Communication system
at SBAB

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Communication system at BSAB

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Abstract

This report for the bachelor’s degree is designed to present the work and results carried out on Bottenvikens Stuveri AB, BSAB, in Piteå. The work was conducted in spring 2012 in collaboration with Anton Klava. BSAB is already aware of their long delays for incoming trucks and asked us to make it more effective.

Delays refers to the time from a truck announces arrival at the port until the truck is assigned a offload location. This time should not normally exceed 5 minutes, but sometimes have attained 60 minutes. The reason for the long delays may be due to the current system used for notification between a truck and the forklift driver. For the forklift driver to gain knowledge of arrived trucks it requires that the driver monitors the computer inside the forklift. If the driver is not present to monitor the computer, delays can be very long.

A solution to this problem was carried out by implementing a SMS service where the forklift driver receives a SMS for each truck arrived. The driver is then freed from monitoring the computer inside the forklift. The implementation also allowed the forklift driver to reply an SMS containing the offload location.

In an attempt to reduce waiting times further, there was a possibility for trucks to pre-register their arrival. This test is mainly for evaluation purposes to see if it’s worth continuing with pre-registration.

SMS service became very popular in Piteå and is constantly used by the forklift drivers. According to them self the SMS service is more reliable than the computer system. Because of the very few trucks that pre-registered its arrival, it is difficult to show results on it. However, the truck drivers admit it might be pleasant to know when a truck arrives, but that it is not worth the extra work required.

The result should be seen as successful and BSAB is pleased with the work.
Sammanfattning

Denna rapport för kandidatexamen har till syfte att presentera arbete och resultat genomfört på Bottenvikens Stuveri AB, BSAB, i Piteå. Arbetet genomfördes Våren 2012 i sammarbete med Anton Klava. BSAB är sedan tidigare medvetna om deras långa väntetider för ankommande lastbilar och bad oss effektivisera detta.

Med väntetider menas den tid från det en lastbil anmäler ankomst i hamnen till dess att lastbilen blir tilldelad en avlossningsplats. Denna tid borde i normala fall inte överstiga 5 minuter men har ibland uppnått 60 minuter. Anledningen till de långa väntetiderna kan antas bero på det dåvarande system som används för notifikation mellan lastbil och truckförare. För att truckföraren ska få kunskap om ankommen lastbil krävs det att föraren överblickar den dator som finns i trucken. Om föraren inte befinner sig i trucken och inte kan övervaka datorn kan ankommen lastbil få vänta länge.

En lösning till problemet genomfördes genom att implementera en SMS-tjänst där truckföraren får ett sms för varje ankommen lastbil. Föraren är då befriad från att övervaka datorn i trucken. Det implementerades även möjlighet att svara med SMS vilken lossplats lastbilen ska till.

För att försöka minska väntetiderna ytterligare genomfördes en möjlighet för lastbilar att föranmäla sin ankomst. Detta försök är huvudsakligen i utvärderingssyfte för att se om det är värt att fortsätta med föranmälningar.

SMS-tjänsten blev väldigt uppskattad i piteå och används av truckförarna. Enligt de själva är SMS-tjänsten mer pålitligt än datorsystemet. På grund av väldigt få lastbilar som föranmälde sin ankomst är det svårt att visa resultat på det. Däremot anser truckförarna att det kan vara behagligt att veta när en lastbil ankommer men att det inte är värt det extra jobb som krävs.

Resultatet får ses som lyckat och BSAB är väldigt nöjda med arbetet.
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1 Introduction

Time is money is an old cliché and is widely common these days. The saying can almost be implied everywhere and there is no exceptions for ports.

An interview with Patrick Verhoeven, Secretary General of the European Seaports Organisation (ESPO), [5] reveals that there are more than 1200 commercial ports along the European coast and they represent a total of 90% of the international trade in Europe.

If the time for loading and unloading ships would decrease it would mean shorter time at port and more goods throughput. Since the ports stands for such a big percentage, the amount of shipped goods would increase greatly with reduced loading times. Therefore it is important for every port to always strive for effectiveness in their loading routines.

