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TECHNOLOGY KUMASI, GHANA**

SCHOOL OF GRADUATE STUDENTS

**“IMPLEMENTATION OF MOBILE APPLICATIONS FOR A
COMMERCIAL COMPANY”**

(CASE STUDY: BRALIMA’S BILLING SYSTEM)

By

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**A DISSERTATION PRESENTED TO OSEI TUTU II INSTITUTE FOR
ADVANCED ICT STUDIES, GHANA IN PARTIAL FULFILMENT OF
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Certification page

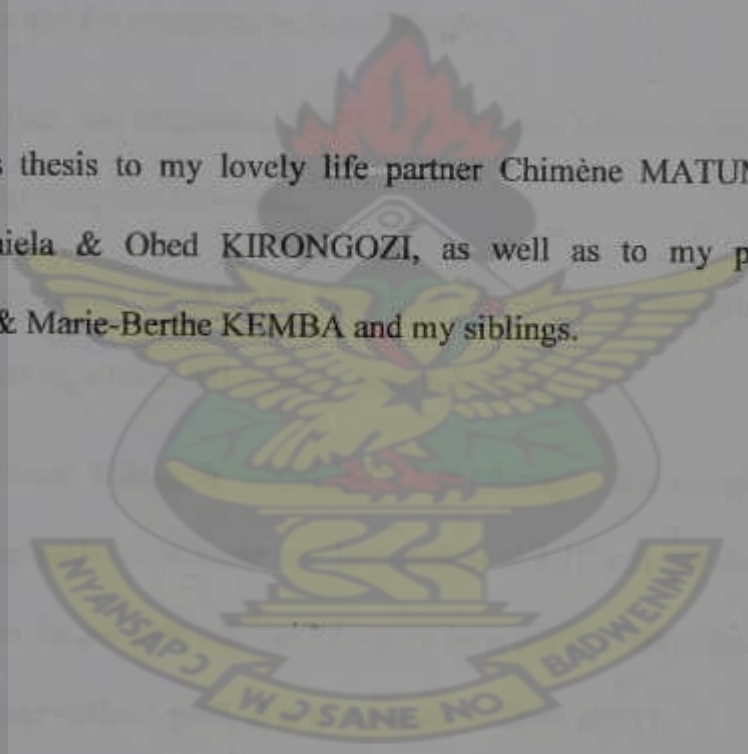
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Dedication

KNUST

I dedicate this thesis to my lovely life partner Chimène MATUMA and to my daughters Daniela & Obed KIRONGOZI, as well as to my parents Thomas KIRONGOZI & Marie-Berthe KEMBA and my siblings.



Acknowledgments

I praise and thank Almighty God in the name of Jesus-Christ, for giving me life and guidance during my work on this thesis.

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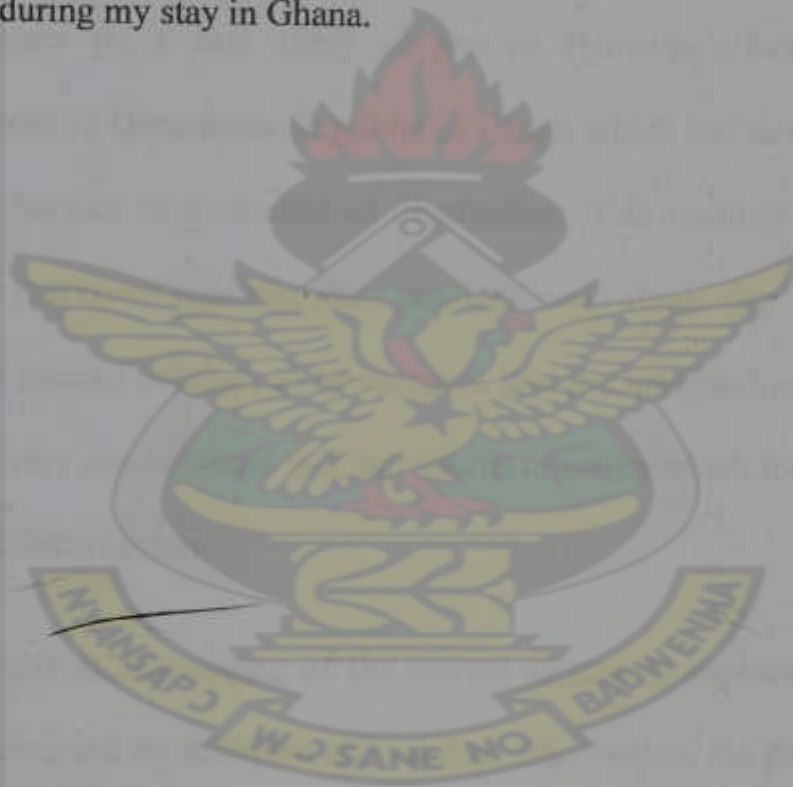
- Mr. Tom de Man, Heineken President Africa and Middle East, Peter Wever, Heineken IT Manager Africa and Middle East, for initiating this of masters program and for accepting my candidature,
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Abstract

Selling products at home is one of the channels used by many commercial companies for increasing incomes and competitive advantages. However, the capturing of manual invoices issued by salespersons into information systems for statistical analyses could be a consuming task and source of errors, particularly if the company has a great number of customers.

This thesis focuses on a case study of one of Heineken's breweries, called BRALIMA, located in Democratic Republic of Congo which had developed a great Home Delivery Service as a channel of distribution. This brewery boasts around 3,000 customers that could patronize their products every single day. Therefore, this involves a lot of manual invoices to be captured into the information system called MISHA SRD, a very cumbersome task and source of errors which lead to customer complaints and dissatisfaction.

This thesis attempts an assessment of the current system of capturing invoices at BRALIMA, to bring out its strengths and weaknesses. Further, the project analyses the opportunity of a new system based on mobile application and assess the risks involved. The implementation and assessment of the result of this mobile application are parts of this thesis.

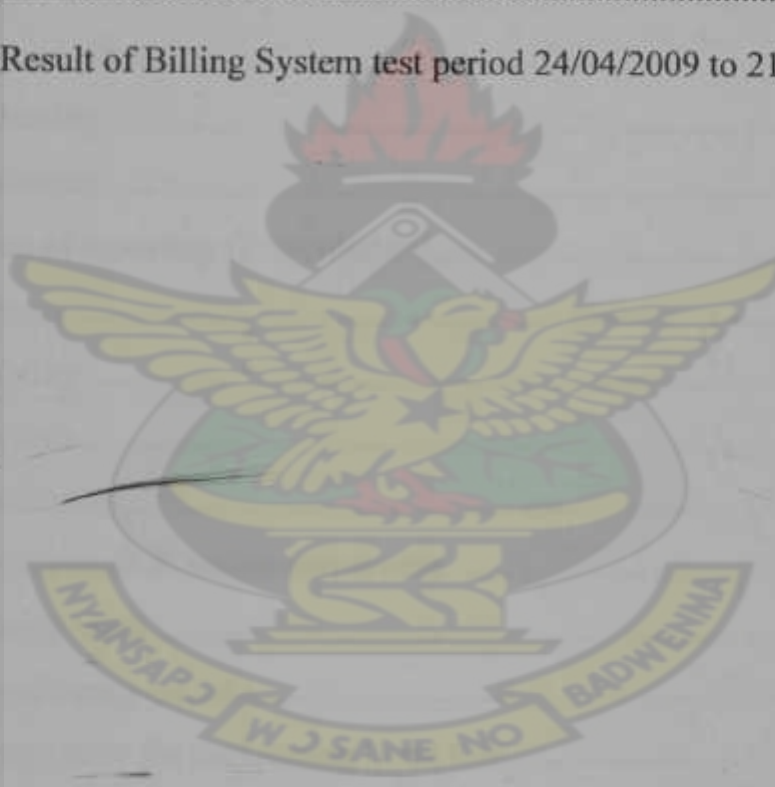
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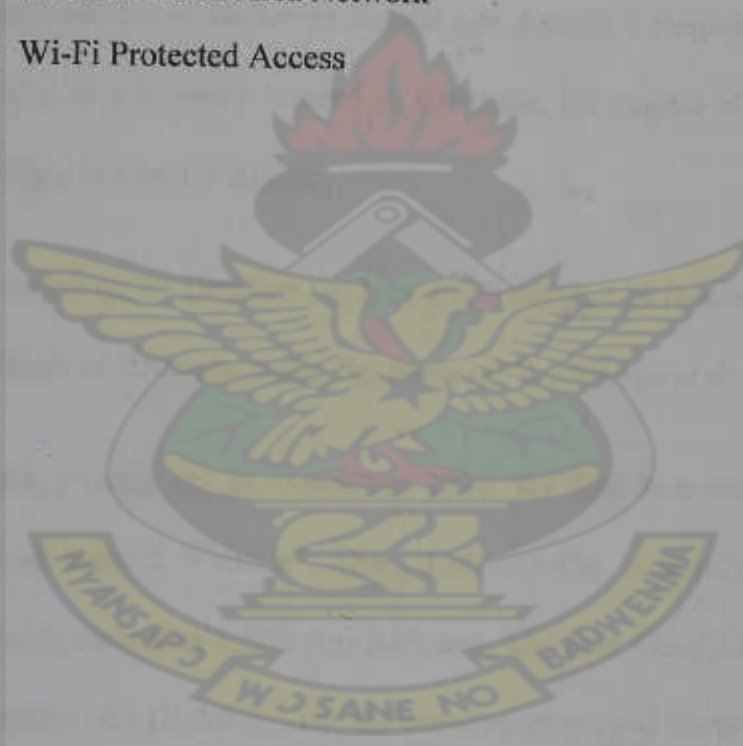
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List of Abbreviations

APN	Access Point Name
BRALIMA	Brasserie Limonaderie et Malterie
BS	Billing System
CISSP	Certified Information Systems Security Professional
CSD	Circuit Switched Data
DRC	Democratic Republic of Congo
EBIT	Earning Before Interest and taxes
EDA	Enterprise Digital Assistant
EDGE	Enhanced Data rate for GSM Evolution
FTP	File Transfer Protocol
FTPS	File Transfer Protocol Secure
GPRS	General Packet Radio Service
GSM	Global System for Mobile Communications
HTTP	Hypertext Transfer Protocol
HTTPS	Hypertext Transfer Protocol Secure
IEEE	Institute of Electrical and Electronics Engineers
IIS	Internet Information Service
IPMA	International Project Management Association
IrDA	Infrared Data Association
ISO	International Organization for Standardization
JEM	JustEnough Management
LAN	Local Area Network
MBPN	Mobile Backbone Packet Network
MISHA	Management Information System Heineken for Africa
PDA	Personal Digital Assistant
SD	Secure Digital
SDLC	Software Development Life Cycle
SFA	Sales Force Automation

SMTP	Simple Mail Transfer Protocol
SRD	Service Rendu Détaillant
SSID	Service Set Identifier
TDMA	Time Division Multiple Access
TKIP	Temporal Key Integrity Protocol
USB	Universal Serial Bus
VPN	Virtual Private Network
WBS	Work Breakdown Structure
Wi-Fi	Wireless Fidelity
Windows CE	Windows Embedded Compact
WLAN	Wireless Local Area Network
WPA	Wi-Fi Protected Access



1.1. Research context and stakeholders

BRALIMA sale volumes are growing. This has had some consequences: increase in number of customers, number of invoices, delay in invoice recording on the server, data entry errors, delay in decision making and decrease in data entry control, that finally become sources of error and customer complaints.

