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e-FREIGHT@SINGAPORE: A COST - BENEFIT ANALYSIS

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NUS National University of Singapore

Georgia Institute of Technology

CONTRIBUTING AUTHORS:

Dr. Robert de Souza
Dr. Mark Goh
Dr. Albert Tan Wee Kwan
Hafidza Bte Othman
Miti Garg

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EXECUTIVE SUMMARY

e-freight@Singapore is a Business Process Reengineering (BPR) initiative aimed at improving the efficiency and productivity of the air cargo and logistics community. It leverages on International Air Transport Association (IATA) *e-freight*, which attempts to make air freight shipments paper free.

The key concepts of *e-freight@Singapore* are *data@source* and *data reuse*. *data@source* is the process of capturing data from source documents and reusing the data (*data reuse*) to generate the subsequent air export documents. By adopting *e-freight@Singapore*, the stakeholders will realise reduced data entry errors as well as increased productivity.

Although aware of the benefits of *e-freight@Singapore*, the stakeholders need to understand the tangible benefits and costs associated with its adoption. Hence, a Cost - Benefit Analysis (CBA) toolkit was developed to enable the stakeholders to estimate the cost savings generated and productivity gained when moving from the current documentation process to *e-freight@Singapore*.

e-freight@Singapore can be achieved via two proposed or 'to-be' solutions. Each solution follows a different cost structure. An analysis was done to assist the stakeholders in deciding which option is a better solution for their company. In addition, an analysis of the cost savings and productivity gains generated through *e-freight@Singapore* adoption was done for each stakeholder. *e-freight@Singapore* will bring about benefits even when the number of documents generated is as low as 1,700 House Air Waybills (HAWBs) per month for freight forwarders. It is anticipated that these findings will encourage more companies, especially the Small and Medium Enterprises (SMEs), to adopt *e-freight@Singapore*.

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1. INTRODUCTION

Business Process Reengineering (BPR) involves the redesigning of a business process to obtain a significant and sustained improvement in quality, cost, service and productivity (Gunasekaran and Kobu, 2002). BPR has become a popular management tool to improve the existing performance in a particular organisation. It serves as a stepping stone to increase productivity and generate savings for a company. There are numerous examples of companies employing BPR to improve various performance indicators such as cost, efficiency and quality. On balance, it is worthwhile to note that not many BPR projects achieve their intended goals. However, when properly done, couple with effective and extensive use of information technology (IT), BPR can produce significant gains in performance (Ranganathan and Dhaliwal, 2001). Thus, IT serves as an enabler to BPR as it offers tremendous advantage to an organisation (Childe *et al.* 1994) with high labour cost.

e-freight@Singapore is a BPR initiative proposed with the objective of improving the efficiency and productivity of the air cargo and logistics community. Presently, up to 30 different paper documents accompany each air freight shipment. IATA aims to reduce the use of paper documents in the air freight supply chain by replacing these physical paper documents with electronic messages.

Through *e-freight@Singapore,* players in the supply chain are expected to reap savings and increase productivity. These can be quantified by studying the feasibility of *data@source* and *data reuse* as well as developing a CBA model to identify potential monetary and time savings. The CBA toolkit has been developed specifically for the players in the air freight community adopting *e-freight@Singapore.*

2. BACKGROUND

data@source and *data reuse* are the key concepts of *e-freight@Singapore*. *data@source* is the process of capturing determinant data from source documents. The captured data is then reused in subsequent documents along the supply chain without having to re-enter similar data. For example, if the Invoice is the source document, similar data from the Invoice can be reused to generate subsequent documents such as the Packing list, Master Air Waybill (MAWB) and Certificate of Origin (COO). Through *data@source* and *data reuse*,

takeholders can minimise data re-entry and data entry errors as well as avoid the duplication of work. This will in turn, streamline the cargo documentation process, leading to shorter industry cycle times and higher data accuracy.

The main objective of the study is to eventually increase the adoption of *e-freight@Singapore* process within the air cargo community. One way to achieve this is by enabling stakeholders to visualise the tangible benefits associated with the adoption of *e-freight@Singapore*.