1.1 Background

Bottenvikens Stuveri AB, BSAB, [1] is a Swedish company located at Piteå in northern Sweden. Their main activity is shipping and storing sawed timber with focus on export. BSAB currently hold four ports which are Piteå, Luleå, Kalix, and Skellefteå where Piteå is the largest. Each year all 130 employees contribute to the total sale for about 200 millions SEK and handle 5 millions tons of goods.

When a sawmill wants to sell or export their sawed timber they contact BSAB and tell them which customer they are selling to and how much. It could be a customer in Poland, Egypt or any other country. BSAB will then have a ship scheduled to their port when they have enough goods booked to fill the ship. After the ship is scheduled the sawmills can start sending goods by truck. BSAB has no idea if the goods will arrive today, tomorrow or the day the boat arrives. They just know how much, the destination and from who they will get it.

When a truck arrives at the port, the driver announce the arrival with its contents to a forklift driver. The forklift driver then signals the truck where to unload all the goods, unloads it and waits for the next truck.

The current system of that time used for communicating between the forklift driver and truck driver has some flaws and could need a make over.
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Bachelor at BSAB

Figure 1: The old truck arrival system

Figure 2: The arrival screen
1.1.1 Current system

The structure of the system can be seen in Figure 1. It starts with a truck arriving at “Gate terminal” and entering its content on the screen seen in Figure 2. The driver first enters “Registreringsnr” which is the license plate, then he selects “Anlösnummer” for which boat the load should go on and finally selects the customer or destination in “Godsmarkering”.

Then all the information is sent to the forklift drivers computer. The forklift driver will then decide what storage location the goods will go in and mark it on the computer. A few seconds later a script will write the location on a big screen for the truck driver to see it.

A major problem with this system is that the forklift driver does not get any notification when a new truck has arrived. All he gets is a new row in a list of active trucks. If the driver does not pay full attention to the screen he has no idea if anyone is waiting.

1.1.2 New system

The new system is based on the old system. Almost everything from the old system is intact with only a few extra lines of codes. The big difference is the new websites written in ruby on rails [4] and the SMS-service provided by Cellsynt [3].

The new websites are:

- Registration of phone numbers that can receive SMS
- Web form for preregistering a upcoming truck
- List of all the preregistered trucks

When a truck arrives at the gate and announce its arrival, an SMS is automatically sent out to all active registered numbers. The forklift driver receives the SMS on the truck phone. This means the driver is not bound to constantly look at the screen for new trucks. It also includes the possibility to answer with the unload location as an SMS.
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1.1.3 Similar systems

Södertälje Hamn differs a lot from BSAB in Piteå. Södertälje is only handling containers that each has a unique number, its specific size and its storage location. The competition in the Stockholm region is much higher so they have to strive for better results.

The gates at Södertälje is equipped with several cameras detecting the license plate, how many containers and the unique number of each container. If the truck is pre-registered, about 70% are, the truck can go through the automatic gates and the driver selects the containers supposed to be loaded. A forklift driver loads the containers and the truck is done and leaves.

Södertälje is the first in Sweden to use the system and is absolutely leading in technology. The system cost several millions and required new roads and major reconstructions to be made.

1.2 Limitation

Even though implementation of the new system was successfully, we are aware of some limitations. The amount of data collected prior to the new system is a bit more then 3 years comparing to only 2 weeks after implementation. The load of trucks vary a lot over the year so the comparison will not give the whole picture and can be misleading in results.

During the 2 weeks after implementation, each forklift driver will only have a short amount of time and might not get comfortable enough to use it fully. Perhaps it will be other results later when the forklift drivers are more comfortable with it.

The pre-boking system is only used by one sawmill and not even for all the trucks from that sawmill. The conclusion and results for this is mostly based on interviews with the drivers and not so much of solid data.
2 Problem

The main issues are long delays for trucks and the forklift driver having a hard time noticing new trucks. The trucks should not need to wait more than a few minutes for an offload location if there are no other trucks in the queue. From previous years, delays could be well over one hour.

