2 has a significant proportion of 32%, which is a cause for worry as this means a new PR-to-PR sub-process must be triggered for every rejection of PR as the stock does not tally. Thus, some process remodeling would need to be done to lower the proportion of Path 2 which would lead to an increase in proportion of the most successful path which is Path 1.

Bottleneck Analysis Summary

The result from the Path Analysis showed that out of 100 Purchase Requests (20 per day) that were introduced at the start even of the PR-to-PO sub process, only a total of 46 instances from the two end events were completed at the end of the five days. With reference to the Bottleneck Analysis table in Appendix C, we have identified four activities that contributed significantly to the bottlenecks in the process.

It was found that the Procurement Admin's (PA) task of logging into the PWS to check the items and sourcing for new suppliers contributed the most to the bottlenecks, which could be due to a lack of an efficient sourcing system. In addition, the PA also has a second task of manually keying in the requested items, thus it would require a longer time for the PA to decipher poorly handwritten PR forms and be incredibly meticulous with his work.

Despite having a single task to complete, the Finance Clerk (FC) has caused a relatively long delay of 535 minutes in the PR-to-PO sub-process. A possible reason for bottleneck from this task is that there is only one FC tallying of items' costs and processing for all the budgets, thus he might have been overworked and not able to handle the bottleneck when numerous PR requests comes in all at once.

Thus, with the bottlenecks accumulated from the above tasks mentioned, the Professional Buyer's (PB) task of doing the final review, creating and printing the PO for PR in PWS would ultimately be affected.

RECOMMENDED INITIATIVES AND RATIONALES

S/N	Initiative	Rationale
1	Introduction of a new centralized IT system for PR-to-PO subprocess to allow people from different departments to view softcopy documents (e.g. purchase requisition and contracts)	Root cause: Paper-based <ul style="list-style-type: none"> Easily accessible by people from different departments PB has no need to look for hard copy of contracts of suppliers that fulfil the requirements Hard copy documents(e.g. purchase requisition) will be readable
2	Enterprise Integration of Procurement Workspace (PWS), Financial Information System (FIS), and Logistic Information System (LIS). The integrated system is called iLIP.	Root cause: Lack of system integration <ul style="list-style-type: none"> Reliable and integrated and updated data to be shared across all departments Integrate the existing PWS, FIS and LIS together to facilitate automatic retrieval of documents and data, in addition to real-time updates to the existing systems.
3	Outsource the Warehouse Process and remove WM from the process.	Root cause: Inadequate expertise in warehouse management and the Warehouse process is inefficient. <ul style="list-style-type: none"> The current Warehouse Inventory System (WIS) is difficult to use and has limited functionalities. To cater the high-level vision of the Management which is to outsource the Warehouse Process.
4	Removal of MRPC and FC in the sub-process by automating MRPC tasks (e.g. validation and endorsement of PR data) in iLIP and delegating FC's tasks to PA (tally item costs and commit budget)	Root cause: Redundant roles of MRPC and FC. <ul style="list-style-type: none"> Since MRPC is only responsible for emailing and validation. The iLIP can take on the roles and make them automated. PA can take on roles of the FC as the Procurement Department has expressed a high level 'want' to manage their manufacturing expenditures.
5	Shift stock availability check to before the search of contracts and negotiation with suppliers	Root cause: Late stock availability check <ul style="list-style-type: none"> Currently, the stock availability check is done after the search of contracts and negotiation with suppliers; which is a lengthy process. This leads to time and cost wastage as if the stock does not tally, a new sub-process has to be triggered. Can be mitigated through early rejection of sub-process if stock is unavailable

TO-BE BUSINESS PROCESS SCENARIO, USERS INVOLVED AND IT APPLICATIONS USED

Our To-Be business scenario utilises all the recommended initiatives (Initiative 1 to 5). Firstly, we replaced the hardcopy documents such as the Purchase Requisition forms and supplier contracts to softcopy version. These softcopy documents can be viewed in our integrated Logistics Inventory Procurement (iLIP) system, and hence reduces the need for manual activities (e.g. Manual input of PR data and searching of hardcopy contracts) previously present in the As-Is business process.

In addition, our iLIP system is able to integrate the data from PWS, FIS and LIS. This provides a more centralised and reliable system for different departments to access the data. For example, a high level "want" that were

expressed by the Procurement Department was to be given the requirement to manage the manufacturing's expenditures. To address this, our iLIP system allows the Procurement Admin (PA) to tally the items cost and commit their budget which would then be updated in the FIS. This allows us to remove redundant roles specifically in the sub-process such as FC so as to save costs and improve efficiency. Previously, MRPC was only doing simple roles such as emailing and validation of PR data, which our iLIP system is now able to automate these tasks and save costs. For supplier management, we also managed to seamlessly integrate suppliers with our iLIP system, which is able to keep a catalogue of existing suppliers and also able to conduct intelligent sourcing for new suppliers in an online marketplace if needed. Our iLIP system then provides real-time updates to the existing LIS system.

We also proposed the outsourcing of the Warehouse process, especially since the management has expressed a high level 'want' that is keen on doing so. From the As-Is business process, the warehousing process was often unreliable and inaccurate, causing significant delays in the sub-process. As such, outsourcing the warehouse process to an expert would allow Treats Food to focus their resources on higher value-adding activities instead of wasting time and resources in the warehousing process.

In addition, we found that the stock availability check was conducted too late in the As-Is business process and led to numerous inefficiencies and wastage when the stock is unavailable. As such, moving the stock availability check early and now to be conducted by our iLIP system would allow an early rejection of the process

Users involved:

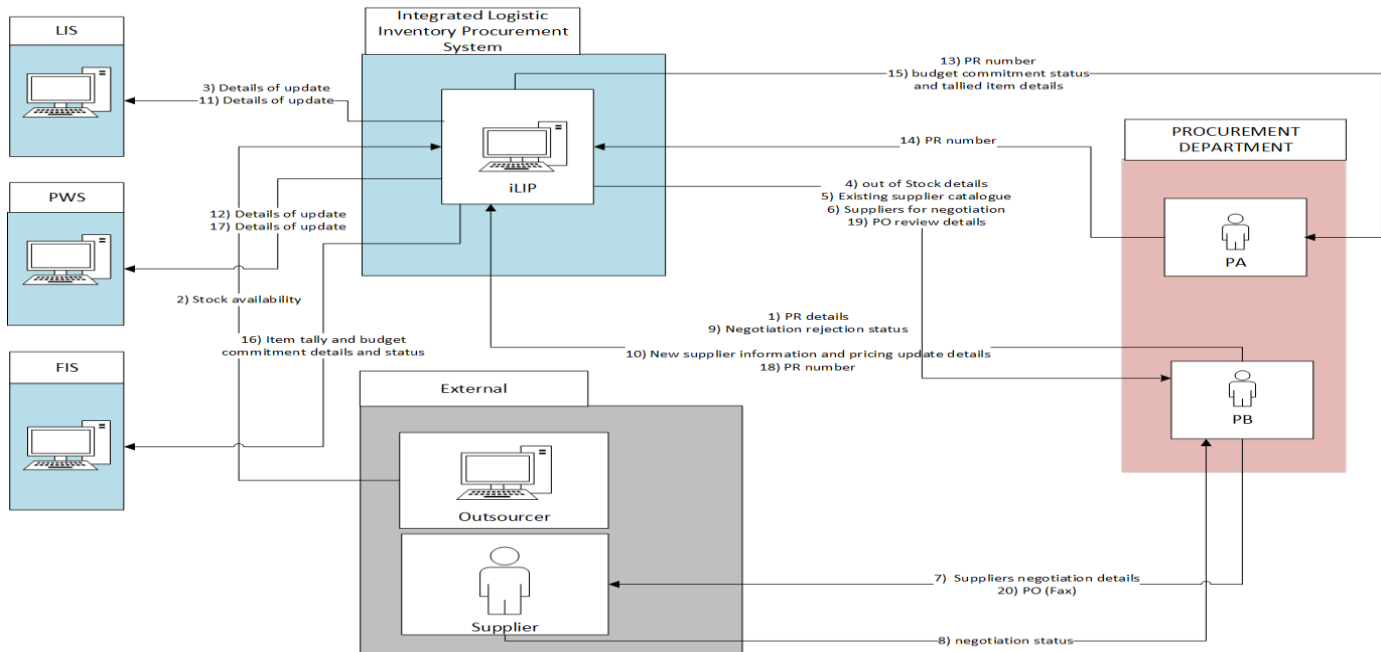
User	Description
Procurement Admin (PA)	Tally item costs and commit budget in iLIP; Update budget commitment status in iLIP
Professional Buyer (PB)	Call and negotiate with suppliers; Update negotiation rejection status in iLIP if negotiation fails; Update supplier information and pricing details in iLIP; Final review, create and print PO in iLIP; Fax PO to suppliers