The initial stage of the study was to map out the current or 'as-is' process of air cargo export. Gaps, challenges and opportunities of the current process were identified through discussion sessions with the stakeholders. Subsequently, the proposed or 'to-be' process was mapped. The main difference between the 'as-is' and 'to-be' processes is in the flow of documents from one stakeholder to the next. Physical documents are carried in consol pouches together with the cargo in the 'as-is' process. In the 'to-be' process, air export documents are transmitted via XML messages and it is independent of the cargo flow i.e. XML messages can be sent to downstream stakeholders even before the cargo is ready. To implement the 'to-be' process, two options for implementation (Host-to-Host Integration or Web Portal) were proposed. It is important to note that cargo flow in the 'as-is' and 'to-be' process does not vary. Cargo from shipper, in most instances, will be picked-up by the assigned freight forwarder, consolidated and palletised. The consolidated cargo will be sent to the Ground Handling Agent (GHA). Finally, the cargo will be loaded onto the carrier.

The last stage of the study is to develop a CBA toolkit which is used to compute the time and cost savings achieved when adopting *e-freight@Singapore*.

3. COST - BENEFIT ANALYSIS (CBA) TOOLKIT

Table 1 lists the qualitative costs and benefits of e-freight gathered from the group discussion sessions attended by the various stakeholders.

Table 1: Stakeholders perspective – Costs and Benefits of *e-freight* adoption (Qualitative)

	Shipper	Origin Freight Forwarder	GHA	Airlines
Costs	- Data Integration with freight forwarder and large shippers - Update of IT or web based system for small shipper - Lock in of IT system with contracted freight forwarder - IT training and e-freight awareness of manpower	- Host-to-Host Integration with large shippers - Update of IT or web based system for SME freight forwarder - Cost of IT systems, manpower training, Cargo Community Network (CCN) [i] subscription and messaging charges - Dual Processing during transition period - e-freight reduces paper documents during export process, but not during import process since not all countries have adopted e-freight	- IT Investment includes purchase of data mapper for Host-to-Host Integration, upgrade of existing system to receive and transmit XML messages	- Mandates may result in loss of business from freight forwarders who are not e-freight ready - Cost of revision of a few messages are borne by airlines
Benefits	- Less holding inventory since surety and speed of air cargo will improve - Transparency of information especially in cases of off-load - Status updates e.g. from the time the cargo is loaded on the carrier to the time when cargo reaches destination - Less paper retained	- IT lock-in with large shipper will provide freight forwarder with recurring business - Faster transmission of information regarding cargo off-load - Compliance with airlines and customs requirements - Lead time reduction will increase business volume and improve efficiency - Reduced space requirement for storage of paper document	- Prepare accurate Flight Manifest in lesser time which can be relayed electronically to destination GHA - Reduced effort since retyping of information from different MAWBs is not required	- Reduces the need to carry bulky paper documents approx. 5 kg. in weight per flight - Accurate and timely flight manifest information can be prepared through date reuse - Reduced space requirement for storage and processing of documents - Accurate information can be transmitted to customs authorities electronically

Focus group discussion sessions suggest that most companies are worried about the cost of implementing *e-freight@Singapore* even though they are aware of the potential savings that they can reap from it. The question is whether the potential savings are significant enough to outweigh the changes and costs needed to adopt *e-freight@Singapore*.

Hence, the CBA toolkit was designed with the objectives of demonstrating the time and cost savings associated with the change in document processing when moving from the current air export process to *e-freight@Singapore*.

3.1 CBA COST COMPONENTS

The cost components that are included in the CBA toolkit are costs that are related solely to document processing. Some cost components are found in both the *'as-is'* and *'to-be'* processes such as manpower and penalty cost, while other cost components are exclusive to either the *'as-is'* or the *'to-be'* process only. Table 2 lists the cost components computed in the CBA toolkit.