1.1.1. BRALIMA history

The organization which this research is describing is called BRALIMA SARL, or *Brasseries, Limonaderies et Malteries Société par Actions à Responsabilité Limitée*. BRALIMA SARL is a brewery located in Kinshasa, the capital of the Democratic Republic of Congo, in Central Africa.

This brewery started on 23 October 1923 by a few number of business men with the support of the Bank of Brussels, under the name of “*La Brasserie de Léopoldville*”.

After three years, exactly on 24 December 1926, the first beer was produced and consumed; it was named “Primus”. Then, Leopoldville, currently Kinshasa, had 27,000 inhabitants including 1,500 non Africans. The first Chief Executive Officer of BRALIMA name was DUMOULIN, the brewery employed thirty Congolese, two Belgians, one French and one Swiss. In 1933, the brewery went bankrupt, with an annual production of 3,600 hl.

After the Second World War (1940-1945), the Congo's economy improved so, BRALIMA's stakeholders came back into business and built breweries all over the country and neighbouring countries:

- ❖ 1950 Bukavu brewery, DRC
- ❖ 1952 Brazzaville brewery, Republic of Congo
- ❖ 1954 Bujumbura brewery, Burundi
- ❖ 1957 Kisangani brewery, DRC
- ❖ 1958 Boma brewery, DRC
- ❖ 1959 Gisenyi brewery, Rwanda
- ❖ 1972 Mbandaka brewery, DRC
- ❖ 1992 Soft Drink plant of Lubumbashi, DRC
- ❖ 2008 Lubumbashi brewery, DRC.

In 1987, the Heineken Group (of Holland) became the major shareholder of all BRALIMA's production plants, (Babala, B., 2009), Setibo, J., 2008).

1.1.2. Geographic location and legal status

The BRALIMA Head Office is located in Kinshasa, the capital of Democratic Republic of Congo, precisely on *Avenue Du Drapeau N°1, Commune/Barumbu*.

BRALIMA belongs to the category of DRC private company, called *Société par Action Anonyme à Responsabilité Limitée (SARL)*, (Bompulenge, M., 2008).

1.1.3. Principal activities

The main activities of BRALIMA SARL are brewing (beers, malt drinks), producing soft drinks and selling of these products. It is important to note that BRALIMA SARL is certified ISO 9001 since 2003 as a result of its excellent work and effort.

1.1.4. BRALIMA's objectives

BRALIMA's objectives include to produce any types of beverage with the best quality for its clientele (Congolese in particular and other countries in general); to sell any types of beverage that it is produced at reasonable prices according to population revenue.

1.1.5. Latest volumes sold and market share

❖ Volume (2008)

Table 1-1: BRALIMA sales' volume of 2008

<u>Region</u>	<u>Volume</u>	<u>Growth vs 2007</u>
Kinshasa	1.894.905 hl	+35%
Boma	426.588	+13%
Bukavu	572.209	+15%
Kisangani	97.679	+19%
Lubumbashi	97.430	+41%
Mbandaka	50.698	+46%
Hors-Kin	71.697	+16%
Total	3.211.206 hl	+27%

Source: (Dolf, B., 2009)

❖ Market share (2008)

Table 1-2: BRALIMA market share of 2008

<u>Brands</u>	<u>Market share</u>	<u>Growth vs Dec 2007</u>
Primus Kinshasa	72.4%	+13.7%
Turbo-king Kinshasa	46.1%	+12.7%
Beer Region 1	71.3%	+11.7%
BG Region 1	72.9%	+4.8%
Total beverage Region 1	72.9%	+9.0%

Source: (Dolf, B., 2009)

1.1.6. BRALIMA politics of sales

BRALIMA has mainly two types of customers: distributors and retailers. The distributors are BRALIMA customers who buy products from her and sell them to retailers. They are recorded onto BRALIMA's Integrated System called ISHA which stand for Information System Heineken for Africa. Each distributor has an account number which allows them to place order immediately onto the Integrated System.

The retailers are not incorporated into BRALIMA's Integrated System; they obtain their goods direct from BRALIMA's drivers who play the role of BRALIMA's salespersons. Drivers are, however, in ISHA and have each, account numbers.

60% and above of BRALIMA-Kinshasa sales are realised by retailers using Home Delivery Service, called SRD (Service Rendu Détaillants). The SRD is a distribution method of sale that BRALIMA is using for selling finished products (beers, malta and soft drinks) to its retailers. Instead of allowing retailers to come into BRALIMA factory to place orders, BRALIMA trucks loaded with products go out to the retailers at their premises.

This master thesis, however, focuses on Home Delivery Service (SRD) rather than the distributors.

The table and figure below describe the percentage owned by each channel of distribution.

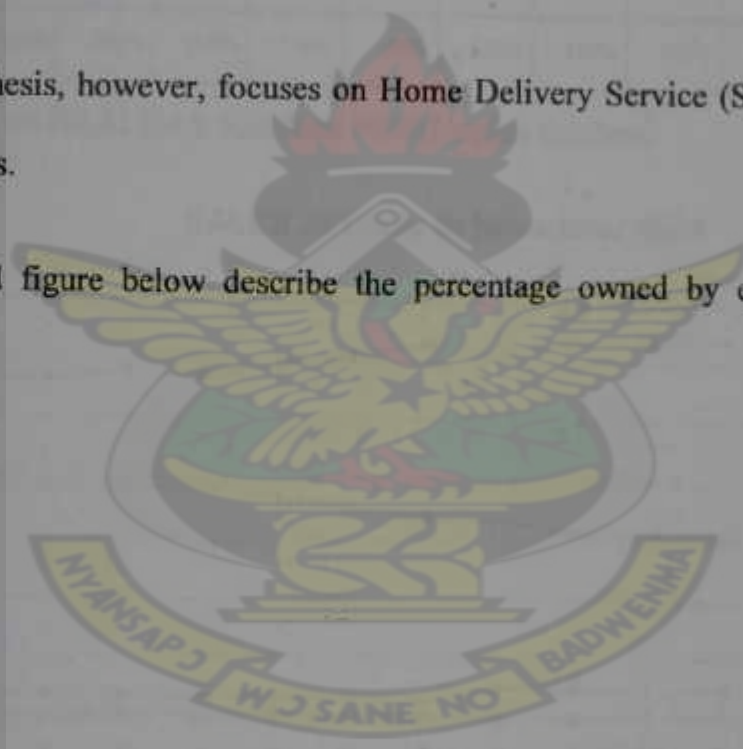
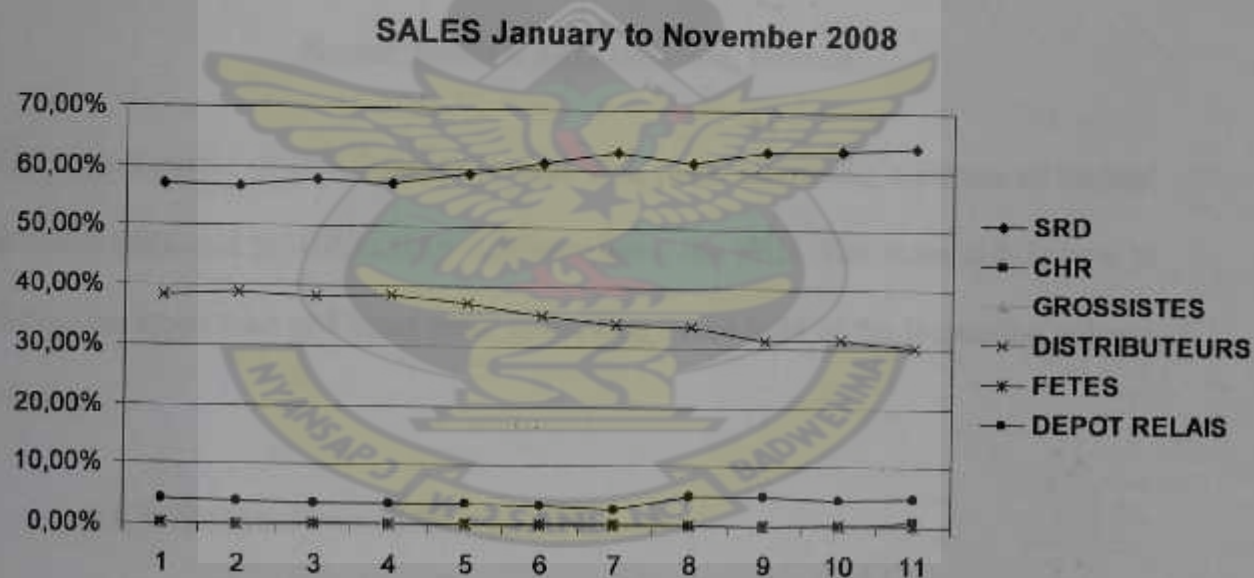


Table 1-3: Sales Evolution from January to November 2008, Kinshasa

Type of clients	English meaning	Jan-08	Feb-08	Mar-08	Apr-08	May-08	June08	Jul-08	Aug-08	Sep-08	Oct-08	Nov-08	Total
SRD	Home Delivery Service	57,05%	56,85%	57,93%	57,40%	58,96%	61,06%	62,92%	61,22%	63,21%	63,67%	64,07%	60,53%
CHR	Coffee Hotels & Restaurant	0,14%	0,11%	0,13%	0,13%	0,15%	0,12%	0,20%	0,13%	0,12%	0,12%	0,73%	0,20%
Grossistes	Wholesalers	0,07%	0,05%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,00%	0,01%
Distributeurs	Distributors	38,45%	38,98%	38,24%	38,63%	37,13%	35,15%	33,76%	33,53%	31,49%	31,54%	30,27%	35,00%
Fêtes	Parties	0,17%	0,12%	0,20%	0,17%	0,16%	0,24%	0,28%	0,19%	0,12%	0,17%	0,15%	0,18%
Dépôt Relais	Depots	4,12%	3,89%	3,50%	3,67%	3,59%	3,43%	2,85%	4,93%	5,06%	4,51%	4,78%	4,09%
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	

Source: Based on BRALIMA-Kinshasa MISHAsales database



Source: Based on BRALIMA-Kinshasa MISHAsales database

Figure 1-1: Sales evolution from January to November 2008, Kinshasa

In this introduction, it is important to know that BRALIMA politic of rewarding retailers is based on the total amount of products (beer, malta and soft drinks) sold in a month by each retailer. A discount is calculated based on the total amount bought by the retailer which constitutes their benefit for any specific month.