IT applications:

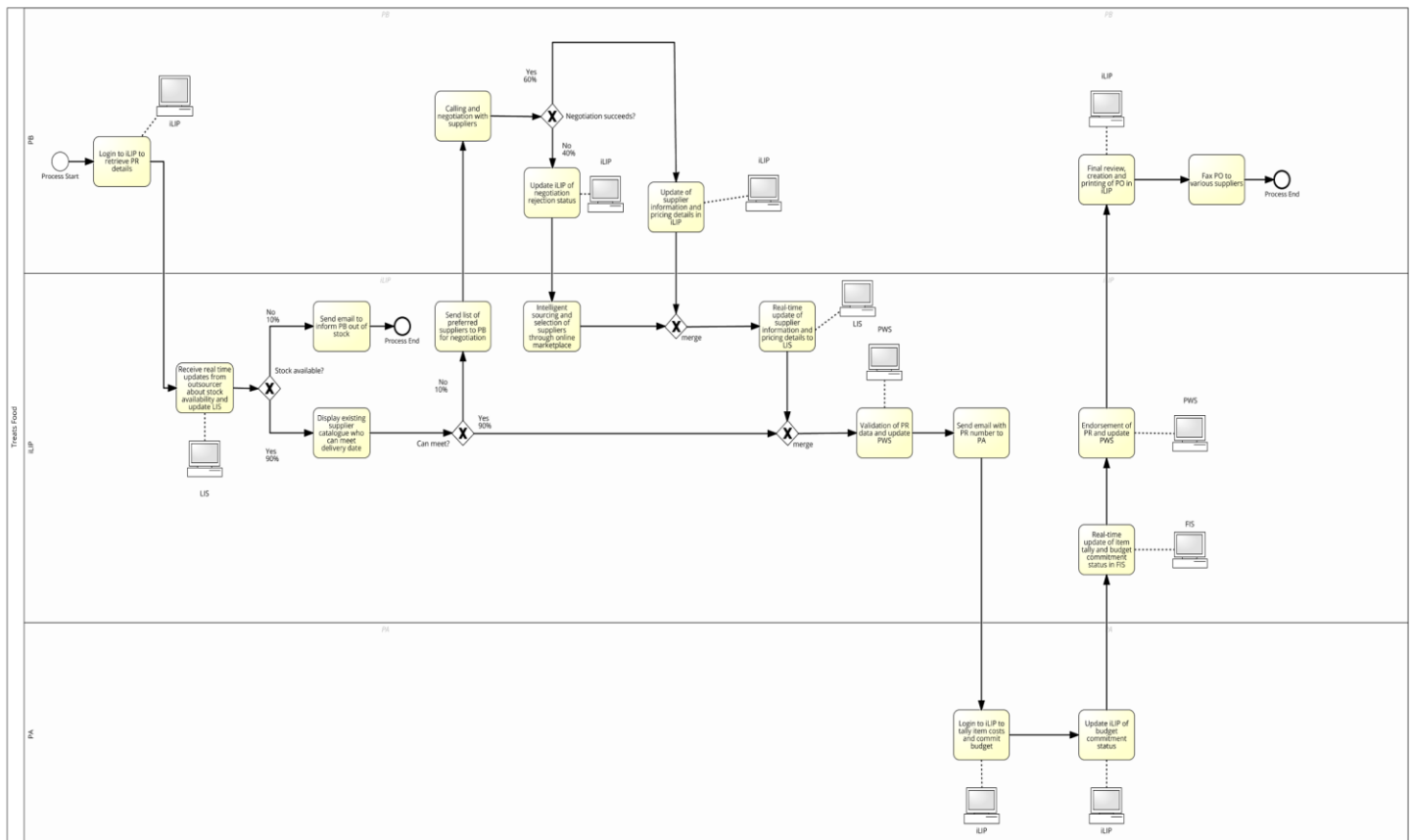
IT systems	Description
Integrated Logistic-Inventory-Procurement (iLIP) system	An integrated system allows users to access and edit data from PWS, LIS and FIS. It can also perform certain tasks automatically such as sourcing and selection of suppliers online, validate the PR data, and generate list of preferred suppliers. In addition, it updates the data in the respective IT systems after tasks are completed.

For a step-by-step of the To-Be business process and more information, refer to **Appendix D**.

TO-BE COLLABORATION MODEL



TO-BE BUSINESS PROCESS WORKFLOW DIAGRAM



SUMMARY OF DYNAMIC ANALYSIS OF TO-BE BUSINESS PROCESS

Path Analysis

Our path analysis for our To-Be business process revealed 4 different paths with 2 different end points from the Purchase Requisition to Purchase Order sub-process for Treats Food. We have estimated the weighted average duration and cost to be 53.378 mins and \$37.35 per Purchase Request (20 per day).

Most Occurring Path

The most occurring path in our To-Be business process is Path 1 (81%), which is when there is available stock to fulfill the Purchase Request and existing contracts can meet the indicated delivery date. Path 1 is also our most ideal path and the large distribution (81%) indicates the value of our To-Be business process. As compared to Path 3 and Path 4 which both have an average higher cost and time taken, Path 1 has a lower average cost and time taken of \$37.35 and 61 minutes respectively. Rejection paths such as Path 2 and Path 4 have low rejection percentages of 10% and 3.6% respectively.

Bottleneck Analysis

We identified no bottlenecks in our new To-Be business process. This indicates that all bottlenecks that were previously identified in our dynamic analysis for our As-Is process has been eliminated. As such, there is no time or cost wastage and all resources have been utilised efficiently.

Please refer to **Appendix E** and **Appendix F** for the data settings for the To-Be business process simulation and also a more detailed write-up analysis (inclusive of Path Analysis Table which details the calculations) of the simulation results.

ANALYSIS OF TO-BE BUSINESS PROCESS VS. AS-IS BUSINESS PROCESS

COMPARISON OF TO-BE BUSINESS PROCESS (20 PR PER DAY) WITH AS-IS BUSINESS PROCESS (20 PR PER DAY)

As-Is Business Process	To-Be Business Process	Improvements
Number of paths = 8	Number of paths = 4	Reduced by 50%
Path rejection percentages = 40%	Path rejection percentages = 13.6%	Reduced by 26.4%
Weighted Average Cost = \$171.96	Weighted Average Cost = \$37.35	Weighted Average Cost = reduced by 78.2%
Weighted Average Duration = 2557.76 mins	Weighted Average Duration = 53.378	Weighted Average Duration = reduced by 97.9%
Number of bottlenecks = 4	Number of bottlenecks = 0	Reduced by 100%

Our To-Be business process shows that the number of paths have reduced from 8 to 4 (50%) and the path rejection percentages have been reduced by 26.4%. This can be attributed to the iLIP system having an existing supplier catalogue and also intelligent sourcing abilities for suppliers in an online marketplace. In addition, there is also the removal of manual activities that were previously resource intensive (e.g. hardcopy searching of contracts) and many activities are now automated.