Table 2: Cost components in CBA toolkit

Cost	Description	'*as-is*' Process	'*to-be*' Process
Manpower	Cost incurred to process air cargo export documents	✓	✓
Printing	Cost of printing documents that need to be carried together with the cargo	✓	
Data entry error	Additional cost incurred to correct the errors made in the submission of documents	✓	✓
Storage	Documents needed to be kept for 5 years (Internal Revenue Authority of Singapore (IRAS) requirement)	✓	
Penalties due to wrong declaration	Charges imposed by other stakeholders due to wrong declaration when submitting documents to other parties/ stakeholders	✓	✓
Disposal	Cost to dispose of documents after the 5 year period is over	✓	
Message transmission	Cost of sending documents electronically to other stakeholders		✓
e-archival	Cost when physical storage of documents is replaced with electronic storage		✓
Implementation	System, software and hardware upgrade, maintenance and training cost		✓

The cost components found in Table 2 are based on feedback from the air cargo industry. It is important to note that this is not an exhaustive list of cost drivers as each business will have its own document processing model, but it does provide a comprehensive guideline.

3.2 CBA ASSUMPTIONS

The following assumptions were made when designing the CBA toolkit:

a) The CBA toolkit does not assume the removal of all documents in the *e-freight@Singapore* supply chain but only key documents for trade, regulations and related business.

In the subsequent analysis, nine documents were considered. These are:

- Invoice
- Packing list
- COO

} Shipper

- HAWB
- MAWB
- Consol manifest
- Export control form

} Freight Forwarder

- Flight manifest

} GHA

- Shipment booking form

} Airlines

b) All penalties are incurred by the first party only. The toolkit will not consider passing the penalties to the other stakeholders involved.

For example, if a GHA imposes a fine on a freight forwarder for wrong weight declaration, then the cost will be entered in the freight forwarder's CBA sheet. If the freight forwarder were to pass on the cost to the shipper, the penalty will not be entered in the shipper's CBA sheet.

c) Documents received from another party for filing will not be considered for costing.

   Documents sent to upstream stakeholders will not be considered. For example, if a freight forwarder sends copies of HAWB, MAWB etc. to the shipper, these will not be considered in the CBA.

d) Freight cost, trade and regulatory documentation fees such as export permit, Dangerous Goods (DG) licence, phytosanitary licence etc. will not be used for computing total cost.

   Similarly, freight charges and costs incurred due to regulatory requirements will remain the same with or without *e-freight* adoption. Hence, considering these costs will not contribute to any difference.

e) The *'to-be'* model is based on 100% *e-freight* processes.

   All shipping documents are generated by using *data@source* and *data reuse*. In addition, all documents are transmitted to downstream stakeholders via XML messages.

f) If implementation costs for *e-freight* are not known, the costs in Appendix A can be used to provide an estimate. The mapping costs are incurred by both parties. For example, if a freight forwarder wants to extract common data fields in the Invoice and use the extracted fields to generate the HAWB, then a mapping between the Invoice and HAWB needs to be done. This is considered as one map. A map between Invoice and HAWB means that both the shipper and the freight forwarder would each need to pay S$ 4,500 for the map.

g) The number of hours for overtime work should not exceed 104 hours per month for each employee.[ii]

4. IMPLEMENTATION COSTS

As mentioned, BPR coupled with the extensive use of IT can help increase productivity and generate savings for a company. This paper presents 2 possible options that can be implemented in the *'to-be'* process. Each option follows a different cost structure and besides weighing the advantages and

disadvantages of the 2 options, companies are mostly interested in the implementation costs involved in each option.

As shown in Appendix A, the first option of Host-to-Host Integration is dependent on the number of mappings required by a particular stakeholder.

On the other hand, in the Web Portal option, the cost is dependent on the number of users who subscribe to access the *e-freight@Singapore* Web Portal at any one time. Companies need to determine the number of 'user access' they require and it is a common practice to apply for access for at least 50% of the total number of employees working in the document processing department.

The difference in cost structure implies that companies need to decide which implementation option suits them better in terms of cost. Table 3 and Figure 1 show the comparison of the Host-to-Host Integration and the Web Portal options for the freight forwarders. Figure 1 shows that, in terms of cost, the Web Portal option is more appropriate for companies who need less than 10 'users access' to the *e-freight@Singapore* Web Portal. A higher number of users imply that higher number of documents needs to be processed. 10 'users access' would mean that approximately 15,000 HAWBs are processed per month. If more than 10 'users access' are needed, Host-to-Host Integration solution will be more cost effective for a company. The same pattern is observed for other stakeholders.

The implementation costs for both solutions are shown in Appendix A. A one-time implementation cost is assumed to be amortised over a period of 3 years in the subsequent analysis.