Before calculating this discount, all written invoices issued by the drivers must be recorded onto MISHA SRD. The statistics show an average of 90,000 monthly written invoices issues by drivers as shown below:

- More than 100 drivers' itineraries (called *Routes*),
- Average of 30 retailers by route,
- 30 days of activities
- Therefore an average of $100 \times 30 \times 30 = 90,000$ manual invoices per month.

Source: MISHA SRD Database, Internal

The main context of this thesis is to deal with these increasing numbers of manual invoices delivered by BRALIMA's drivers using the SRD. The main task is how to reduce the input time and input error of the data in the light of the increasing volume of sales.

1.1.7. Stakeholders of the research

1. BRALIMA SARL

2. Heineken Group

3. Osei Tutu II Institute for Advanced ICT Studies, Ghana

4. Kwame Nkrumah University of Science and Technology-Kumasi, Ghana

1.2. Research goals

As started under “Research context” above, BRALIMA has defined the following goals to help solve its problems and enhance its business:

1. Implement a Windows Mobile Application for a commercial company (Case study: BRALIMA’s Billing System), which will replace the current Data Capturing System by solving current problems and bring more functionalities,
2. Reduce sales operations and administration costs as well as improve sales operations efficiencies,
3. Reduce the report publishing time by using a real-time input system,
4. Provide managers with accurate/ current information with regards to sales force activities,
5. Provide a “best practice” for other breweries or commercial companies which are working in the same way.

1.3. Research questions

1.3.1. Does BRALIMA need a Mobile Application?

What are the additional benefits that BRALIMA SARL could expect by implementing such a system? What are the limits of the old system? Is it cost-benefit?

The first question aims at finding out the real benefits that BRALIMA can gain by implementing a Mobile Application. By answering this question, this research will present clearly the limitations of the old system, how BRALIMA is losing in term of money, time, good will, customer satisfaction and delay on decision making.

This question will present a table which justifies the *investment cost* versus *current loss* (by using actual system). Numerical data shall be presented as proof.

1.3.2. How reliable is this system?

The second question deals with how accurate this system is vis-à-vis what it is expected to perform.

1.3.3. How safe is this system?

The third question is about safety; that is how customer and BRALIMA are kept away from danger by using a Mobile application. By using PDAs, salespersons access BRALIMA LAN via GPRS or Wi-Fi. Which security measure should be taken to avoid sabotage or any threats from outside? A risk management analysis should provide the answer to this question.

1.3.4. How can BRALIMA customers and salespersons be concerned about this mobile application?

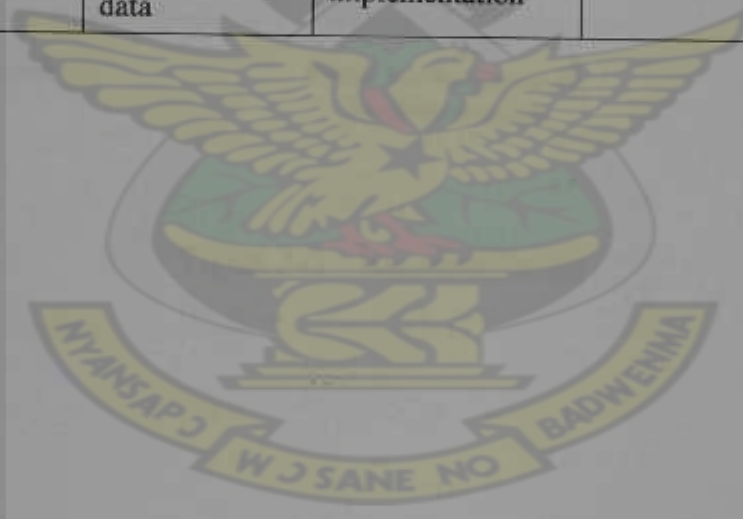
The fourth question deals with stakeholders' involvement. The project can not succeed if the end-users are not fully getting involved. A proper strategy must be used to get drivers and customers involved in this project.

1.3.5. What are the processes and critical success factors involved in implementing Mobile Application?

The last question presents the practical aspect of this thesis: the implementation. It describes step by step how the solution is implemented for helping other companies working the same way to find a "best practices" or guidance for their future implementation. There will be a description of critical success factors which should be followed before getting to the result.

1.4. Research methodologies

Quest. #	Qualitative methods	Quantitative methods	Primary data	Secondary data
1	Open interview with: - Financial Director, - Marketing & Commerce Director, - Internal Audit Manager,	Data analysis	From interview	- Sales data, - payroll of data entry persons,
2		Data analysis	Availability of the components which constitute the new system	
3	(Additional security measure to protect BRALIMA network)			Threats caused by GPRS or WI-Fi / how to prevent unwelcome user into the network.
4	Sensitize	Data analysis	Survey	
5	Business Process Management	Data analysis of primary data and secondary data	Expected outcome of the implementation	Data from old system



1.5. Research design

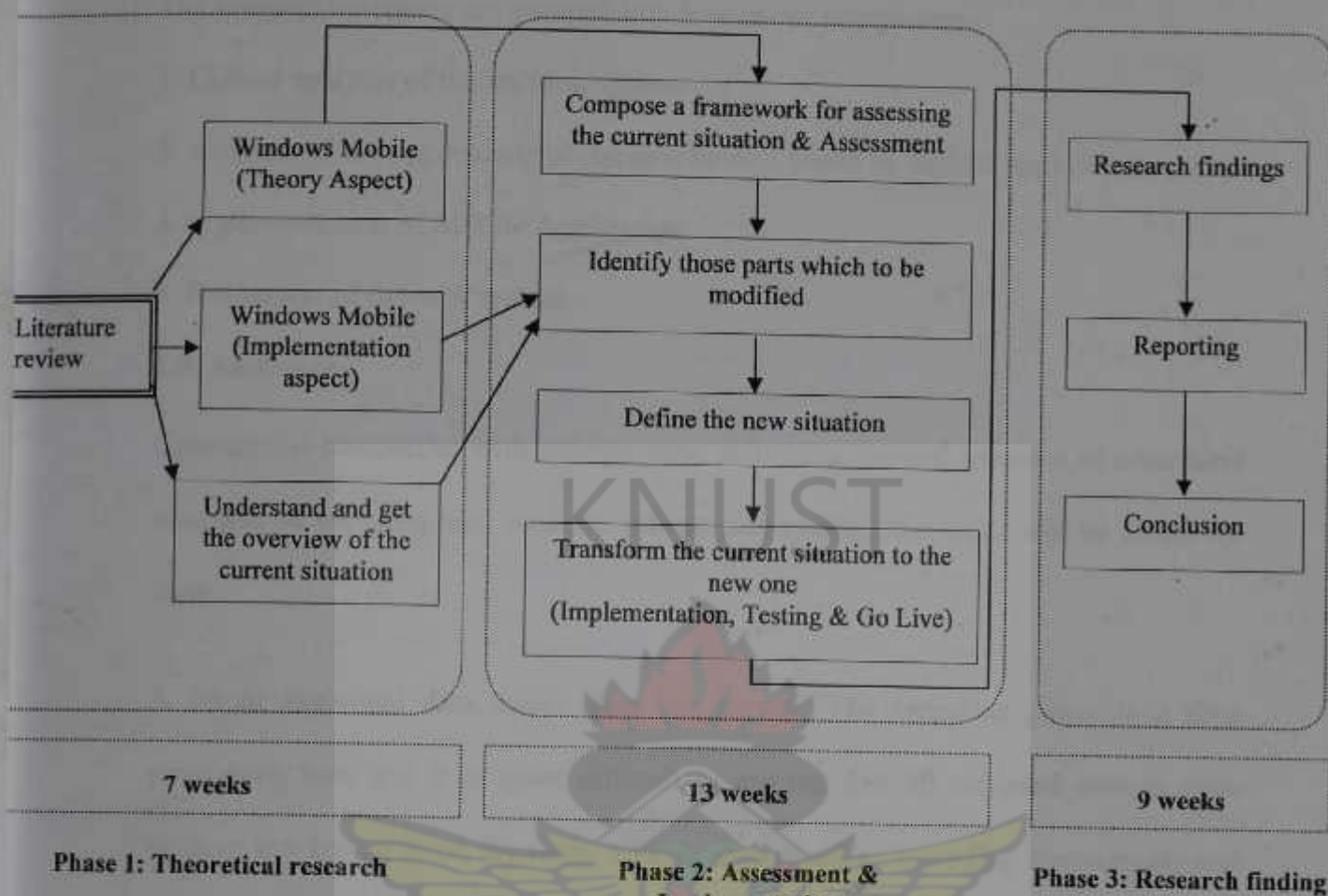


Figure 1-2 : Research design

1.6. Research outcomes

The research outcomes are grouped into four major components:

1. Critical analysis of the existing system
2. Analysis of the opportunity of the new system based on mobile application
3. Implementation of Mobile Application
4. Evaluation of the new system

1.7. Audience

Commercial companies with salespersons delivering manual invoices to customers who will be captured later onto the informatics system, this work will be useful for them.

A lot of statistical data come from the survey. The encoding phase is a time consuming task and it is quite difficult to assume that all recorded data is done without any typing error. By using a PDA, data could be recording immediately and send to the server by docking station, Wi-Fi, GPRS or other without data entry error.