Based on data collected from 2009, 2010 and 2011 a chart has been made, Figure 3. Most of the trucks do not have to wait more than 5 minutes. A few have to wait 10-15 minutes but the major problem is that often trucks will have to wait more than 15 minutes.

![Figure 3: Distribution of trucks in percentage](image)

Apart from the main issues, the thesis is based around seven questions. The seven questions are recurring throughout the thesis.
2.1 Who pays for delays? What does it cost?

A truck, filled with cargo and a driver, that is standing still can be quite expensive. Who suffers for it and who pays for the cost? What if BSAB has allotted to save on decreasing delays. Maybe it is haulage contractors that is the real victim and would appreciate shorter delays.

2.2 What major recurring reasons exists for delays?

What if the delays are mainly caused by some recurring events or reasons? Spot and maybe eliminate those could greatly decrease the delays. It could be things like poorly scheduling of personnel at critical times or forklift drivers doing too much or too little and not noticing new trucks.

2.3 Does Södertälje Hamn have shorter delays then BSAB, why?

How are they working at other harbors? Are they doing it any better? If they have a better system at Södertälje, can the same system be applied at BSAB too? Maybe just some vital parts can be transferred. A visit to Södertälje Hamn could really give good insight in the problem.

2.4 What happens if trucks pre-register?

There is always good to have a schedule. But at BSAB with the current system it can be a bit rough since they do not know when trucks will arrive. Hopefully they will be able to schedule more and reduce delays if trucks will pre-register with their arrival time.

2.5 How does weather/season affect the delays?

There is no such thing as bad weather. Just bad clothes. A common saying, but is it true even in this context? How much does the weather effect delays and are there any parts of the year with more delays? Hopefully some measurements could give a positive effect.
2.6 Notifications to the forklift driver

One planned solution is to give notifications directly to the forklift driver instead of the forklift. This would be solved sending a SMS for each arrived truck. Is it a good solution and what are the benefits?

2.6.1 Can the forklift driver do anything else?

If the forklift driver receives a notification to the cellphone, it would ease the need of constant watch on the truck computer. The forklift driver could then leave the truck and return when notified. Is it possible for the forklift driver to have other tasks between trucks?

2.6.2 How are delays affected?

Even if the forklift driver is notified for each new truck, it could result in longer delays when the driver is further away from the forklift. Hopefully it will result in longer delays being eliminated and keeping the majority to a few minutes. Will it be a good implementation or not?
3 Purpose

There are mainly two purposes for this thesis. The first is to reduce the delays. Delays when a truck arrives at the harbor until he is assigned a offload location can sometimes be more then 30 minutes. This is not something that neither the haulage contractors or BSAB benefit from. This is well known, but there is little done in the past years. BSAB wants to reduce it as much as possible.

The second purpose is to relieve the forklift driver from the need of constant looking at the truck computer. If that is accomplished, the driver might then be able to do some other tasks. The purpose is not to give the forklift driver some other tasks but rather to determine how much time the forklift driver can spare.
4  Method

How did we do to answer our questions and what methods did we use to evaluate the problems.

4.1 Determine who pays for delays and its costs

Determining who pays for delays could be trivial. Nina Lidberg at BSAB will be one of the subject for interviewing and a haulage contractor will be the other. Nina gave a redirection to Arne Lindgren at Kiruna Bilfrakt [2] which is one of the haulage contractors.

The cost for a truck standing still might be different for each haulage contractor. Therefore an estimated mean will be used to define the cost for delays. Determining the delays are based on the database containing arrival time and the time an offload location is assigned for each truck. From the database a mean value is calculated and then multiplied by the cost to get an estimated price tag on the delays.

4.2 Find recurring reasons for delays

Reason for a delay could be many things. During the visit in Piteå, interviews with the forklift drivers took place to figure out if anything in their habits contributes to delays recurring.

A search for patterns in the database will also be performed. Patterns pointing to lack of personnel at consistent times etc.