As such, cost and time wastage have been reduced. This can be seen from the reduction rates of 78.2% and 97.9% for weighted average cost and weighted average duration respectively, which shows a huge improvement.

Alongside, bottlenecks have also been removed completely (previously 4). This is also in part due to the better delegation of workload and removal of redundant roles. For example, our iLIP system has been able to automate the work of MRPC such as validation and endorsement of PR data.

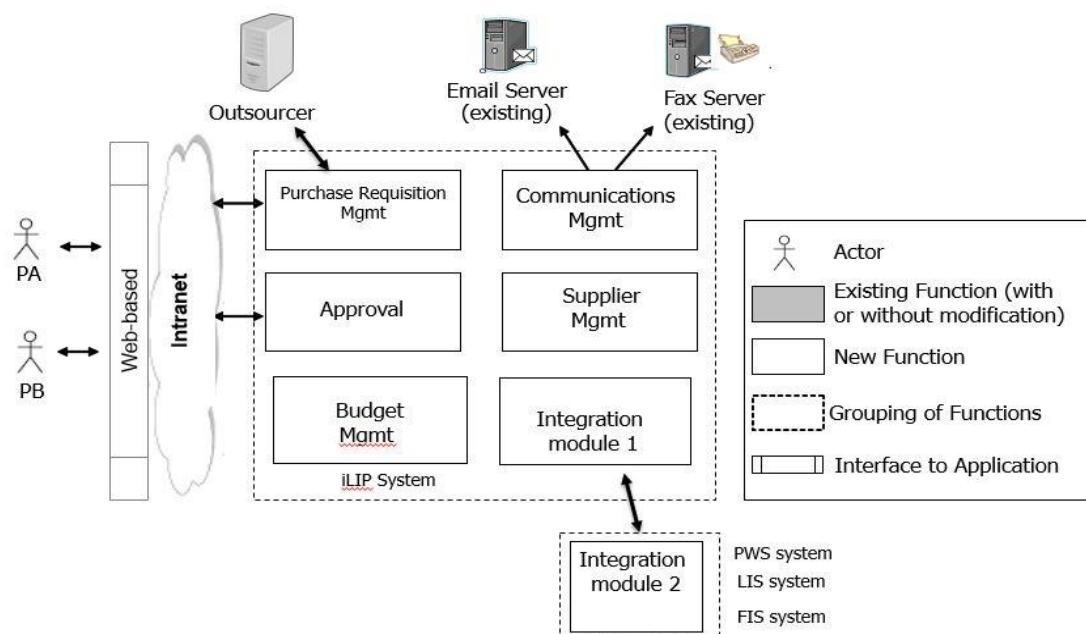
Thus, these improvements show the success of our proposed To-Be as it fulfills our process performance targets and metrics stated previously.

FUTURE DEMAND ANALYSIS OF TO-BE BUSINESS PROCESS (50 PR PER DAY)

We simulated our proposed To-Be to accommodate the future forecast of 50 PR per day. We found that the weighted average cost remained the same. In addition, no bottlenecks were present. This suggests that our proposed to-be plan is a sustainable model that can meet future demands easily.

CONCEPT SOLUTION BLUEPRINT

(I) SOLUTION OVERVIEW MODEL

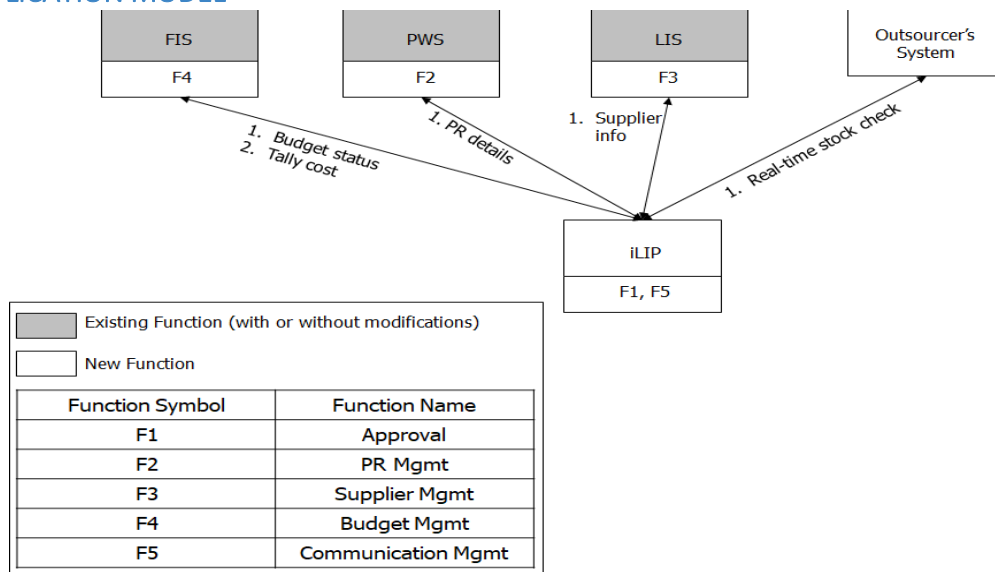


(II) FUNCTION MODEL

Function	Use Case	New/Existing/To be Modified	Comments
PR Request Management	Receive real-time update from outsourcer about stock availability Update negotiation rejection status in iLIP Retrieve PR details from iLIP Create and print PO in iLIP	New	These functions are designed to be in the new application, iLIP (integrated Logistics Inventory Procurement) system
Approval	Validate PR data in iLIP Endorse PR in iLIP	New	
Communications Management	Send email Send fax	New	Existing email servers
Budget Management	Tally items costs on iLIP Commit budget in iLIP Update budget commitment status on iLIP	New	Currently is done in FIS
Supplier Management	Update supplier information and pricing details Real-time update supplier information and pricing details Intelligent sourcing of suppliers through online marketplace Send list of suppliers to PB	New	Have a database of existing suppliers in iLIP and also ability to conduct intelligent sourcing of new suppliers in the Internet
Integration module 1	iLIP system send updates of stock availability check to the LIS system iLIP system send updates of supplier information and pricing details to the LIS system iLIP system validates data and send updates to the PWS system. iLIP system send updates of the budget commitment status to the FIS system. iLIP system endorses PR number and send endorsed PR number to the PWS system	New	Mainly for sending and updating of data from iLIP to the three respective systems: PWS, LIS and FIS

Integration module 2	<p>LIS system gets updates from the of stock availability from the iLIP system</p> <p>LIS system gets updates of the supplier information and pricing details from the iLIP system</p> <p>PWS system get updates of validated data from the iLIP system</p> <p>FIS system gets the updates of the budget commitment status from the iLIP system</p> <p>PSW system gets the updated PR number from the iLIP system.</p>	New	Mainly for retrieving of data from iLIP to the three respective systems: PWS, LIS and FIS
----------------------	--	-----	---

(III) APPLICATION MODEL



APPLICATION OF DATA ANALYTICS TO THE TO-BE BUSINESS PROCESS

DESCRIPTION OF BUSINESS CHALLENGES

No.	Business Challenges
1	What is the success rate for negotiation with suppliers?
2	What is the predicted wait time for the "Intelligent sourcing of suppliers through online marketplace" task?
3	Efficiency of real-time updates provided by outsourcer for stock availability

4	Time taken for data migration of PWS, LIS and FIS with the new centralised system iLIP
5	What is the predicted wait time for creation and printing of PO in iLIP?