Commercial companies like those engaged in Water or Electricity Supplier working on post paid manner could find here a useful way to facilitate their work. How? Some of them used to send their representatives to read of meters to determine what is consumed by each customer for invoicing. Once they came back to the Head Office the information recorded manually from the field is handled by data entry persons before customer are printed invoices. By using a mobile application, the encoding phase could be easily done away with to gain time and save energy. This list is not exhaustive; several mobile applications can be found in real life.

Chapter 2: Critical analysis of the existing system

This chapter will be joined to the next one to answer the first research question “Does BRALIMA need a Mobile application”. The assessment of the current situation will help answer this question. Therefore, throughout this chapter the current situation will be described and analyzed critically. Its flow of information and functionalities will be described. We shall discuss how the current system is seen from IT, Commercial, Internal Audit, and end users perspectives. This chapter establishes the foundation and brings out evidence on the need of improvement of the current system or the need of a new system for managing drivers and retailers in BRALIMA.

2.1. The main purpose of the current application

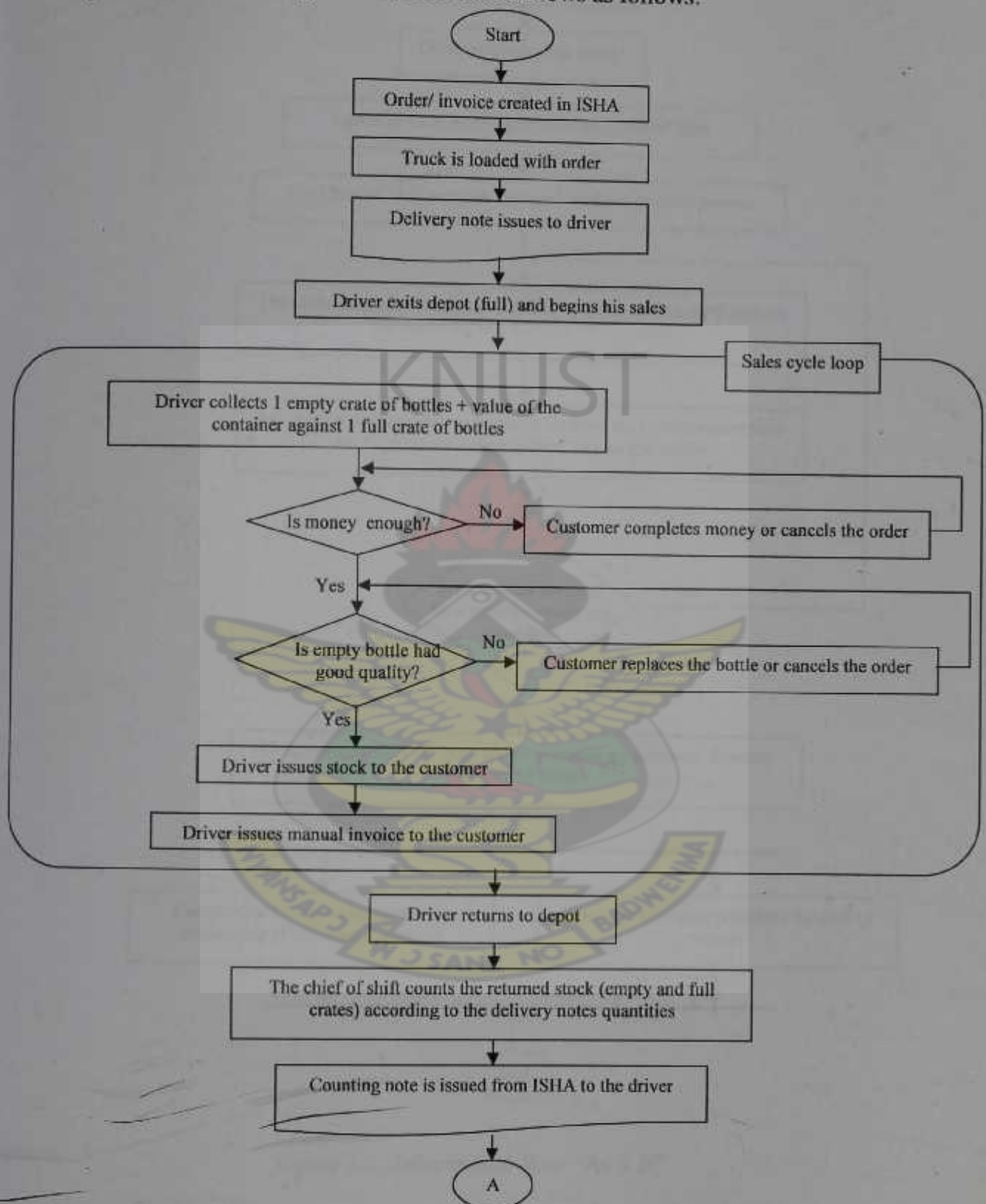
The current application is named MISHA SRD, standing for Manager Information System for Heineken *Service Rendu Détaillant* (Home Delivery Service); this software was developed by BRALIMA employees to facilitate data entry of written invoices delivered by the salespersons (truck drivers) to BRALIMA retailers.

MISHA SRD applications goals are to:

- provide an interface for data entry of manual invoices delivered by salespersons,
- calculate retailers' discount (rewards),
- calculate drivers' wages,
- facilitate data analysis of retailers,
- provide sales' statistical analysis by road, by area, by region, etc.

2.1.1. Information flow

As part of the start-of-day routine, information flows as follows:



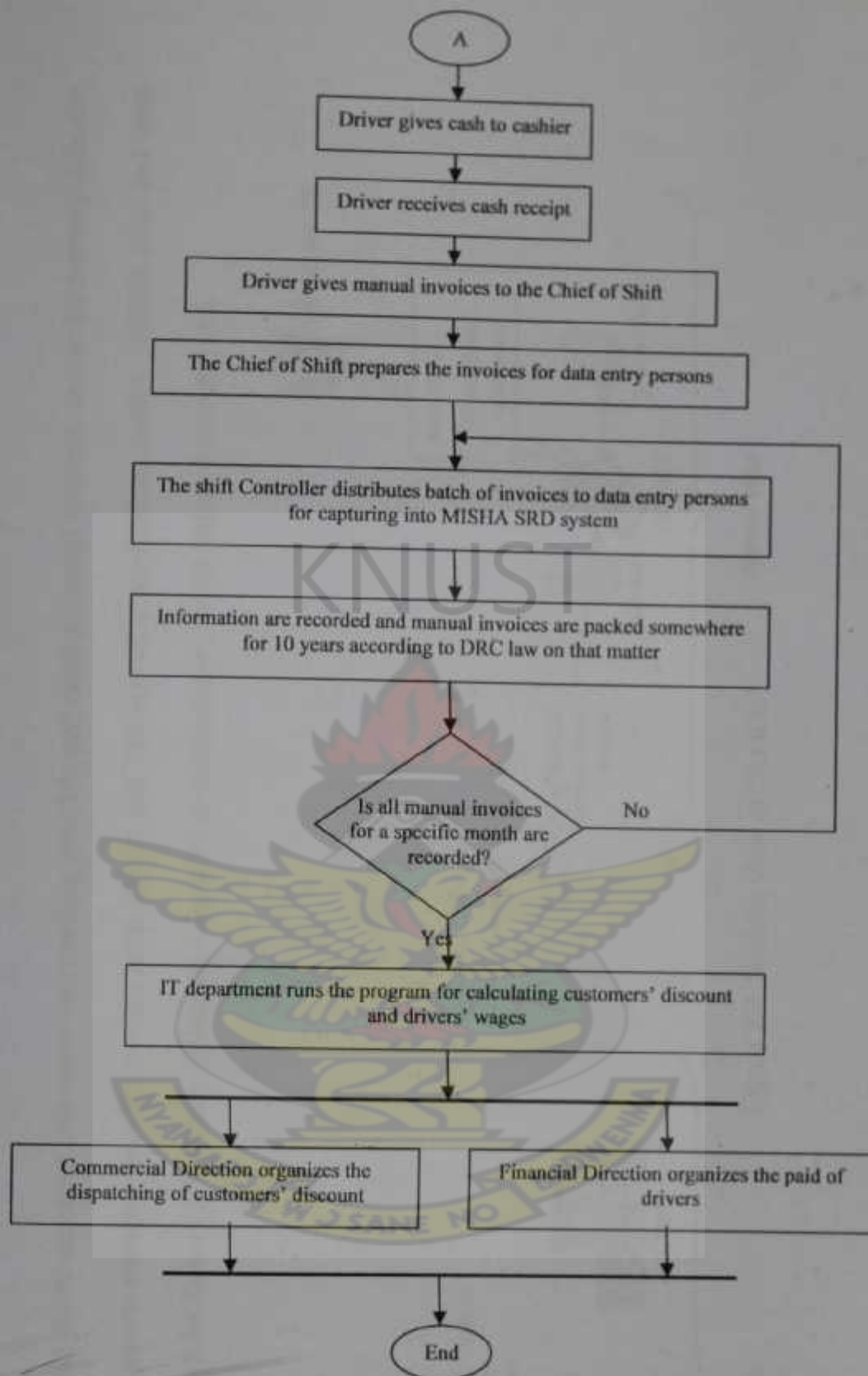


Figure 2-1: Information flow "As it is"

2.1.1.2. Holistic view of "As it is"

These images below show the driver on client side where he is selling products and issuing manual invoices, and at the brewery side, the reader can see a data entry person encoding manual invoices from drivers into MISHA SRD application. Briefly, MISHA SRD had been developed with Visual Basic 5 for data entry interface, Microsoft Access 97 as database and Crystal Report 5 for reporting.