Table 3: Implementation cost for freight forwarders

	Implementation Cost				
No. of users[1] (per month)	**Host-to-Host Integration (No. of maps = 7)**	**Web Portal**	**Difference (S$ per month)**	**Difference (S$ per year)**	**Difference (%)**
2	3,486	984	2,502	30,024	71.77
4	3,486	1,624	1,862	22,344	53.41
5	3,486	1,944	1,542	18,504	44.23
6	3,486	2,264	1,222	14,664	35.05
10	3,486	3,544	(58)	(696)	(1.66)
15	3,486	3,719	(233)	(2,796)	(6.68)
20	3,486	4,844	(1,358)	(16,296)	(38.96)

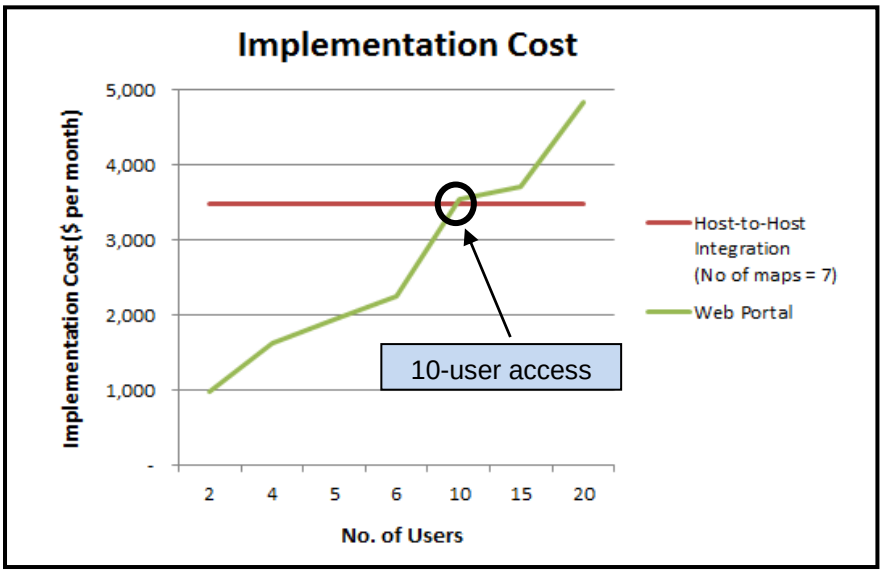

Figure 1: Host-to-Host Integration and Web Portal cost comparison

[1] No. of Users refers to the number of access a particular freight forwarder has to the Web Portal

5. E-FREIGHT SAVINGS

The concept of *data@source* and *data reuse* will very likely generate time and cost savings for a company. However to embark on *e-freight*, implementation costs would need to be incurred. Hence an analysis was done to determine at which point the *e-freight@Singapore* savings will outweigh the implementation cost.

The analysis for the freight forwarders was done by varying the number of HAWBs processed and by observing the savings generated as the number of HAWBs is increased. As shown in Table 4 and Figure 2, a freight forwarder will start to accrue savings at approximately 1,700 HAWBs per month or 55 HAWBs per day. As the number of HAWBs increases, the savings will increase and eventually settle at about 31%.

Table 4: Savings generated through *e-freight@Singapore* adoption for freight forwarder

No. of HAWBs (per month)	Current process cost (S$ per month)	New process cost (S$ per month)	Net savings (S$ per month)	Net savings (S$ per year)	Savings (%)
1,000	3,837	4,464	(627)	(7,524)	(16.34)
1,500	5,938	6,501	(563)	(6,756)	(9.48)
1,800	7,389	6,556	833	9,996	11.27
2,000	8,354	6,593	1,761	21,132	21.08
5,000	21,443	15,226	6,217	74,604	28.99
10,000	44,035	30,297	13,738	164,856	31.20
12,000	50,847	34,992	15,855	190,260	31.18
15,000	66,373	45,758	20,615	247,380	31.06