DATA NEEDED

Actor	Data Attribute
Procurement Admin	Employee ID, Employee name, Birthdate, Age, Gender
Professional Buyer	Employee ID, Employee name, Birthdate, Age, Gender
Integrated Logistic Inventory Procurement (iLIP) system	Stock availability status, Email ID, Supplier ID, Delivery Date, Purchase Requisition ID

Activity	Data Attributes
Receive real time updates from outsourcer about stock availability	Real Time Stock Update Id, Stock Availability status
Intelligent Sourcing for new suppliers	Supplier Id, Purchase Order ID, Recommendation Percentage
Update of supplier information and pricing details in iLIP	Supplier Id, Pricing Details

Supplementary data	Data Attributes
Outsourcer	Name of Company, Real Time Stock Availability Status, Length of Contract
Purchase Order	Purchase Order ID, Date, Item description, Quantity, Price, Supplier name, Shipping details, Billing details

STATISTICAL MEASURES

No.	Statistical Measures
1	Stock Availability rate
2	Number of suppliers provided by intelligent sourcing
3	Average number of updates from outsourcer per day
4	Ratio of successful negotiations to unsuccessful negotiations
5	Number of suppliers that can meet delivery date
6	Number of preferred suppliers
7	Average Intelligent sourcing turnaround
8	Percentage of PRs endorsed
9	Number of item costs tallied and budget committed
10	Average final review, creation and printing of PO time

ANALYTICS QUESTIONS

Analytic code	Analytic Questions	Analytic Type
D1	What is the average time taken to tally costs and commit budget by PA?	Descriptive
D2	What is the average wait time for real time stock availability updates?	Descriptive
D3	What is the % of successful negotiations	Descriptive
D4	What is the average final review, creation and printing of PO in iLIP turnaround?	Descriptive
P1	What is the predicted % of contracts which can meet delivery date?	Predictive
P2	What is the predicted % success rate for negotiations with suppliers?	Predictive

P3	What is the predicted contract pricing details? (Because details is priced to be for highest success rate. If price is too high, intelligent sourcing will not recommend them as supplier)	Predictive
P4	What is the predicted average wait time for endorsement of PR	Predictive
R1	How often should data migration occur to ensure smooth integration of existing systems with iLIP	Recommendation
R2	Advices on contract pricing for suppliers?	Recommendation
R3	Which is the recommended new supplier to deal with?	Recommendation
R4	Advices on time and cost efficiency of outsourcer?	Recommendation

DISCUSSION OF ANALYTICS QUESTIONS THAT ADDRESSES BUSINESS CHALLENGES COMPLETELY OR PARTIALLY

Business Challenge	Analytics Question	Partially or completely? Why?
What is the success rate for negotiation with suppliers?	What is the % of successful negotiations (Descriptive)	Completely. The percentage of successful negotiations is directly proportional to the success rate.
	What is the predicted success rate for negotiations with suppliers? (Predictive)	Partially, as the prediction will be based on historical data. The predicted success rate will enable the company to make more informed, better decisions on how much to price their contracts, as well as how long to wait for a counteroffer/acceptance of terms.
What is the predicted wait time for the "Intelligent sourcing and selection of suppliers through online marketplace" task	What is the predicted contract pricing details? (Predictive)	Partially, as the number of details in the contract pricing will increase the number of outputs processed and hence increase waiting time for the sourcing. This does not affect the selection part of the task. By setting a desired price filter, based on historical records, the pool of potential suppliers will be smaller. Hence, sourcing time will shorten.
	Advices on contract pricing for suppliers?	Partially. By having automated selection of the best supplier(s), time taken by the PB to deliberate over new supplier choices are reduced or eliminated. However, this process does not affect the sourcing part of the task.

	(Prescriptive)	Our iLIP system's intelligence sourcing utilises machine learning and price decision analytics to determine the best prices quoted on the online marketplace.
	Which is the recommended new supplier to deal with? (Prescriptive)	Completely, as the recommended new supplier can only be derived after sourcing and selection.
Efficacy of real-time updates provided by outsourcer for stock availability	What is the average wait time for real time stock availability updates? (Descriptive)	Completely, as the wait time is a major factor in deciding if the updates are useful. If the interval between updates are too long, the PR-PO sub-process might be bottlenecked at this stage.
	Advices on time and cost efficiency of outsourcer? (Prescriptive)	Completely. If the number of real time updates per day is too much, it would take excess server space and cause memory/performance issues. This might lead to increased infrastructural costs. If the number of real time updates per day is too little, there might be a delay in the PR-PO process while waiting for the next update. Hence, calculating the time/cost efficiency is pertinent in deciding if the outsourcer is more cost-effective than the in-house equivalent.
Time taken for data migration of PWS, LIS and FIS with the new centralised system iLIP	How often should data migration occur to ensure smooth integration of existing systems with iLIP (Prescriptive)	Completely. How often data migration occurs will be directly affected by the time taken since ideally, the number of times data migration occurs is enough to ensure that the user does not experience information lag between systems. It should not be too many times as this could lag the server or take up too much server space.
What is the predicted wait time for creation and printing of PO in iLIP	What is the average final review, creation and printing of PO in iLIP turnaround? (Descriptive)	Partially, as the analysis of the current turnarounds is likely to be a good estimate for future turnarounds. However, it is not complete as the predicted wait time will likely consist of other factors such as the number of details in the PO.

PROPOSED JUSTIFICATION AND CONCLUSION

In conclusion, our proposed To-be business process integrates the existing systems (PWS, FIS, and LIS) together through our centralised system, iLIP. This allows different roles to access the information easily and reduces the need for hardcopy documents. The automation of activities such as validation and endorsement of PR by our iLIP system also allows redundant roles such as MRPC to be removed. The procurement department has also been given access to manage their expenditures, removing the role of FC in the process. In addition, the warehousing process has also been outsourced and the previously unreliable and inaccurate WIS has been removed. The stock availability check which would be done by the outsourced system would provide real-time updates early on in the sub-process, allowing early rejection of PO instead of late rejection (as in the As-Is) which led to time and cost wastage.

As a result of the above initiatives, the company's performance targets have been fulfilled. The number of paths have dropped from 8 to 4 from the As-Is business process to the To-Be business process, with a reduction in path rejection rate from 40% to 13.6%. Manual activities such as searching of hardcopy contracts have also been eliminated with the introduction of automated activities in our iLIP system. All bottlenecks have also been eliminated. In addition, the weighted average cost and duration have been reduced by 78.2% and 97.9% respectively.

Appendices

APPENDIX A: AS-IS BUSINESS PROCESS SCENARIO, USERS INVOLVED AND IT APPLICATIONS USED

As-Is Scenario			
S/N	Role	Activity	Time Taken
1	PA	PA login to the PWS to manually enter the requested items from hardcopy PR form	15 mins
2	PA	PA emails PR number to PB	5 mins
3	PB	PB login to PWS to retrieve PR details	5 mins
4	PB	PB login to LIS to retrieve suppliers for items to be purchased	15 mins
5	PB	PB searches hardcopy contracts for suppliers who can meet the items delivery date	30 mins
6	PB	If contracts do not meet delivery date, PB will call and negotiate with suppliers	30 mins
7	PB	If negotiation fails, PB will reply PA's email with pricing information and items to be one-time sourced	5 mins
8	PA	PA login to PWS to check items and source for new suppliers	60 mins
9	PA	PA drafts and emails PB the suppliers' details	5 mins
10	PB	PB calls, negotiates and requests for single-one-time agreement for suppliers	45 mins
11	PB	If it is new supplier, PB will update new supplier information to LIS	10 mins
12	PB	PB updates supplier information and existing/new contract pricing details to PWS	10 mins
13	PB	PB emails MRPC PR number	5 mins
14	MRPC	MRPC validates PR data in PWS	10 mins
15	MRPC	MRPC emails FC the PR number	5 mins
16	FC	FC login to PWS to tally items costs and commit budget in FIS	20 mins
17	FC	FC emails MRPC that budget is committed	5 mins
18	PB	PB send email with PR number to WM and request stock availability check	5 mins
19	WM	WM performs stock availability check	45 mins
20	WM	If stock does not tally, WM updates WIS of actual stock numbers and PWS of stock check rejection status	15 mins
21	WM	If stock tally, WM emails MRPC of PR stock check rejection and item shortage details	5 mins
22	WM	WM calculates and plans space for new stock in warehouse and update WIS of space requirements	15 mins
23	WM	WM approves stock check status of PR in PWS	3 mins
24	WM	WM emails MRPC of stock check and space planning completion	5 mins