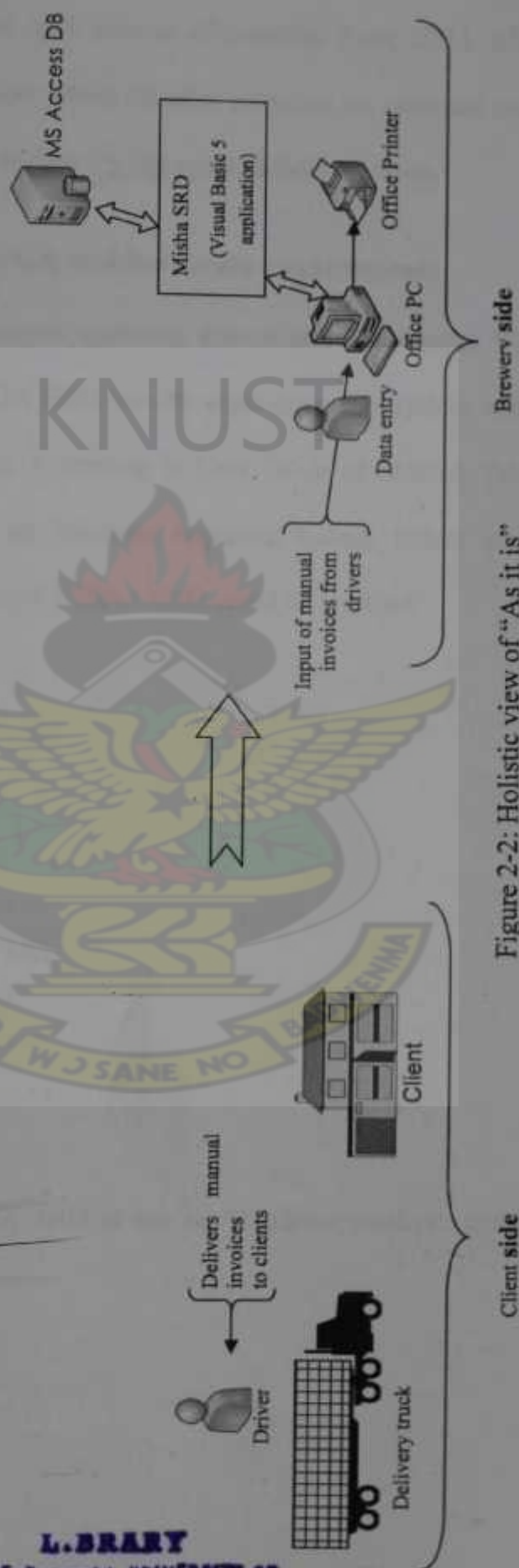


Figure 2-2: Holistic view of "As it is"

2.2. Functionalities

MISHA SRD is a desktop application designed on Client/Server architecture. It runs over a Local Area Network, and sources information from ISHA which is the BRALIMA's Integrated System where all sales activities are recorded and provides interfaces for data entry to complete the life cycle of delivery notes.

2.2.1. Operating system and hardware requirements

MISHA SRD is run on Windows operating system and can support Windows 95 version and later ones. MISHA SRD has the same operating system and hardware requirement as MISHA Sales. According to User Guide of MISHA Sales, (Anon, 1998), MISHA SRD is run on Windows operating system. Below are minimum requirements for a desktop where MISHA SRD could be installed:

- Software (Minimum)

Windows 95

MS Office 97

- Hardware (Minimum)

Processor: Pentium 75 MHz

RAM: 16 MO

Hard disk: 100 MB

2.2.2. Database

As introduced earlier, MISHA SRD is run on Windows platform and Microsoft Access 97 database.

2.3. Limitations of MISHA SRD

2.3.1. From IT perspective

From the IT perspective, this database has some drawbacks when it is compared to the current level of database features:

- Limited size of the database at 1 GB. This limited size makes it difficult to archive information for a long period in the same database
- Low security level, when it is compared to MS SQL Server, Oracle, other database. According to the online encyclopedia (Wikipedia, 2009a): *"The Access Jet database is a file based system and does not have the features of servers such as SQL Server, Oracle, or other ODBC compliant databases"*,
- *"Microsoft Access is most often used for individual and workgroup projects (the Access 97 speed characterization was done for 32 users)"*, (Wikipedia, 2009a)
- The maintenance of the system is not easy to perform. As a desktop application, any new release needs to be installed over all end-user desktops. This could be fine if the maintenance is supposed to be done only into the server side by using a web application.

2.3.2. From Internal Audit perspective

In a recent study, (Mpata, S., 2008) a Senior Auditor, had recommended to solution to storage space of MISHA SRD which makes the data analysis process difficult for Internal Audit, and argued about fraud caused by MISHA SRD weakness. The auditor came out with evidence that the total of delivery notes issued from ISHA and encoded in detail in MISHA SRD are above the loading capacity of the truck and therefore is not corresponding to the delivery notes issued from ISHA. In other words, the total of manual invoices encoded by data entry persons is over the corresponding delivery notes. This situation is unacceptable and a source of fraud.

The sample below explains the evidence of this Senior Auditor:

Table 2-1: Difference between quantities sold in MISHA SRD against quantities sold in Isha

	N° Commandes	Qté saisie MISHA SRD	Quantité Ventes nettes Isha	Différences	% de dépassement
	[Order Numbers]	[Qty in MISHA SRD]	[Qty in ISHA]	[Difference]	[Exceed %]
1	Total 28C0036411	2321	409	1 912	467%
2	Total 28C0034111	1540	454	1 086	239%
3	Total 28C0037233	1119	376	743	198%
4	Total 28C0040267	999	361	638	177%
5	Total 28C0039713	799	310	489	158%
6	Total 28C0040077	802	345	457	132%
7	Total 28C0038869	650	296	354	120%
8	Total 28C0039067	834	411	423	103%
9	Total 28C0039060	975	481	494	103%
10	Total 28C0039249	702	357	345	97%
11	Total 28C0040273	969	496	473	95%
12	Total 28C0038871	925	482	443	92%
13	Total 28C0040064	655	342	313	92%
14	Total 28C0035599	1082	572	510	89%
15	Total 28C0038560	781	418	363	87%

Source: BRALIMA Internal Audit

The table above shows that [Qty in ISHA] which is the real quantity loaded onto the truck compared to [Qty in MISHA SRD] that is the sum of manual invoices issued by the driver for the same [Order Numbers] indicates a difference. The worst thing is this [Qty in MISHA SRD] goes beyond the loading capacity of the truck. For instance, a truck used for this SRD channel of distribution, can not load more than 530 crates at once, I mean for the same [Order Numbers], in the first line shows that [Qty in MISHA SRD] is 2321 which is beyond the loading capacity of the truck. In a normal situation, the [Qty in MISHA SRD] should be less or equal to [Qty in ISHA].

2.3.3. From the Commercial perspective

The Director of Commerce and Marketing, Dolf van den Brink, noticed that :
“*Current manual system of invoicing our direct delivery customers (SRD) is fraud sensitive, error sensitive, time intensive, labor intensive and all together costly*”,
(Dolf, B., 2008).

Every manual invoice issued by the driver at the customer end had been encoded to the brewery by a data entry person. As described in paragraph 1.1.6, roughly 90,000 manual invoices are generated per month. This data entry task is done as below:

Table 2-2: Monthly cost caused by MISHA SRD

Heading	Amounts (US \$)	Qty/ FTE*	Total (US \$)
Data entry person UFF*	200	7	1,400
Data entry person BRALIMA*	350	1	350
Controller*	250	2	500
Fraud	5000	1	5000
Data entry errors' impact on discount	1,500	1	1,500
FTE handling complaints*	250	2	500
Invoices' paper	3,50	1000	3,500
IT support*	0.15	1000	150
Total			12,900

Source: Human Resources Paid Office, (Kutula, G., 2009)

Approximately **US \$12,900** is lost every month.

There is one more important thing that could not be estimated “*Company's good will*”. Customer complaints can tarnish the image of the company. This situation is not good at all for the company.

2.3.4. From end-users perspective

A survey had been carried out to collect end-users point of view about MISHA SRD application. The research approach is based on James Wetherbe's framework, called PIECES framework.

PIECES framework is based on six areas:

- P* *the need to improve performance*
- I* *the need to improve information (and data)*
- E* *the need to improve economics, control costs, or increase profits*
- C* *the need to improve control or security*
- E* *the need to improve efficiency of people and processes*
- S* *the need to improve service to customers, suppliers, partners, employees, etc.*

(Twinomurinzi, H., 2007)

a) Building assessment framework

A questionnaire is built for assessing the current situation. See appendix A for detail.

b) Explanation of each question

1. Performance

1. **Response time:** find out whether or not end-users are satisfied with the time that it takes the system to show out a page, or to react to a click.
2. **Availability:** aimed at finding out whether the system is available for use when and where necessary. (Looijen, M., 1998).

II. Information and data

1. *Consistency*: tried to find out whether end-users come across dissimilarity values in MISHA SRD or not
2. *Format of reporting (Presentation)*: the format of the reporting could facilitate or not the consultation of the application by the end-users. This question wanted to find out whether or not end-users are concerned about the format of reporting.
3. *Accuracy*: end-users are using different sources of data within the company MISHA SRD is one of them. The question here is to discover if end-users appreciate or not the correctness of data in MISHA SRD.
4. *Reliability*: how far end-users trust data in MISHA SRD
5. *Up to date*: is MISHA SRD data are up to date at time or it takes time for its data to be updated?
6. *Consistency*: to some extent, that question is another way of asking the first one. In this question the researcher would like to find out if, end-users have been content with MISHA SRD for their analysis.

III. Economy

Development and maintenance cost: the question aimed at discovering if the development and maintenance cost of MISHA SRD are acceptable or too expensive for the company.

IV. Control and security

1. *Security level*: an application must prevent unauthorized persons from access, editing or deleting of data. This point needs to be treated seriously.

2. **Inconsistency of data:** decision making is based on the quality of data or information. Inconsistency of data could lead to bad decision which could be harmful to the company.

V. Users and procedures efficiencies

1. **Enough time for performing input task:** the idea behind this is time consuming. It will be appreciated if data entry persons are aware that this task is time consuming and needs better option.
2. **Flexibility of access procedure on:** this question tries to know how flexible the process of getting access to the current system is.

VI. Service

1. **Easy to learn or to use:** easy to use is nowadays an important concept when it comes to software development. Attention needs to be paid to whether this application is "Easy to learn or to use".
2. **Operability:** software needs to communicate with others, exportation of reports on others software like MS Excel, Word, PDF, xml, etc. that makes for more flexible data analysis. The question is to find out if end-users feel comfortable with this operability or not.

General comment: any comment from the end-users to help improve upon the current situation, and which could be considered for the new one.

c) Assessment result

This paragraph comments on the result of each question.

I. Performance

Table 2-3: Response time

Response time	Count	%
Satisfactory	13	59,09%
Unsatisfactory	9	40,91%

Comment

In general the response time in MISHA SRD is quiet positive, 59.09% are satisfied. But it is important to note that all data entry persons (DMC-Encodeurs) unanimously are unsatisfied on the response time. As known, DMC-Encodeurs are those who are inputting the most data in MISHA SRD.