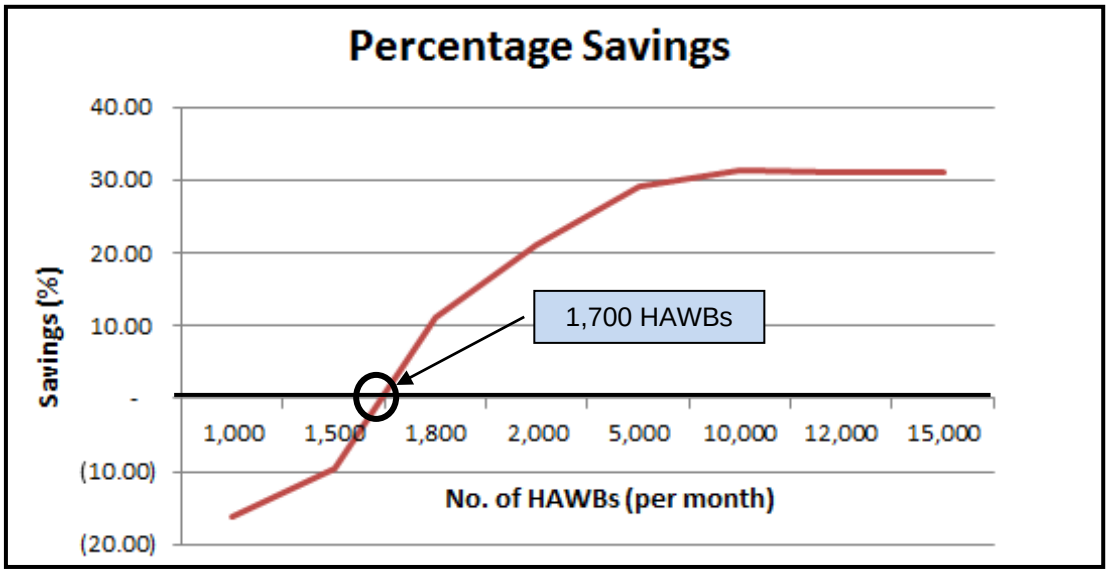

Figure 2: Break-even for *e-freight* adoption for freight forwarders

The same analysis was done for the other stakeholders as shown in Appendix B.

It is observed that the shippers and the freight forwarders reap a higher percentage of savings (approximately 30%) when compared to the GHAs and Airlines (approximately 20%). This is due to the larger number of data segment duplication between the documents generated by the shippers and the freight forwarders. In addition, the shippers and the freight forwarders are the stakeholders that generate most of the air cargo export documents while the GHAs and the airlines only generate the flight manifests and shipment booking

forms respectively. Hence the shippers and the freight forwarders will benefit most when adopting *e-freight@Singapore*.

6. SAVINGS PER E-FREIGHT SHIPMENT

An analysis was done to estimate the savings per *e-freight@Singapore* shipment. The following assumptions were applied to the analysis:

a) Only manpower and implementation costs are considered in the analysis.

b) A normal-hours manpower cost rate is used in computing manpower cost.

c) The invoice is considered as the source document hence, the time taken to generate an invoice in the 'as-is' and 'to-be' process is the same.

d) The number of documents assumed per *e-freight@Singapore* shipment is found in Table 9.

Tables 5 and 6 show the implementation cost and savings generated per document via a Web Portal approach.

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Table 5: Implementation cost per document (Web Portal)

Stakeholder	Document	No. generated (documents per month)	Total implementation cost (S$ per month)	Implementation cost per document (S$ per document)
Shipper	Invoice	5,000	1,624	0.16
	Packing list	5,000		
Freight forwarder	HAWB	5,000	1,624	0.20
	MAWB	1,000		
	Consol manifest	1,000		
	Export control form	1,000		

Table 6: Savings per document (Web Portal)

Document	'*as-is*' processing time (min. per document)	'*to-be*' processing time (min. per document)	Processing time savings (min. per document)	Processing cost savings (S$ per document)	Implementation cost (S$ per document)	Final savings (S$ per document)
Invoice	22	22	-	-	0.16	(0.16)
Packing list	15	5	10	1.33	0.16	1.17
HAWB	17	10	7	0.93	0.20	0.73
MAWB	18	7	11	1.47	0.20	1.27
Consol manifest	6	3	3	0.40	0.20	0.20
Export control form	6	3	3	0.40	0.20	0.20

The same analysis was done with the Host-to-Host Integration implementation option as shown in Table 7 and 8.