25	MRPC	MRPC login to PWS to endorse PR	3 mins
26	MRPC	MRPC email PB of PR number	5 mins
27	PB	PB performs final review, creation and printing of PO for PR in PWS	20 mins
28	PB	PB faxes PO to various suppliers	8 mins

Decision Gateways

Decision	Status	Yes %	No %
Existing suppliers can meet the delivery date	Old	80	20
Negotiation with suppliers succeed	Old	60	40
One-time-agreement is with new supplier	Old	50	50
Stock is tally	Old	60	40

Users involved:

User	Description
Procurement Admin (PA)	Receives Purchase Requisitions (PR) from MRPC; Enters the PR details into Procurement Workspace (PWS); Source for one-time-agreement suppliers.
Professional Buyer (PB)	Negotiate with suppliers; Search for suppliers; Purchase required items; Provide the pricing of the required items to PA; Update new suppliers' information to Logistics Information System (LIS); Update PR in PWS after getting one-time agreement; Final review, create and print POs and fax them to suppliers.
Material Requirements Planning Controller (MRPC)	Validation of the PR data; Endorse the PR.
Finance Clerk (FC)	Budgeting commitment.
Warehouse Manager (WM)	Stock checking; Update stock number and space requirements for pending incoming items in Warehouse Inventory System (WIS); Approve stock check status in PWS.

IT applications:

IT systems	Description
Procurement Workspace (PWS)	A database of Purchase Requests, Purchase Orders and Goods Receipts. It can also route documents to approvers.
Logistics Information System (LIS)	A system that handles Material Requirements Planning (MRP), Production scheduling, Bill of materials (BOM), Sales order management, Supplier information.
Financial Information System (FIS)	An system with functionalities such as General Ledger Module, Accounts Receivable Module, Accounts Payable Module, Sales Order Module and Invoice Module.
Warehouse Inventory System (WIS)	This system controls the storage of materials within the warehouse and processes the associated transactions, including receiving, putaway and picking.

APPENDIX B: AS-IS PROCESS STATIC ANALYSIS WITH BOTH RCI AND RCR MODELS**RCI TABLE**

Process Name: PR-to-PO sub process								
Issue #	Issue Description	Category	Cause Description	Root Cause	Impact	Impact Level	Business Measure Impacted	Business Factor Impacted
1	PB have to manually check for the hardcopy contracts for the suppliers that are able to meet the delivery date time	Process	The existing system for the process does not allow searching of the contracts	Paper-based System	Time wasted to wait for PB to manually check for hard copy contracts	Medium (3)	<u>Measure 1:</u> Manpower and resources <u>Mesaure 2:</u> Total process time	<u>Factor 1:</u> Productivity <u>Factor 2:</u> Eficiency
2	PA have to manually search for one-time-agreement suppliers	Process	There is no system in the process that can collate all suppliers	Lack of supplier integration with system	Time wasted to source for one-time-	High(4)	<u>Measure 1:</u> Total process time	<u>Factor 1:</u> Productivity

	through Internet and calling friendlier suppliers				agreement suppliers			
3	Actual stock inventory count does not tally with the WIS system and the WM have to do multiple counting of stock	System	Lack of an integrated and reliable system which will provide stock counting from the warehouse stock inventory counting.	Lack of system integration	Time and resources wasted to tally the stock numbers.	Medium (3)	<u>Measure 1:</u> Manpower and resources <u>Measure 2:</u> Total process time	<u>Factor 1:</u> Productivity <u>Factor 2:</u> Efficiency <u>Factor 3:</u> Accuracy
4	PA receives 20 hardcopy written purchase requisition form which are difficult to read	Process	The existing system does not provide functions for the purchase requisition form to be sent in softcopy	Paper-based System	Waste of time to decipher the purchase requisition form.	Medium (3)	Measure 1: Total time process	<u>Factor 1:</u> Productivity <u>Factor 2:</u> Accuracy
5	FC overwhelmed with the tally of items cost and budget planning	Policy	Lack of sufficient manpower to tally items cost and conduct budget commitment	Company Policy	Bottleneck as budget commitment must be completed before the process can go on	Very high(5)	Measure 1: Total process time Measure 2: Manpower and resources	<u>Factor 1:</u> Productivity <u>Factor 2:</u> Efficiency
6	Redundant role of MRPC	Process	The only role of MRPC is to validate the data and send emails, which does not justify their 24hr work shift and high pay of \$55	Redundant process	Several redundancies, high cost and time wastage to the company	Medium (3)	Measure 1: Total cost Measure 2: Total process time	<u>Factor 1:</u> Productivity <u>Factor 2:</u> Efficiency

7	Late stock availability check	Process	Stock availability check is done late in the process after searching and negotiation with suppliers, late rejection when stock does not tally.	Inefficient process	Time wastage and high cost to the company	High(4)	Measure 1: Total Cost Measure 2: Total process time	<u>Factor 1:</u> Productivity <u>Factor 2:</u> Efficiency
---	-------------------------------	---------	--	---------------------	---	---------	--	--

RCR TABLE

Root Cause	Recommendation	Recommendation Impact Score	Complexity of implementing recommendations
Paper-based system	Implementing an online system that allows the PB to access all the softcopy of the contracts easily	High (5)	High complexity: <ol style="list-style-type: none"> 1. It would take a significant amount of time for the users to familiarise themselves with the new system 2. Assuming that amendments on contracts need to be validated with a hand-signed signature(s), it could increase the PB's workload.
	Introduce Handheld Personal Digital Assistant(PDA) in each department with the related documents stored inside an application	High (4)	High complexity: <ol style="list-style-type: none"> 1. Adopting handheld devices would incur high operating costs 2. Training the employees about the device and waiting for them to adapt fully to the device would be time consuming

Lack of system integration	Create a centralised system by using Middleware to bridge and integrate the different systems, while also providing a secured online portal for employees to access (e.g. intranet)	High (5)	High complexity: 1. Intense training would be needed for the employees to familiarise themselves with the intranet, which would lead to a long time spent. 2. Implementing a middleware would require an external party to do the job, thus possibly incurring additional costs.
	Outsourcing warehouse process to cut down time spent on doing inventory checks, thus allowing more time for the warehouse department to focus on other tasks at hand.	High (5)	High complexity: 1. There is a possibility that there could be a conflict of interest, which could affect the business. 2. Quality of the task/products would be difficult to manage.
Company policy	Assuming that only the Finance Clerk has access to the FIS, revising the company policy to allow restricted access to other departments would help cut down the tasks for FC and speed up the process time for other departments' duties	High (4)	High complexity: 1. Possibility of information leakage to the rest of the company, which could be detrimental in times of crisis. 2. Server might not be able to withstand the surge in system usage, which could lead to another bottleneck.
	Completely remove the FC to prevent bottlenecks	Moderate (3)	Complex: 1. Other employees would need to be trained in the finance-related tasks, on top of their individual tasks 2. Inconsistent budgeting and tallying, which could lead to higher discrepancies for the company

Redundant role of MRPC	Remove MRPC and give the work to PA	High(5)	Medium <ol style="list-style-type: none"> 1. Retraining needs to be done 2. Additional workload of PA on top of what they are doing
	Give MRPC more work to do, from other roles who are overworked such as PB, FC or WM	Medium(3)	Low <ol style="list-style-type: none"> 1. Resistant to taking on more tasks 2. Certain tasks such as that of PB or FC are specialised and cannot easily be delegated 3. And might be overwhelmed
Late stock availability check	Shift stock availability check to before searching for contracts and negotiating with suppliers	High(4)	Medium <ol style="list-style-type: none"> 1. PB might be resistant to having more tasks than they already have 2. It will take a significant amount of time for PB to learn perform efficiently on their new tasks
	Remove it entirely by outsourcing (Answer to the late stock availability check)	Medium(3)	Medium <ol style="list-style-type: none"> 1. Passing confidential info 2. Need to conduct research to choose who to outsource to; time consuming