Table 2-4: Availability

Availability	Count	%
Highly satisfactory	1	4,55%
Satisfactory	12	54,55%
Unsatisfactory	9	40,91%

Comment

From the result, research found that the availability of the system had the same result as the response time. Nevertheless, response time aimed to find out how quick a page could be loaded after a click-button.

II. Information and data

Table 2-5: Consistency

Consistency	Count	%
Empty	1	4,55%
Good enough	9	40,91%
Good	9	40,91%
Poor	3	13,64%

Comment

The end-users are satisfied by the quality of the content of the current reporting; the result shown 81.82% of end-users are satisfied.

Table 2-6: Format of reporting (Presentation)

Usefull format	Count	%
Empty	1	4,55%
Bad	1	4,55%
Good	12	54,55%
Good Enough	6	27,27%
Very good	2	9,09%

Comment

The reporting format of MISHA SRD satisfies the end-users. Research found out that up to 90% of users are satisfied with the format.

Table 2-7: Accuracy

Accuracy	Count	%
Accurate	1	4,55%
Bad	6	27,27%
Big difference	8	36,36%
Small difference	7	31,82%

Comment

Accuracy is a big issue in MISHA SRD. Only 4.55% sample of the population think that MISHA SRD reporting are accurate. This is linked with the following question about reliability.

Table 2-8: Reliability

Reliability	Count	%
Empty	2	9,09%
MISHA SRD	4	18,18%
Other answer	6	27,27%
Other source	9	40,91%

Comment

In general, MISHA SRD is not reliable. Only 18.18% of the population's sample consider MISHA as their most trusted source of data, when compared with other sources.

Table 2-9: Up to date

Up to date	Count	%
Empty	2	9,09%
Quiet fast	6	27,27%
Slow	9	40,91%
very slow	4	18,18%

Comment

The update of the information in MISHA SRD is quiet slower, 27.27% of the population's sample estimate that the current system is quiet fast.

Table 2-10: Consistency

Missing Data	Count	%
Empty	2	9,09%
No	6	27,27%
Yes	13	59,09%

Comment

From the end-users point of view, MISHA SRD has quite a reliable way of reporting its analyses. Approximately 2/3 of the end-users who responded to this question found all necessary report they need.

III. Economy

Table 2-11: Development & maintenance cost

Cost	Count	%
Empty	15	68,18%
Cheaper	2	9,09%
Normal	3	13,64%
Very expensive	1	4,55%

Comment

Most people don't have any idea about the cost of the current application. 68.18% of the sample do not answer the question. This makes sense because most end-users do not care about the cost of the software they are using. Nevertheless, some answers have been collected from IT & Audit. 9.09% found it Cheaper, 13.64% found it Normal, and 4.55% found it very expensive. From the answers received, MISHA SRD application is running at normal cost.

IV. Control and security

Table 2-12: Security level

Security	Count	%
Strong	11	50,00%
Very Strong	2	9,09%
Very weak	4	18,18%
Weak	5	22,73%

Comment

The security of MISHA SRD is not efficient. 18.18% found it very weak and 22.73% found it weak. This means 40% of the population sample are not satisfied with the security level of MISHA SRD. It is clear that this weakness can become a threat for all the system. The research noted that all DMC-Encodeurs, and IT found it weak.

Table 2-13: Inconsistency of data

Control	Count	%
Empty	3	13,64%
Never hear about	1	4,55%
No	9	40,91%
Yes	8	36,36%

Comment

From this survey, 36.36% of the population's samples came across contradictory data within MISHA SRD.

V. Users and procedures efficiencies

Table 2-14: Enough time for performing input task

User efficiency	Count	%
Empty	1	4,55%
No	10	45,45%
Other answer	8	36,36%
Yes	2	9,09%

Comment

In this analysis, there are two departments that are making data entry: DMC-Encodeur and Treasury. From this point of view, 7/8 (or 87.5%) of data entry persons do not have enough time to do their job.

Table 2-15: Access' procedure onto the system

Data access process	Count	%
Normal	21	95,45%
Slows down the process	1	4,55%

Comment

The process established for data access is highly appreciated.

VI. Service

Table 2-16: Easy to learn or to use

User friendly	Count	%
No	1	4,55%
Yes	21	95,45%

Comment

MISHA SRD is easy to use. The research disclosures that 95.45% of end-users find MISHA SRD easy to use.

1. Operability

MISHA SRD's reporting could be easily exported to MS Excel, Rich Text Format (RTF), html, format for further analysis.

General comment from end-users

- Minimize the difference between ISHA reporting and MISHA SRD,
- Add some reporting for controlling or reconciling data, for a good follow up,
- On the first date of each month, there is a bug which raises the quantity sold and that situation doesn't help at all,
- Need to add some tools for enhancing the internal control of the system

d) Strength and weakness

From the result analyzed above, those points could be considered as strengths and weaknesses of the current application:

I. Lack of Performance

1. *Response time*: slow response time
2. *Availability*: low availability

II. Need to improve Information and data

1. *Consistency*: lack of consistency
2. *Format of reporting (Presentation)*: good presentation of the reporting
3. *Accuracy*: not accurate
4. *Reliability*: not reliable
5. *Up to date*: not up to date
6. *Consistency*: lack of consistency

III. Economy

Development & maintenance cost: normal cost

IV. Lack of control and security

1. *Security level:* not secure
2. *Inconsistency of data:* yes, it is

V. Users and procedures efficiencies

1. *Enough time for performing input task:* not enough time for data entry persons
2. *Flexibility of access procedure on:* yes, it is

VI. Good Service

1. *Easy to learn or to use:* yes, it is
2. *Operability:* yes, it is

General comment:

MISHA SRD needs to be improved.

2.5. Partial conclusion

Tableau 2-1: Strength and weakness of the current system

Strengths	Weaknesses
<ul style="list-style-type: none">✓ Format of reporting (Presentation)✓ Flexibility of access' procedure✓ Easy to learn or to use✓ Operability	<ul style="list-style-type: none">✗ Low response time✗ Low availability✗ Inconsistency of data✗ Inaccuracy✗ Low reliability✗ Not Up to date✗ Low security level✗ Not Enough time for performing input task

Source: Analysis of the questionnaire.

The table above shows that 2/3 of key indicators are not satisfied by the current system. The current application has been used basically by Commercial Direction, Financial Direction (IT Department, Treasury Department) and General Administration (Internal Audit). Throughout this chapter, the research showed that all those end-users from IT, Internal Audit, Commercial perspectives, unanimously

are aware of the weakness of the current situation, and they need its improvement. To some extent, all of these entities show the limit of the current situation.

The input errors generated by data entry persons lead to dissatisfaction of the end-users, which makes this application not reliable, not accurate, not consistent, source of customer complaints. Therefore, this is the need for improving data and information.

The next chapter will bring the remaining piece of information to answer completely the first research question.



Chapter 3: Analysis of the opportunity of a new system based on mobile application

This chapter will complete the previous one to answer the first research question by bringing the remaining piece of information, and then go on to bring out necessary elements to answer the second and third research questions: "How reliable is this system?" and "How safe or secure is this system?" respectively.

An effort will be made to analyze the opportunity of a new system based on mobile application and to describe the main purpose of mobile application. In the context of this thesis, how a mobile application can reduce the slow rate of information flow, how it can overcome the weakness of the current system, its functionalities, and implementation cost. These constitute the information needed to answer the first research question.

In addition, the thesis will be a discussion about reliability, and counter measures against failure. It will end with an assessment of security issues of this system. These paragraphs will help to answer the second and third research questions.

3.1. Definition mobile application

Literature showed that there are many definitions for mobile software. The definition given by Giguère is *"an application is mobile if it runs on a portable computing device and either always or occasionally connected to a network. This definition includes applications that run on notebook computers, personal digital assistants (PDAs) and cellphones, among others"*, (Giguère, E., 1999).

From the online encyclopedia, Mobile software are defined as those application designed to run on handheld computers, personal digital assistants (PDAs), Enterprise Digital Assistants (EDAs), smartphones and cellphones. (Wikipedia, 2009b).

3.2. Mobile application trend

The tendency of using mobile devices is growing as more users go mobile, so that many organizations are discovering that it is important to build and implement mobile software to add value to the handheld computers use by their staff.

From the online encyclopedia, *"Since the first handheld computers of the 1980s, the popularity of these platforms has risen considerably. Recent model cellphones have included the ability to run user-installed software."* (Wikipedia, 2009a).

In the same vein, Thearon W. and Bryan N., add *"Mobile devices—more specifically, personal digital assistants (PDAs)—are being shipped to more and more people around the world. A market once owned by Palm's Operating System is now a market full of devices running Microsoft Windows CE... The demand for applications to make PDAs and other smart devices valuable to companies is growing with the number of PDAs in use by corporations."* (Theoran, W. and Bryan, N., 2006).

Seven years ago, Mueller said *"The world is becoming more mobile all the time. It's nothing to see someone talking over a cell phone today—just a few years ago it was a novelty. When I first saw a Personal Digital Assistant (PDA) in 1998, I thought they might be a passing fad or a device of limited use. Today, that vision has changed significantly. Developers create applications for PDAs now that many people would have thought impossible even a year ago."* (Mueller, P., 2002)

Thus, the trend of using mobile application is keeps growing. Where the use of laptops has been cumbersome, mobile devices such as PDAs, Smartphones, cellphones are breaking down distance barriers which prevented people from accessing remotely the database system of their organization using a mobile device.

3.3. The main purpose of mobile application

Nowadays organizations are growing bigger, some of them with many branches located far away. C. de Wijs observed that, *"Computerized information systems form a crucial part of modern organizations"*, (Wijs, C., 1995). He is talking about information system that involves hardware, software, application, database and network.

BRALIMA sees the importance of this trend of availability and accessibility of information remotely by users using mobile devices. The main concept that BRALIMA sees behind this mobile application is the accessibility and the availability of the database from outside the brewery by salespersons and Sales Representatives.