4.3 Visit at Södertälje Hamn

A meeting with CEO Erik Froste at Södertälje Hamn is scheduled. The visit includes interviews with Erik and their IT-technician Tomas Zackrisson and also a tour around the harbor. Based on the visit, the differences between Södertälje Hamn and BSAB will be determined. It is also used for inspiration and foundation to what system implementation will be used at BSAB.
4.4 Pre-registering trucks

After the visit at Södertälje, a pre-booking system seems really efficient. The system they use is too expensive and can’t be used, but what parts can. After consideration and discussion the system would allow the haulage contractors to register trucks with a web page and the truck driver can announce the arrival with either SMS or inside the registration booth.

To be able to get some results we asked one of the sawmills, Setragroup [9], to pre-register as many trucks as possible. Gunilla Westin at Setragroup agreed to the work for the upcoming two weeks.

Interviews with forklift drivers, Gunilla and other people involved will mainly determine if pre-registering is something good. The database will also be used to see if the delays are affected in some way.

4.5 Analyze weather and seasons for delays

From the database it is possible to plot a diagram showing the summarized and mean delays for each week. The diagram will then be compared to seasons and its corresponding weather.

The interview with the forklift driver will also emphasize their opinion on weather and its impact on delays. However, the results from the driver could be more of a subjective view and differ from the database result.

4.6 SMS notifications

To reduce the delays, an SMS-service were implemented. This allows the forklift driver to be announced of new trucks. These two subsections will evaluate the SMS-service considering the delay time but also if it eases the forklift driver at low work intensity. Further reading on the SMS implementation can be found in chapter 5.

4.6.1 Determine if the forklift driver can do anything else

For the forklift driver to be able to do anything else, sufficient time between trucks are required. What sufficient means is hard to determine and depends on the task to be performed. One way to determine time between trucks is to take the number of trucks each day and multiply by the time it takes to handle a truck. Then compare it to the total work time each day.
4.6.2 Effect on delays

The effect of the SMS service will hopefully be positive on the delays. Though it is possible that the average will increase and the maximum decreases. This is due to the forklift driver not being present in the forklift all the time. To determine the effect, two chart showing the delay times will be created. One for the old system and one for the new SMS-service.
5 SMS-notification service

The old system is based on classic ASP [6] backed up by an SQL-2000 [7] database. An employee at BSAB implemented it in 2008 and has been left almost untouched since. Figure 1 is an overview of the old system.

When implementing the new system, the goal was to leave the old system almost as intact as possible. This was achieved by each time something needs to be done, a HTTP request was sent to the new ruby on rails system. If BSAB would like to remove the new features they just have to delete a few lines of code from the classic ASP files.

![Diagram: The new truck arrival system](image)

The things that differ from the old system is the box with Ruby on Rails and its WAN connections. Ruby on Rails [4] is a framework build on Ruby and designed for web construction. Instead of using the old SQL-2000 database, a new MySQL [8] database is used.
As mentioned earlier in the Introduction, the SMS service is provided by Cellsynt [3] and sending an SMS is done through their HTTP API. Sending an SMS could look like following.

http://se-1.cellsynt.net/sms.php?
username=SomeUsername&
password=SomePassword&
destination=SomeDestination&
originator=SomeOriginator&
text=TheTextMessageToSend

Each time an SMS is sent, it is done through the new Ruby on Rails web pages. The forklift driver will get an SMS like following each time a truck arrives.

ABC123, 27051, AB1203C
ID: 12032
Answer with ID and offload location.
Ex. “12032 7”

The numbers might seem difficult to understand but makes sense to the forklift drivers. The forklift drivers are pleased with the layout of the SMS and had no suggestions for changes.

### 5.1 Choice of implementation

Several different methods of implementations were discussed. One with the drivers able to do several things by sending different SMS. This caused a lot of SMS traffic and was unnecessarily complex. Another method was an application for a smartphone. This was voted out due to poorly WiFi and 3g connection across the harbor. A few other were also discussed but simplicity was the most requested. Therefore the current system with one SMS for each truck arriving was decided.
6 Results

Results are based on data collected for the two weeks after implementation and compared to data from a three year period with the old system. It is also based on many questions and discussions with people involved.