Table 7: Implementation cost per document (Host-to-Host Integration)

Stakeholder	Document	No. generated (documents per month)	Total implementation cost (S$ per month)	Implementation cost per document (S$ per document)
Shipper	Invoice	15,000	3,186	0.11
	Packing list	15,000		
Freight forwarder	HAWB	15,000	3,486	0.12
	MAWB	5,000		
	Consol manifest	5,000		
	Export control form	5,000		

Table 8: Savings per document (Host-to-Host Integration)

Document	'*as-is*' processing time (min. per document)	'*to-be*' processing time (min. per document)	Processing time savings (min. per document)	Processing cost savings (S$ per document)	Implementation cost (S$ per document)	Final savings (S$ per document)
Invoice	22	22	-	-	0.11	(0.11)
Packing list	15	5	10	1.33	0.11	1.22
HAWB	17	10	7	0.93	0.12	0.81
MAWB	18	7	11	1.47	0.12	1.35
Consol manifest	6	3	3	0.40	0.12	0.28
Export control form	6	3	3	0.40	0.12	0.28

Based on the assumed number of documents comprising an *e-freight@Singapore* shipment as shown in Table 9, the total savings per shipment are calculated for both implementation methods.

Table 9: Savings per *e-freight@Singapore* shipment

Document	No. per shipment	Savings (S$)	
		Web Portal	Host-to-Host Integration
Invoice	5	(0.80)	(0.55)
Packing list	5	5.87	6.12
HAWB	5	3.67	4.07
MAWB	1	1.27	1.35
Consol manifest	1	0.20	0.28
Export control form	1	0.20	0.28
Total savings per *e-freight* shipment:		**10.40**	**11.54**

7. CONCLUSION

data@source and *data reuse* are the key concepts behind *e-freight@Singapore*. These concepts are realised due to the vast amount of data duplication across the air export documentation process. A CBA toolkit was developed to compute time and cost savings associated with the change in document processing when moving from the current air export process to *e-freight@Singapore*. Only the costs associated with document processing are included in the CBA. Nine documents were analysed and it was seen that *e-freight* adoption benefits the stakeholders even if the number of documents generated is not significantly high.

APPENDIX A: E-FREIGHT IMPLEMENTATION COST

Two *e-freight* implementation options were presented to stakeholders. The Host-to-Host Integration option involves the use of a Data Mapper that enables conversion of data from one format to another e.g. EDI format to XML format. The Web Portal option employs third party IT vendors supplying hardware infrastructure and software products. Interaction with users is through a front-end portal via Internet. The estimated cost shown below is based on a quote provided by a third party IT vendor.

Implementation Option A: Host-to-Host Integration mapping cost

No. of maps required	Cost (S$ per map)	Total mapping cost
1	4,500	4,500
2	4,300	8,600
3	4,100	12,300
4	3,900	15,600
5	3,700	18,500
6	3,500	21,000
7	3,300	23,100
8	3,100	24,800
9	2,900	26,100
10	2,700	27,000

Implementation Option A: Host-to-Host Integration maintenance cost

No. of users	Maintenance cost (S$ per year)
1 to 4	1,758
5 to 9	8,338
10 and above	14,940

Implementation Option B: Web Portal

No. of users	Cost (S$ per user per month)
Up to 10	**320**
11 to 50	**225**
More than 51	**160**

APPENDIX B: STAKEHOLDER SAVINGS THROUGH E-FREIGHT ADOPTION

Table B1: Savings generated through *e-freight* adoption for shippers

No. of invoices (per month)	Current process cost (S$ per month)	New process cost (S$ per month)	Net savings (S$ per month)	Net savings (S$ per year)	Savings (%)
1,000	6,270	6,116	154	1,848	2.46
2,000	14,373	11,467	2,906	34,872	20.22
5,000	36,005	27,490	8,515	102,180	23.65
10,000	71,569	50,121	21,448	257,376	29.97
12,000	86,121	58,412	27,709	332,508	32.17
15,000	107,753	72,822	34,931	419,172	32.42