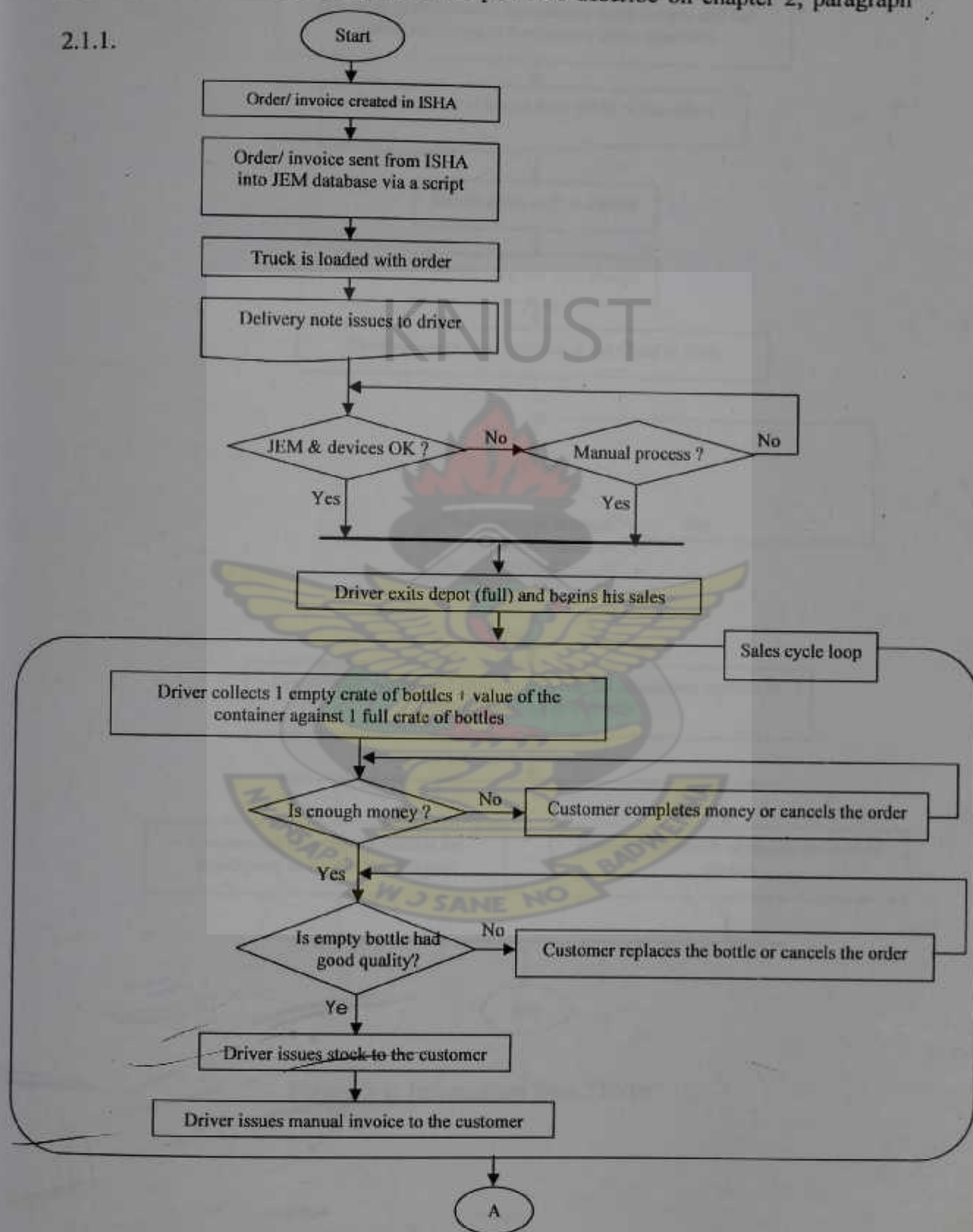
Certainly, mobile applications are able to provide the solution which will allow drivers equipped with personal digital assistant (PDA) in which software is installed, to compute data into the server and print invoices to customers using wireless printer.



3.2.1. Information flow

BRALIMA information flow will change by using the new process. Below are the new flow which can be compare to the previous describe on chapter 2, paragraph

2.1.1.



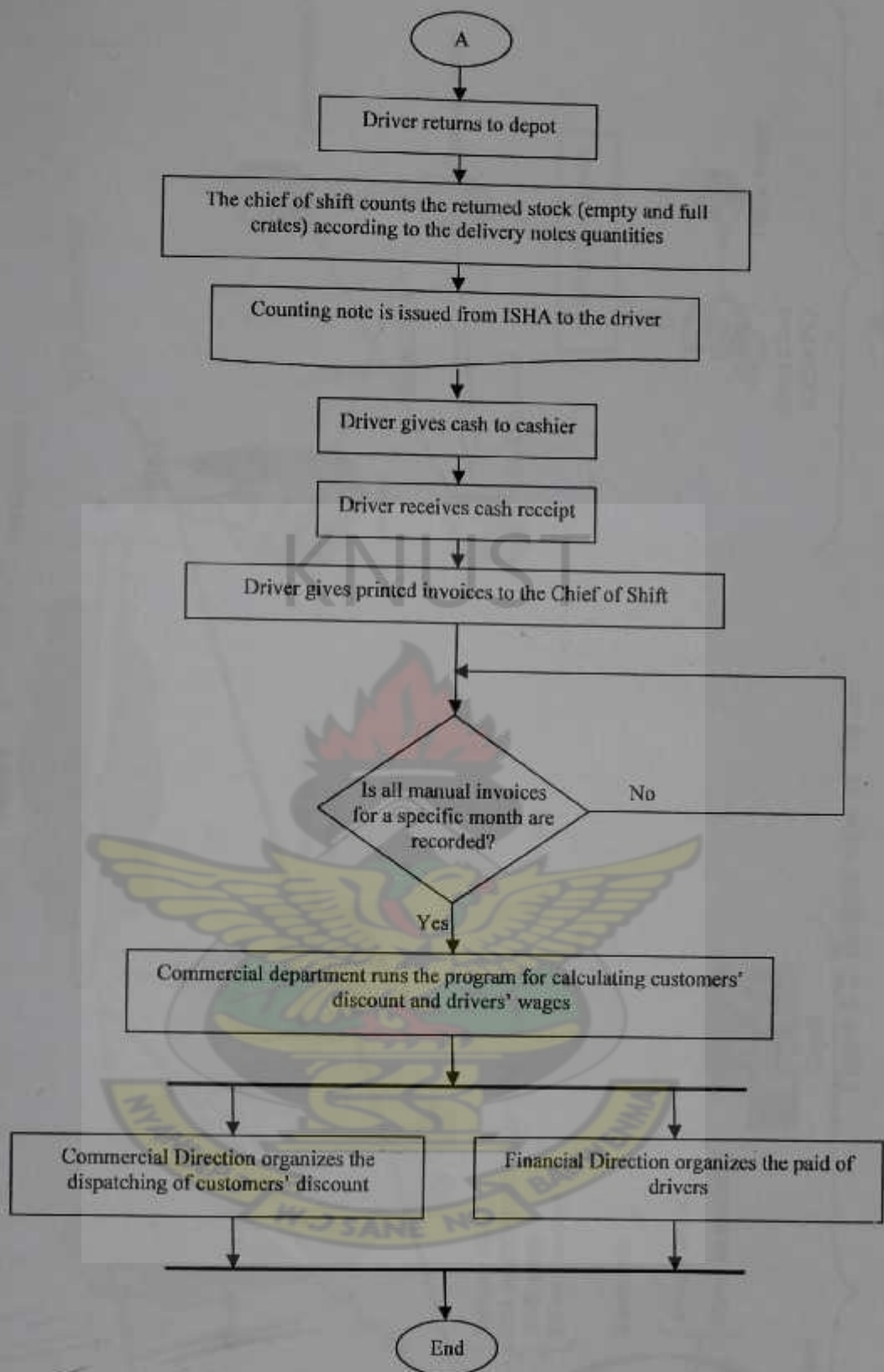


Figure 3-1: Information flow "To be"

3.2.2. Holistic view of "To be"

The images below describe how the new system is working from the customer side to the brewery via telecom support (GPRS, VPN, APN). Vehicles are equipped with onboard PDA and wireless printers for input data and printing invoices. Data is stored into PDA's SD memory and sent to the database server using GPRS/VPN support or Wi-Fi connection when the drivers get to the brewery.

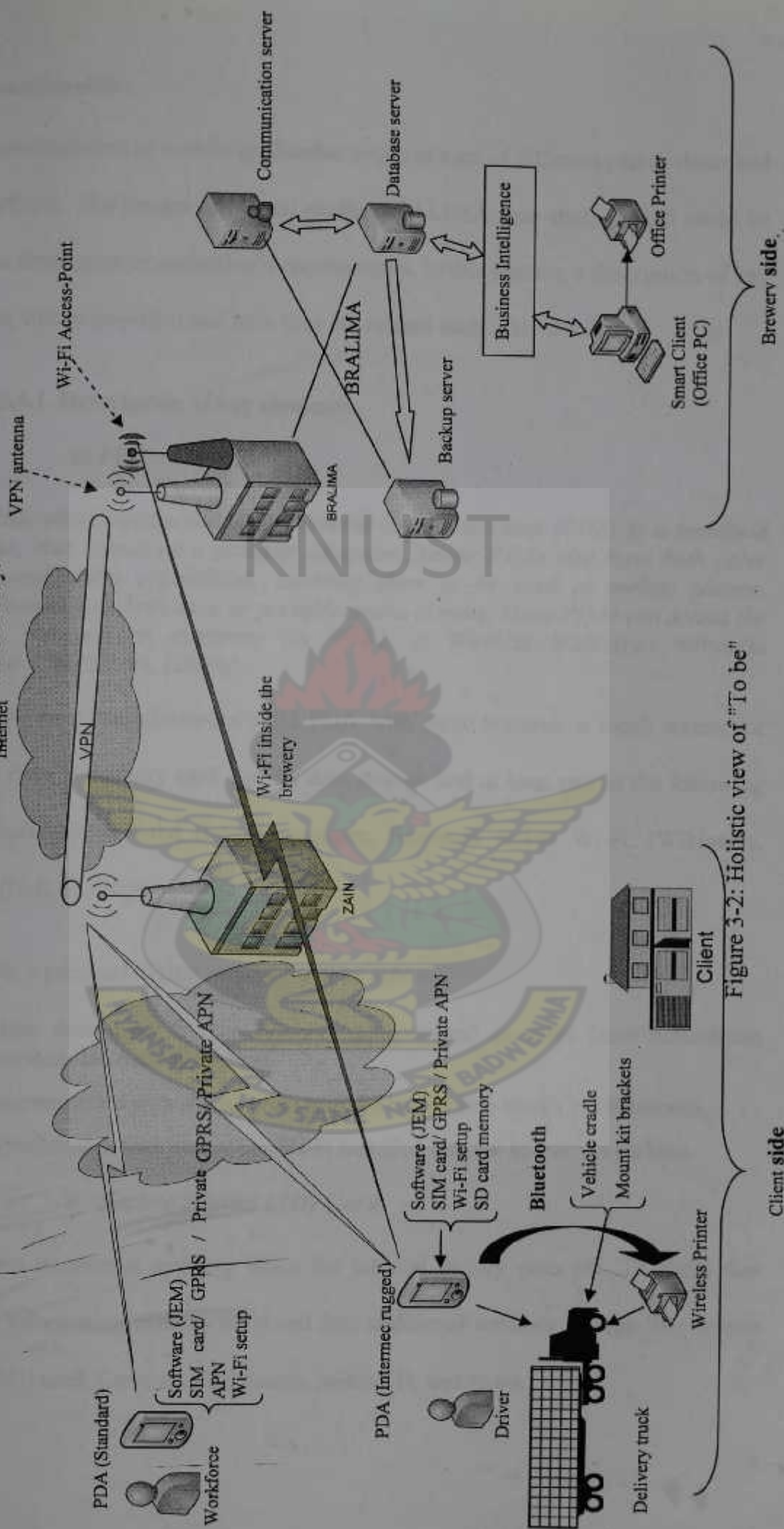


Figure 3-2: Holistic view of "To be"