Figure 5: Distribution of trucks in percentage before SMS-service, 13848 trucks

Figure 6: Distribution of trucks in percentage after SMS-service, 191 trucks
6.1 Paid delays and the costs

The cost for a truck to stand still depends a lot on the combination of its current load. According to Arne Lindgren, Kiruna Bilfrakt [2] averages a cost around 500 SEK per hour.

The price model that BSAB both sends and receives usually includes the time for offload. If it takes unnecessary long, the haulage contractors might bill extra for it. Arne Lindgren says that they charge extra for the unnecessary long times but this have never occurred for BSAB as far as Nina can recall.

From the same databases used to create Figure 5, the mean value of delays for all trucks were calculated to 9 minutes and 17 seconds. That is around 100 SEK extra for each truck arriving. During the three year period BSAB had a around 13000 trucks arriving in Piteå. The total cost sums up to 1.3 million. No matter who pays for it, it is still unnecessary.

Figure 6 shows the same thing but after the implementation. During this time the mean value were 5 minutes and 28 seconds. If this would have been the mean time during 2009-2012 it would have saved half a million.

\textit{This is calculated from the database and the outcome in real world may be different when other things come in play.}

6.2 Regular reasons for delays?

From interviewing the forklift drivers, the major regular reason for delays are the forklift driver not noticing a new truck. It is mainly caused by the driver not being present in the truck during low intensity days. If the driver is out talking to other employees or inventory the stored goods, a new truck can easily be missed.

Figure 7 shows how many trucks arriving each week. Each year, the weeks 29-32 has very little intensity of cars. But during that time of the year the average delay for each truck is the highest, can bee seen in figure 8. When comparing these two graphs it appears that low intensity gives higher waiting time. The forklift drivers says that this causes them to leave the forklift more often due to lack of work and then miss the trucks. It is seldom needed more than one forklift driver at the same time.
Figure 7: Total number of trucks arriving with goods at Piteå harbor

Figure 8: Average delays for trucks arriving each week
6.3 Reason for Södertälje Hamns shorter delays

The biggest reason for their short delays are the system that allows the haulage contractors to pre-register all upcoming trucks and detecting arriving trucks. As mentioned in the Introduction, Södertälje has about 70% of their trucks pre-registered. When a driver arrives there is no reason to stop and wait for anything.

It is hard to compare the two harbors due to their differences. A system like the one in Södertälje would be unnecessary to use in Piteå. The benefits wouldn’t make up for the cost of several millions.

Södertälje Hamn has provided the following chart showing average time for a truck inside the harbor. This time is almost lower then the single delay up in piteå.

![Time inside the harbor gates chart]

Figure 9: Average time at Södertälje for a trucks goods to be registered, unload/offload and leave through the gates

6.4 Pre-registered trucks

The pre-registering only resulted in seven successfully pre-registered trucks. The average time was 2 minutes, but that does not say much for so few trucks. It is hard to get some solid results from the database without testing it fully. Automatic detection of arriving trucks were examined. The current entry security system keeps tracks of which license plate going in and out through the gates. That could be used for pre-registering in the future.

From an email with Arne Lindgren, he believes pre-registering is a good idea and could benefit both the haulage contractors and BSAB. This opinion is
shared with Gunilla at the sawmill. Though she is unsure off who should do the registration. It will mean extensive work for the one performing it.

6.5 weather/season impact on delays

From an interview with one of the forklift drivers in Pieä, he clearly states that weather has a significant impact on delays, especially snow. During the winter, Piteä can get around 1 meter in snow deep [10]. The snow makes it harder for the forklift to drive and trucks might not be able to get to the correct offload location before the road have been plowed from snow.

From considering Figure 8 and the database, no major relationship between weather and delays are seen. The forklift driver insinuates that the total handling time of a trucks is affected but maybe not the delay.