APPENDIX C: DYNAMIC ANALYSIS OF THE AS-IS BUSINESS PROCESS WITH RECTIFICATION FROM INTERIM REPORT

Data Settings

Start Event Trigger: Day	Frequency (No. of Applications per day)	Duration (For simulation run)
Monday - Friday, 0800 - 1800	20	5 days

Roles/Resources	Hiring Cost	Working Hours	Number of Resources
PA	\$22/hr	Monday - Friday, 0800 - 1800 (excl. one hour lunch at 12pm)	2
PB	\$55/hr	Monday - Friday, 0800 - 1800 (excl. one hour lunch at 12pm)	4
FC	\$45/hr	Monday - Friday, 0800 - 1800 (excl. one hour lunch at 12pm)	1
WM	\$33/hr	Daily 24 hours shift(there is always 1 in every shift)	2
MRPC	\$55/hr	Daily 24 hours shift(there is always 1 in every shift)	1

Path Analysis

Path	Description	Distribution	Average cost	Time taken (in minutes)
1	Contracts meet delivery date and stock tallies	48%	\$174.38	2774

2	Contracts meet delivery date and stock does not tally	32%	\$139.74	1991
3	Contracts do not meet delivery date, negotiation succeeds and stock tallies	7.2%	\$201.88	2912
4	Contracts do not meet delivery date, negotiation succeeds and stock does not tally	4.8%	\$167.24	2129
5	Contracts do not meet delivery date, negotiation fails, new supplier and stock tallies	2.4%	\$280.71	3784
6	Contracts do not meet delivery date, negotiation fails, new supplier and stock does not tally	1.6%	\$246.07	3001
7	Contracts do not meet delivery date, negotiation fails, old supplier and stock tallies	2.4%	\$271.54	3774

8	Contracts do not meet delivery date, negotiation fails, old supplier and stock does not tally	1.6%	\$236.90	2991
<i>Weighted Averages</i>			\$171.96	2557.76 mins

Our path analysis revealed 8 different paths with 2 different end points from the Purchase Requisition to Purchase Order sub-process for Treats Food. We have estimated the weighted average duration and cost to be 2557.76 mins (42 hrs 38 mins) and \$171.96 per Purchase Request.

The analysis also indicated that out of 100 Purchase Requests (20 per day) that were introduced at the start of the PR-to-PO sub process, only 46 instances in total from the 2 end events were completed at the end of 5 days. For the first end event after the activity “Email MRPC of PR stock check rejection and item shortage details”, only 19 instances were completed. For the end event after the activity of “Fax PO to various suppliers”, only 27 instances were completed, with 4 PRs still being processed and 8 PRs waiting at the activity of “Final review, creation and printing of PO for PR in PWS”. The less than satisfactory completion rate of 46% suggests numerous bottlenecks, which would be further explored in our bottleneck analysis below.

Most Occurring Path

Based on a percentage distribution method of calculating each path’s distribution using the decision gateways’ probabilities, we have identified the most occurring path to be Path 1, which is if existing contracts meet the required delivery date indicated in the PR and if the stock availability check tallies. Path 1 has a distribution of 48%.

We believe Path 1 is theoretically the most ideal and successful path for Treats Food. However, Path 1’s average cost of \$174.38 and average duration of 2774 minutes over a period of 5 days is slightly higher than the weighted average cost of \$171.96 and weighted average duration of 2557.76 minutes respectively. This signifies that there are still numerous inefficiencies and bottlenecks present in Path 1, which again would be further identified in our bottleneck analysis below.

In addition, the next most occurring path is Path 2, which is when the existing contracts meet the required delivery date as indicated in the PR but the stock availability check does not tally. Path 2 has a significant proportion of 32%, which is a cause for worry as this means a new PR-to-PR sub-process must be triggered for every rejection of PR as the stock does not tally. Thus, some process remodelling would need to be done to lower the proportion of Path 2 which would lead to an increase in proportion of the most successful path which is Path 1.

Resources	Task	Total waiting time
PA	Draft and email PB the suppliers' details	2d 02:41h
	Email PR number to PB	4d 10:08h
	Manual entry of requested Items	28d 12:46h
	Login to PWS to check items and source for new suppliers	12d 13:27h
PB	Update new supplier information to LIS	00:00h
	Login to PWS to retrieve PR details	03:37h
	Search hardcopy contracts for suppliers who can meet the items delivery date	4d 17:48h
	Reply PA's email with pricing information and items to be one-time sourced	00:35h
	Update supplier information and existing/new contract pricing details to PWS	2d 11:08h
	Call, negotiate and request for single-one-time agreement for suppliers	00:00h
	Final review, creation and printing of PO for PR in PWS	6d 14:05h
	Calling and negotiation with suppliers	1d 11:55h
	Fax PO to various suppliers	10:13h
	Login to LIS to retrieve suppliers for items to be purchased	16:16h
	Email MRPC PR number	13:46h
WM	Email MRPC of stock check and space planning completion	13:07h
	Perform stock availability check	2d 21:03h

	Update WIS of actual stock numbers and PWS of stock check rejection status	1d 17:00h
	Approve stock check status of PR in PWS	1d 01:45h
	Email MRPC of PR stock check rejection and item shortage details	05:20h
	Calculate and plan space for new stock in warehouse and update WIS of space requirements	6d 08:51h
MRPC	Login to PWS to endorse PR	02:08h
	Validate PR data in PWS	1d 20:00h
	Email FC the PR number	3d 13:20h
	Send email with PR number to WM and request stock availability check	08:55h
	Email PB of PR number	1d 01:12h
FC	Email MRPC that budget is committed	10d 02:25h
	Login to PWS to tally items costs and commit budget in FIS	22d 09:30h

Role	Activity	Average Delay Duration (in minutes)
Finance Clerk (FC)	Login to PWS to tally items costs and commit budget in FIS	535

Professional Buyer (PB)	Final review, creation and printing of PO for PR in PWS	548
Procurement Admin (PA)	Manual entry of requested items	480
	Login to PWS to check items and source for new suppliers through calling suppliers or using the Internet	804

Based on our simulation run, the Excel generated bottleneck analysis report generated the total waiting time and instances at each activity or task and highlighted several inefficiencies and delays. Looking at the figures, we believe that the above 4 identified activities contributed to the most significant bottlenecks in the PR-to-PO sub-process.

Amongst the roles listed above, the Procurement Admin's task of logging into the PWS to check the items and sourcing for new suppliers contributed the most to the bottlenecks. The task requires the PA to painstakingly and actively search for new suppliers who are willing to do a one-time agreement. This activity takes about an hour for an instance as the PA needs to search Internet for new suppliers or to contact their friendlier suppliers to introduce contacts. From our simulation results using a period of 5 days, we found that this activity led to an average delay duration of 804 minutes, which is the highest average delay duration in all the activities. We believe that this significant delay process is due to a lack of an efficient sourcing system or contingency plan that can ease the PA's work in looking for new suppliers for one-time agreements.

Similarly, the activity of PA manually keying in the requested items also led to a significant bottleneck due to a high average delay duration of 480 minutes in our simulation. We believe this was so as it was stated in the interview transcript that PA had a difficult time deciphering the handwritten hardcopy PR form. As such, the PA must be more meticulous to double-check if the details they key in is accurate and this naturally takes more time and is inefficient.

Despite having a single task to complete, the Finance Clerk has caused a relatively long delay of 535 minutes in the PR-to-PO sub-process. One reason for this is that there is only one FC tallying the items' costs and processing for all the budgets. Thus, the FC might have been overworked and not able to handle the bottleneck when he needs to tally all the items' costs and commitment of budgets when numerous PR requests comes in all at once.