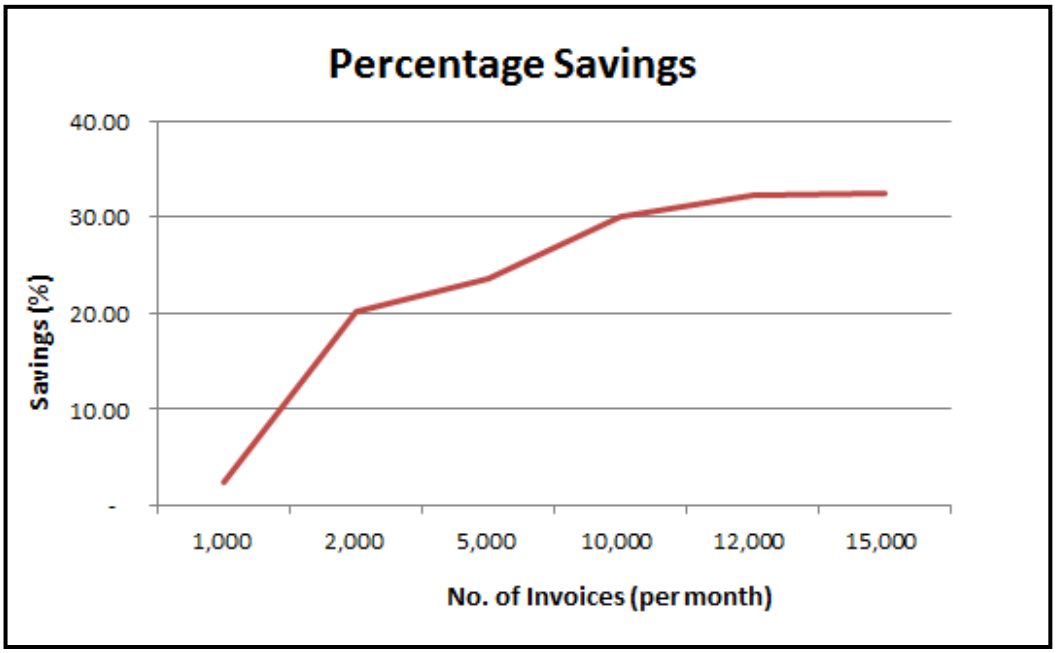

Figure B1: Break-even for *e-freight* adoption for shippers

Table B2: Savings generated through *e-freight* adoption for GHAs

No. of flight manifests (per month)	Current process cost (S$ per month)	New process cost (S$ per month)	Net savings (S$ per month)	Net savings (S$ per year)	Savings (%)
1,000	3,632	4,490	(858)	(10,296)	(23.62)
1,200	4,176	4,513	(337)	(4,044)	(8.07)
1,500	5,465	4,728	737	8,844	13.49
2,000	7,308	6,550	758	9,096	10.37
5,000	19,821	15,491	4,330	51,960	21.85
10,000	39,816	30,618	9,198	110,376	23.10
15000	59,812	46,347	13,465	161,580	22.51