6.6 SMS notifications

Overall, the SMS-service were very much appreciated by the forklift drivers. In their opinion it is really good to receive an SMS for each truck. The possibility to return the offload location with an SMS were seldom used. One of the reasons is the cellphone assigned for the drivers. It is an old Motorola which makes it hard to write numbers in an SMS. The truck drivers suggested in purchasing a new smart phone to be able to use the reply function.

6.6.1 The other things a forklift truck driver can do

From the databases it is possible to see that BSAB averages 16 (15.9) registered trucks per day. Nina Lidbergs also adds another 10 trucks to that number due to unregistered trucks. The time it takes to offload a truck is about 10 minutes according to Nina. With some pre and post work needed, total time for a truck is about 20 minutes. 20 minutes for each truck and 26 trucks each day gives 8.5 hours (520 minutes) of work. There exists two shifts for the drivers each day, one from 6:00 to 14:30 and one from 14:30 to 22:00, with a 30 minute break each day. This means that they are working 15 hours a day and 8.5 of those are needed to take care of incoming trucks.

This is of course depending on the season and the number of trucks arriving. During the summer it is not uncommon with less than 10 trucks each day. However, at the end of each year it can be up to 40.

At average it is 15 minutes of “spare” time between each truck. It’s possible that’s not enough to do some other tasks. But during the summer and low intensity days a suitable task should be possible to find.
6.6.2 Impact on delays

As seen in Figure 5, almost 55% of the trucks are assigned an offload location within 5 minutes. In Figure 6, this number has increased to more then 70%. Also, less then 10% compared to more then 20% previously has to wait more then 15 minutes.

Before the implementation it was an average of 9 minutes and 17 seconds that each truck had to wait. With the SMS system the average delay were almost reduce to half, 5 minutes and 28 seconds.

Even though the numbers are showing a good result, keep in consideration this is compared with only 191 trucks and a 2 week period.

From an interview with the forklift drivers the delays are shorter in their opinion.
7 Discussion

As mentioned in the results, the cost for delays was 1.3 million. To get this to zero would be almost impossible since it would require that no truck would ever have to wait. Nina Lidberg says that this cost does not affect them, so BSAB does not directly benefit from shorter delays. Though it will help their relationship with the sawmills and haulage contractors if they are lower. One reason for BSABs lack of improvement on the subject may be due to low competition. They are pretty much the only choice for shipping timber from the northern part of Sweden.

A few rows from the database were deleted when the statistics was to be calculated. It was mainly test rows from testing the system. The test rows had their license plate column set to TEST so they were easy to spot and remove. Some other entries should maybe have been removed too. The longest delay in the database was was 9.5 hours. It is very unlikely that this is a delay caused by the forklift driver not being able to give an offload location. To determine what caused the long delay would be really hard and we decided to keep it there. There are a few more trucks with 9 hours, around 20 with 8 hours and so on. Since we could not know the reason for these trucks we decided to keep them.

One expected result concerning the pre-booking system was that the forklift drivers could be more stressed due to knowing how many trucks would arrive. One of the forklift drivers when interviewing them mentioned this could be a side effect. If the trucks are not arriving when stated it could mean the forklift drivers are waiting unnecessarily. The truck could be 30 minutes late and then the point of pre-booking is lost.

A comparison could be made where data is extracted from the same days as the new system were used. The days are from 9th of may until the 25th of may, this should be used as a filter for 2009-2011 and then compared to see the difference with the same time period.

![Figure 10: Example of different correlations. Image from wikipedia[11]](image)
Another comparison like the one in Figure 10 could be made. One axis would be the waiting time and the other the frequency of trucks. Hopefully the result would be one in the middle row, but it will probably be a more spread out.
8 Conclusion

Even though the results are based on a two week period, and would need more time to determine if it really is effective, the outcome is positive. The pre-booking system were appreciated but will probably be long before used fully in reality. If BSAB would to obtain a smartphone for the forklift drivers they might use the reply function for offload location even more.

The forklift drivers are very pleased with the implementation and says it eased their work a lot. Nina Lidberg is also happy with the work and a presentation in Piteå is requested in the near future. Further work could be of interest for both us and BSAB.
9 References