Our team believes that all these bottlenecks present in the activities and roles mentioned above also ultimately led to a bottleneck at the final review, creation and printing of PO for PR in PWS, done by the Professional Buyer. Despite having a total of 4 resources, our simulation run indicated that this activity led to a significant average delay duration of 548 minutes. We believe this is so as this activity is one of the last activities present in the PR-to-PO sub-process. As such, the bottlenecks in the activities identified earlier would ultimately lead to a trickle-down effect and affect the last few activities.

APPENDIX D: STEP BY STEP DESCRIPTION OF TO-BE BUSINESS PROCESS

Scenario #1			
Initiatives Implemented: 1,2,3,4 and 5			
<p><u>Description:</u></p> <ul style="list-style-type: none"> · Softcopy documents such as purchase requisitions and supplier contracts can be viewed in iLIP now · Real-time integration of data from PWS, FIS and LIS through iLIP, · The Procurement Department (i.e PA) is allowed to manage the manufacturing expenditures now · The Warehouse Process is now outsourced · MRPC's roles are handled by iLIP and PA can commit budget now · Stock availability check is now performed before searching for contracts and negotiating with suppliers 			
S/N	Role	Activity	Time Taken
1	PB	PB login to iLIP to retrieve PR details	1 min
2	iLIP	iLIP receives real time updates from outsourcer about stock availability and update LIS	1 min
3	iLIP	iLIP send email to inform PB out of stock	1 min
4	iLIP	iLIP display existing supplier catalogue who can meet delivery date	3 min
5	iLIP	iLIP sends list of preferred suppliers to PB for negotiation	1 min
6	PB	PB calls and negotiate with suppliers	30 mins
7	PB	PB updates iLIP of negotiation rejection status	1 min
8	PB	PB updates supplier information and pricing details in iLIP	1 min
9	iLIP	iLIP performs intelligent sourcing and selection of suppliers through online marketplace	3 mins
10	iLIP	iLIP performs real-time update of supplier information and pricing details to LIS	1 min

11	iLIP	iLIP performs validation of PR data and update PWS	1 min
12	iLIP	iLIP sends email with PR number to PA	3 mins
13	PA	PA login to iLIP to tally item costs and commit budget	1 min
14	PA	PA updates iLIP of budget commitment status	5 mins
15	iLIP	iLIP performs real-time update of item tally and budget commitment status in FIS	1 min
16	iLIP	iLIP performs endorsement of PR and update PWS	1 min
17	PB	PB does the final review, creation and printing of PO in iLIP	20 mins
18	PB	PB fax PO to various suppliers	10 mins
Decision Gateways			
Decision	Status	Yes %	No %
Stock available	New	90	10
Existing suppliers can meet the delivery date	New	90	10
Negotiation with new suppliers	Old	60	40

Rationale

This scenario removes the WIS and integrates PWS, FIS and LIS into an integrated system called iLIP. The new system would allow authorised personnel, in this process, PA and PB, to retrieve information from different existing systems. This helps to remove the root causes of a paper-based system and lacking an integrated system. This reduces the time taken to look for hardcopy contracts and human errors may be incurred in handwritten purchasing requisitions as all documents are now shared electronically. The Procurement Department is also granted the right to manage the manufacturing expenditures. This removes the bottleneck at FC and allows the department to analyse important information such as costs and ensure that suppliers are delivering quality products. Additionally, this new IT system also remove the redundant roles of MRPC and FC, MRPC's jobs can now be handled by the iLIP and FC's works are delegated to PA. This improves the efficiency and cost of the entire process. Other than an integrated IT system, this scenario has also catered one of the high-level "wants" of the Management which is to outsource the Warehouse Process. This allows the company to find professionals to manage their inventory given that they have inadequate expertise in inventory management and existing WIS is difficult to use. Lastly, in this scenario, the stock availability check is also performed before the start of the suppliers sourcing process which helps to eliminate unnecessary suppliers search if stock is not available. With this implementation of this scenario, the company will be able to improve the efficiency of the PR-to-PO sub process and also make this process more cost effective. One drawback of this scenario will be the new integrated system iLIP will need time to be implemented and employees will also have to take time to get used to the system.

APPENDIX E: DATA SETTINGS FOR TO-BE BUSINESS PROCESS SIMULATION

Start Event Trigger: Day	Frequency (No. of Applications per day)	Duration (For simulation run)
Monday - Friday, 0800 - 1800	20 (Current) 50 (Future forecast)	5 days

Roles/Resources	Hiring Cost	Working Hours	Number of Resources
PA	\$22/hr	Monday - Friday, 0800 - 1800 (excl. one hour lunch at 12pm)	2
PB	\$55/hr	Monday - Friday, 0800 - 1800 (excl. one hour lunch at 12pm)	4
iLIP	-	Monday - Sunday, 0000 - 2400	100 (Current) 250 (Forecast)

APPENDIX F: DYNAMIC ANALYSIS OF TO-BE BUSINESS PROCESS

Path Analysis

Path	Description	Distributi on	Average cost (20 PR per day)	Time taken(in minutes) (20 PR per day)	Average cost (50 PR per day)	Time taken(in minutes) (50 PR per day)
1	Success: Stock is available, existing contracts can meet delivery date	81%	\$38.11	55	\$38.11	56
2	Rejected: Stock is not available	10%	\$2.58	8	\$2.58	7
3	Success: Stock is available, existing contracts does not meet delivery date, negotiation with existing suppliers succeed	5.4%	\$68.19	88	\$68.19	89
4	Rejected: Stock is available, existing contracts does not meet delivery date, negotiation with existing suppliers does not succeed	3.6%	\$70.69	91	\$70.69	92
Weighted Averages			\$37.35	53.378 mins	\$37.35	54.178 mins

Our path analysis for our To-Be business process revealed 4 different paths with 2 different end points from the Purchase Requisition to Purchase Order sub-process for Treats Food. We have estimated the weighted average duration and cost to be 53.378 mins and \$37.35 per Purchase Request (20 per day).

Rejection paths such as Path 2 and Path 4 have low rejection percentages of 10% and 3.6% respectively. For Path 2, it is mainly due to the outsourcing of warehousing process. The outsourcing system would have the necessary capabilities to handle the stock availability check in a fast and efficient manner, as compared to the WIS which was inaccurate and unreliable. For Path 4, there is a

low rejection rate mainly due to our iLIP system having a supplier catalogue which makes the searching of softcopy contracts easier and more likely to succeed, as opposed to As-Is where there is time and cost wastage due to the manual searching of hardcopy contracts.

Most Occurring Path

The most occurring path in our To-Be business process is Path 1 (81%), which is when there is available stock to fulfill the Purchase Request and existing contracts can meet the indicated delivery date. Path 1 is also our most ideal path and the large distribution (81%) indicates the value of our To-Be business process. As compared to Path 3 and Path 4 which both have a higher weighted average cost and time taken, Path 1 has a lower average higher cost and time taken of \$38.11 and 55 minutes respectively.