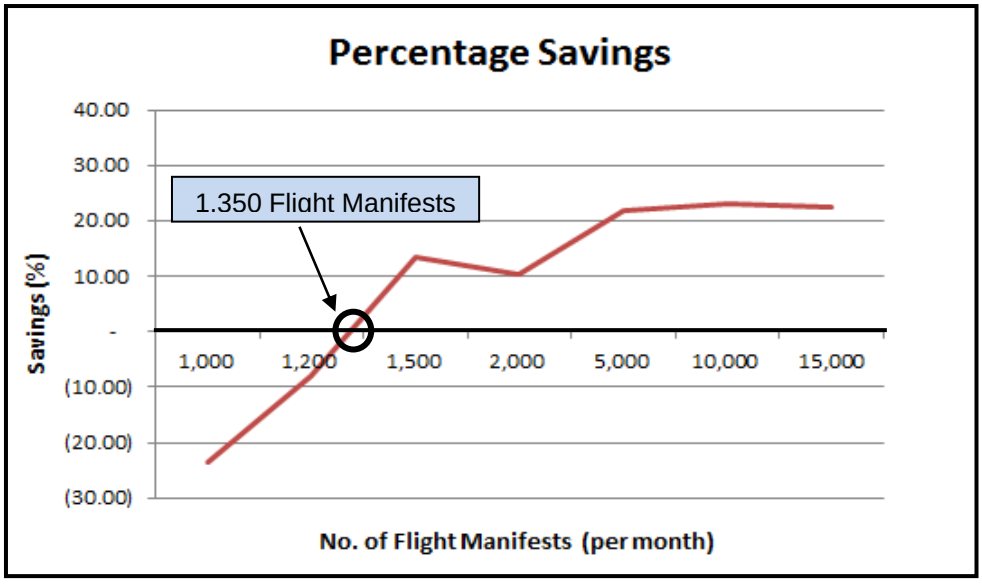

Figure B2: Break-even for *e-freight* adoption for GHAs

Table B3: Savings generated through *e-freight* adoption for Airlines

No. of shipment bookings (per month)	Current process cost (S$ per month)	New process cost (S$ per month)	Net savings (S$ per month)	Net savings (S$ per year)	Savings (%)
1,000	1,869	2,475	(606)	(7,272)	(32.42)
2,000	3,613	4,510	(897)	(10,764)	(24.83)
3,000	5,436	4,720	716	8,592	13.17
5,000	9,408	7,415	1,993	23,916	21.18
10,000	19,715	14,971	4,744	56,928	24.06
15,000	29,297	22,342	6,955	83,460	23.74

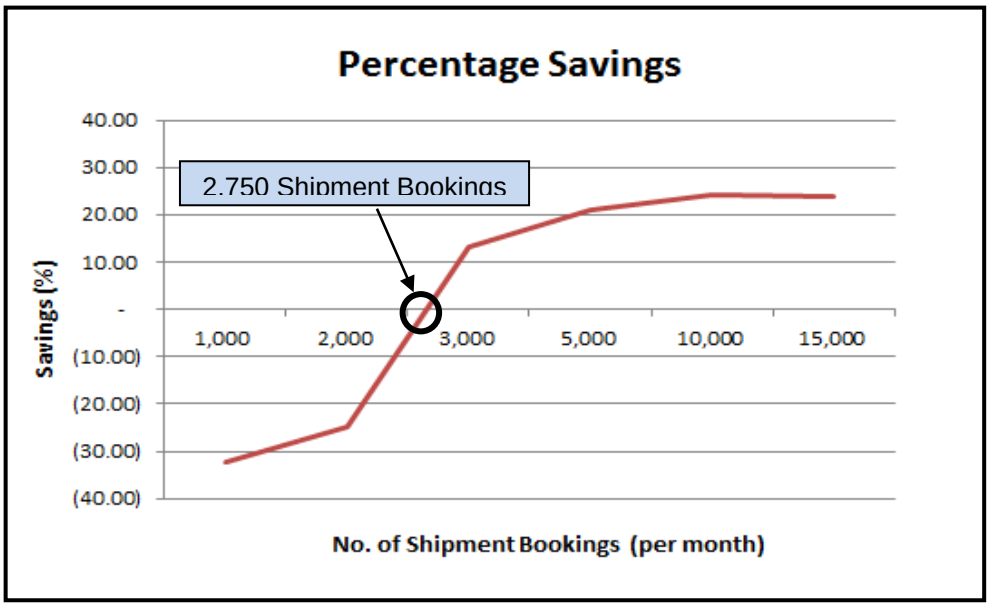

Figure B3: Break-even for *e-freight* adoption for Airlines

[i] Cargo Community Network (CCN) is a provider of e-service solutions together with network connectivity. (Available at http://www.ccn.com.sg/ accessed on 20/10/2011).

[ii] Ministry of Manpower Website (Hours of work, overtime and rest days (2011), available at: http://www.mom.gov.sg/employment-practices/employment-rights-conditions/hours-of-work-and-overtime/Pages/default.aspx, accessed on 20/10/2011) states that the maximum overtime hours are 72 hours per month excluding weekends/rest days. Hence, it is assumed that 5 working days per week and 8 hours on Saturday are available for overtime. Hence for calculation purposes, 72 hours + (8 hours x 4 Saturdays per month) = 104 overtime hours are allowed per month.

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Singapore 119613

Tel: (65) 6516 4842 • Fax: (65) 6775 3391
E-mail: tlihead@nus.edu.sg • Website: www.tliap.nus.edu.sg