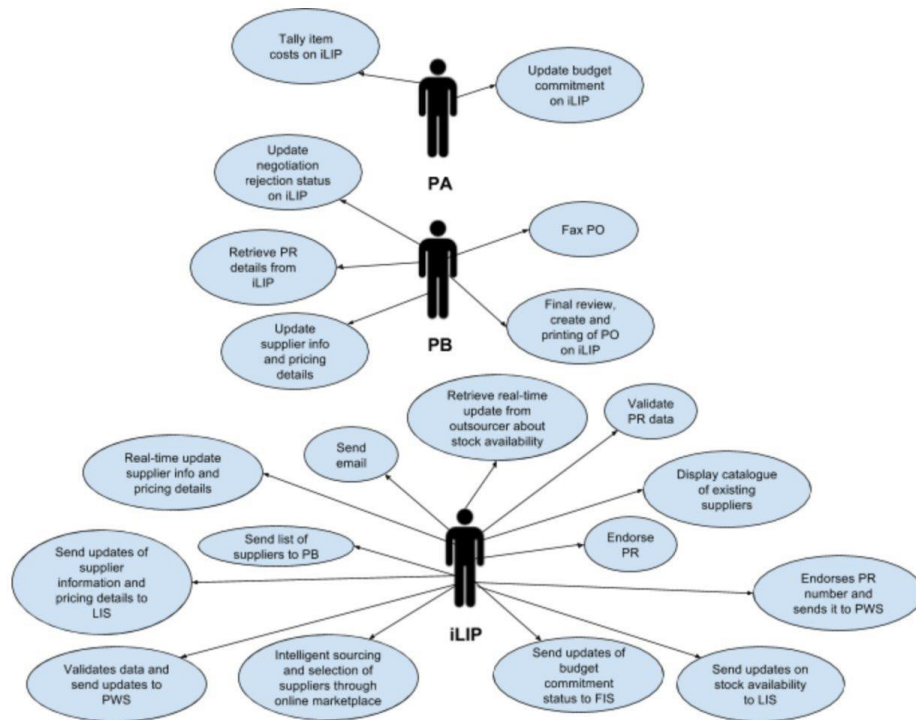
Bottleneck Analysis

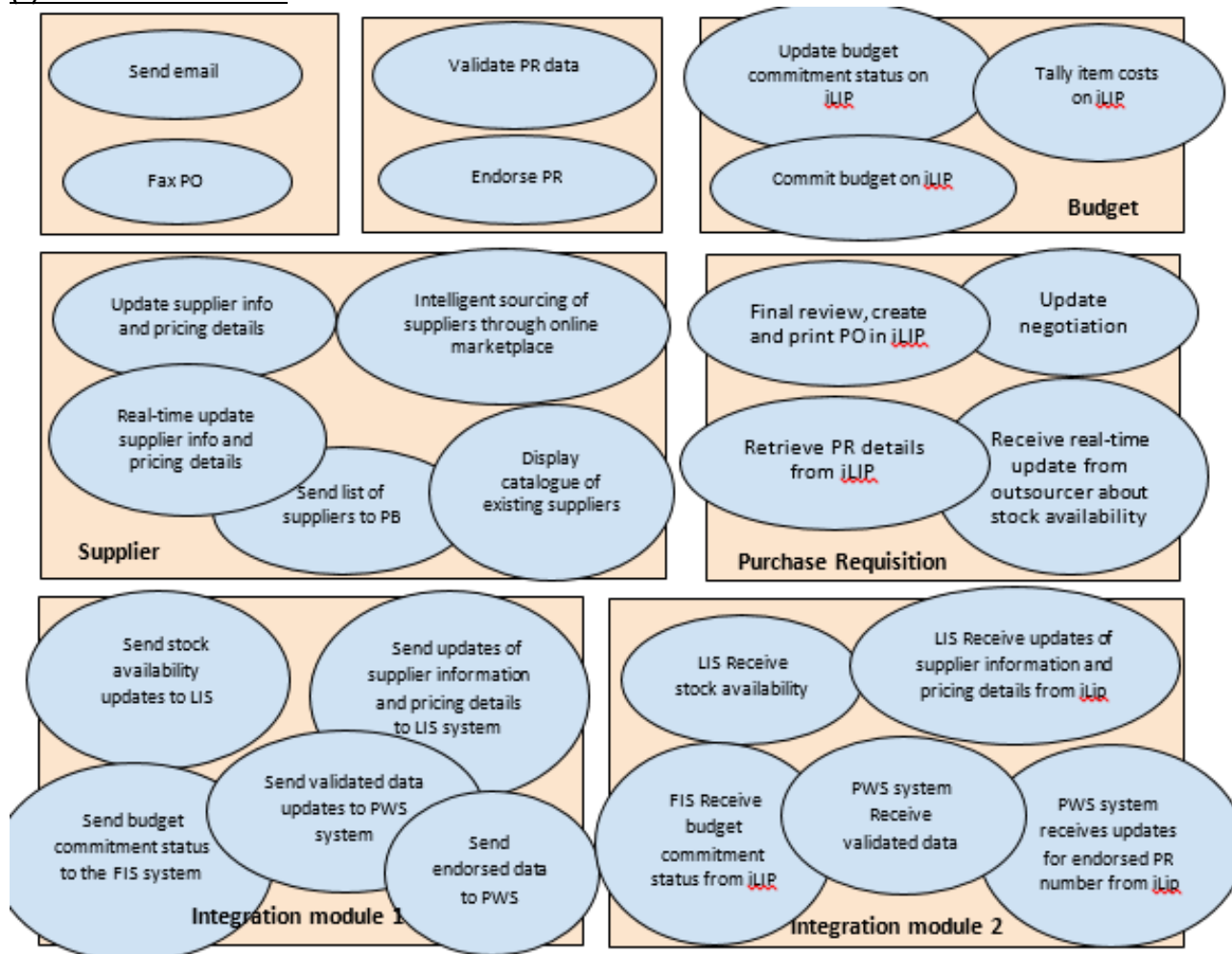
We identified no bottlenecks in our new To-Be business process. This indicates that all bottlenecks that were previously identified in our dynamic analysis for our As-Is process has been eliminated. As such, there is no time or cost wastage and all resources have been utilised efficiently.

Previously, some of the bottlenecks found through Dynamic Analysis of the As-Is business process (refer to **Appendix C**) were manual activities such as manual entry of PR data and also sourcing of suppliers online. Since our iLIP system automates these activities, the bottlenecks have been removed. In addition, previously only one FC was tallying and committing the budget in the As-Is business process. To cater to the high-level management “want” to allow the Procurement Department to have the ability to manage their expenditures, the To-Be business process allows the 2 Procurement Admin to have the ability to tally the item costs and also the commitment of budget. As such, the bottleneck previously present at FC has also been removed. Thus, as a result of the overall improved efficiency of the To-Be business process, most bottlenecks have been eliminated.

APPENDIX G: IT SOLUTIONS REQUIREMENTS DEFINITION FOR PROPOSED TO-BE BUSINESS PROCESS

(i) USE CASE



(II) USE CASE TO FUNCTION(III) NON-FUNCTIONAL REQUIREMENT

No.	Category	Non Functional Requirements
1	Capacity	iLIP must be able to process at least 250 PRs a week.
2	Security	iLIP must be accessible only by authorised personnel, namely the departments involved in the Procurement Process and the higher level management.
3	Reliability	iLIP shall be available 24/7 with at most 5% unplanned downtime.
4	Usability	iLIP must serve as a user-friendly platform to its users so that it will aid them better in their daily tasks.

5	Accuracy	iLIP should keep record of all up-to-date information about the PRs and suppliers. If there are discrepancies, iLIP should be able to highlight and show an alert about these discrepancies.
6	Efficiency	Information should be accessed easily by all departments, provided adequate security concerns are taken care of. This facilitates a smooth and efficient process flow.

APPENDIX H: ALIGN STATISTICAL MEASURES TO ANALYTICS FRAMEWORK

What happened?	What is happening now?	What will happen?
<ol style="list-style-type: none"> Ratio of successful negotiations to unsuccessful negotiations Average number of updates from outsourcer per day Stock Availability rate 	<ol style="list-style-type: none"> % of PRs endorsed Number of preferred suppliers Number of costs items tallied and budget committed Average final review, creation and printing of PO time 	<ol style="list-style-type: none"> Predicted staff demand Item tallying and budget committing turnaround
How and why did it happen?	What's the next best action?	What's the best/worst that can happen?
<ol style="list-style-type: none"> Average number of updates from outsourcer per day Number of costs items tallied and budget committed Average final review, creation and printing of PO time 	<ol style="list-style-type: none"> Number of suppliers provided by intelligent sourcing 	<ol style="list-style-type: none"> Average Intelligent sourcing turnaround

APPENDIX I: EMBED ANALYTIC QUESTIONS INTO TO-BE BUSINESS PROCESS