3.4. Functionalities

The implementation of mobile application requires a set of different part as described in Figure 3-2. The images are based on the BRALIMA case study, which could be different from other organization's requirements. In this section, a description of key elements will be provided and how they are related each other outlined.

3.4.1. Description of key elements

a) PDA

The online encyclopedia states "*A personal digital assistant (PDA) is a handheld computer, also known as a palmtop computer. Newer PDAs also have both color screens and audio capabilities, enabling them to be used as mobile phones, (smartphones), web browsers, or portable media players. Many PDAs can access the Internet, intranets or extranets via Wi-Fi, or Wireless Wide-Area Networks (WWANs).*" Wikipedia, (2009c).

Nowadays most manufacturers build PDA with these features: a touch screen for entering data, a memory card slot for data storage and at least one of the following for connectivity: Infrared Data Association, Bluetooth and/or Wi-Fi. (Wikipedia, 2009c), (Hall, R., 2006).

Therefore, a personal digital assistant will be able to:

- store data input by the drivers (salespersons) or sales force automation persons into a memory card,
- communicate with the wireless printers loaded into trucks via Bluetooth,
- Synchronize with server via Wi-Fi installed into the brewery's parking.

➤ Secure Digital (SD) Card

PDA loses its storage memory when the internal battery goes off. To avoid this incident, information need to be stored into additional memory storage like Secure Digital (SD) card, Compact Flash cards, micro SD, and so on.

➤ *Connectivity models*

The PDA's access to the back office is done through some types of network connection. They are two modes of connectivity which describe how an application connects to its server:

- ❖ *Always connected* model: the application can not function without connection with the server. Therefore, the accessibility of the server is critical for the execution of the application,
- ❖ *Occasionally connected* model: such application works primarily on the offline mode. The connection with the server could be done occasionally according to some schedule. It needs the connection with the server for synchronization, so the server is somewhat optional.

➤ *Subscriber Identity Module (SIM) card*

A smart card inserted into a mobile phone that holds personal information relating to the subscriber such as the subscriber's PIN (Personal Identifier Number) number or stored phone numbers, ("SIM card", DVD, 2007).

b) Wi-Fi (Wireless Fidelity)

Wi-Fi is a commonly used wireless network in computer systems to enable connection to the internet or other devices that have Wi-Fi functionalities. Wi-Fi networks broadcast radio waves that can be picked up by Wi-Fi receivers attached to different computers or mobile phones. Therefore, PDAs can synchronize with the server using Wi-Fi connection instead of using USB connection, for instance.

(Outmesguine, M., 2004)

c) Wireless printer

This project uses mobile printers, easy-to-carry, which are able to communicate with the PDAs via Bluetooth technology. Therefore, there is no need to link PDA and printer with a cable.

d) Bluetooth

The Bluetooth is a trademark for a wireless technology that enables devices such as portable computers, mobile phones, and portable hand-held devices to connect with one another other and to the Internet. (Gehrmann, C. et al. 2004)

e) Local telecommunication supplier

The local telecom supplier selected for this project is ZAIN. ZAIN is a telecommunication company running business in Democratic Republic of Congo since 2001 and BRALIMA signed different contracts with her, for example Voice communication for BRALIMA staff, CSD and GPRS for truck tracking project. The results so far are satisfactory for those abovementioned contracts. That justified the choice of ZAIN services for the Billing System project. Currently, ZAIN is able to provide EDGE service to BRALIMA. It is a better technology than GPRS for transferring data from a mobile device to a remote server.

➤ *General Packet Radio Service (GPRS)*

GPRS is a specification for data transfer on Time Division Multiple Access (TDMA) and GSM networks. GPRS utilizes up to eight 9.05Kb or 13.4Kb TDMA timeslots, for a total bandwidth of 72.4Kb or 107.2Kb.

GPRS is based on Global System for Mobile (GSM) communications and complements existing services such as circuit switched cellular phone connections and the Short Message Service (SMS). GPRS enables packet data (the same as is used by an Ethernet LAN, WAN or the Internet) to be sent to and from a mobile station – For example, mobile phone, PDA or Laptop.

Circuit switching is a type of communication in which a dedicated channel (or circuit) is established for the duration of the transmission.

Packet switching is a type of communication in which the message is divided into packets, and then each packet is sent individually. The packets may take different routes and may arrive out of order, each packet has its sequence number to facilitate the re-ordering process in the receiver and in case of error in some packet, only this packet will be re-sent. (Vasko, F., 2007)

This GPRS technology will allow the mobile application installed in PDA to be run over the internet via local communication supplier, ZAIN for this case.

➤ *Enhanced Data rate for GSM Evolution (EDGE)*

EDGE is a specification for data transfer on GSM networks. This technology features both EGPRS (Enhanced General Packet Radio Service) and ESCD (Enhanced Circuit Switched Data). EGPRS based on a packet capability, and ESCD based on a circuit switched capability.

EDGE is an update to GPRS. EDGE packs up to 69.2Kbps into eight timeslots, for a total theoretical bandwidth of 473.6Kb. With increase of bandwidth, the application installed into PDA should run faster than using GPRS technology.

➤ *Private Access point Name (APN)*

An APN identifies an external network that is accessible from a mobile terminal. (Wikipedia, 2009d). A private APN makes the network much secure for the company. Most service providers have an internet portal which they connect to a DHCP server to give access to the internet. For example ZAIN DRC uses the APN 'internet' for its portal.

f) *Virtual Private Network (VPN)*

A VPN is private and secure network constructed within a public network, such as the global Internet. The VPN provides a secure remote access to the Organization's network via the Internet (which is not secure).

g) *Smart client or Workspace*

The smart client refers to user interfaces (desktop or laptop) that they can access mobile database server without the use of PDA. For instance, in consulting reports, users do not need PDA to access the database server. Therefore they can have access through a PC or a Laptop.

h) Business Intelligence

Business intelligence is the gathering of relevant and accurate information, that is stored to enable rapid access for analysis purposes to improve an organisation's ability to make effective decisions quickly. (Pretorious, 2007).

3.4.2. How the new system works

The following is a rough description of how this new system works. A SD card has been placed in each PDA where software for managing sales has been installed. A SIM card has been placed in each PDA where the functionality of GPRS or EDGE has been activated and a private APN set up to enable the PDA to connect via Internet to the ZAIN facilities more safely. The IP address of the database server is set up in each PDA for connection purposes. Into the truck, a wireless printer is fixed which communicate with PDA software via Bluetooth technology. This allows drivers to print out invoices to customers.

A VPN is created between the ZAIN office and the BRALIMA one to enhance security traffic between both points. There are two ways for synchronizing data with the database server from the PDA: via GPRS/EDGE connection or via Wi-Fi connection.

- ***Via GPRS/EDGE***

A router is placed in the BRALIMA office which plays the role of gateway and is the access point for data traffic coming from PDA. The range of IP address used by PDAs is not in the same range as that of BRALIMA LAN.

- *Via Wi-Fi connection*

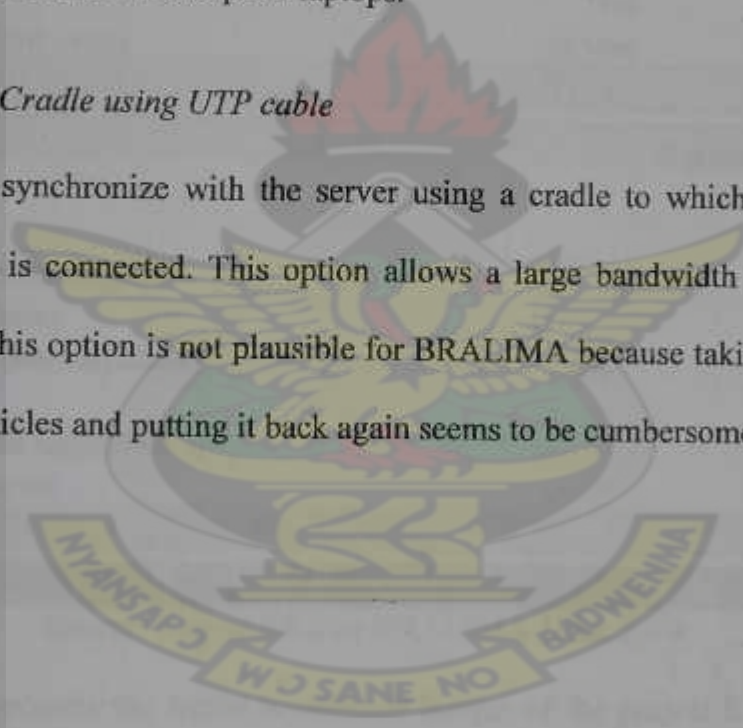
Using a Wi-Fi antenna, a router is placed in BRALIMA office which plays the role of gateway. The range of IP address used by PDAs is not in the same range as that of BRALIMA LAN.

Data input by drivers is raw therefore not much relevant for analysis. Reports are built using Microsoft reporting service to enhance data analysis.

End-users who are working in offices, do not need PDA to access the database. On the other hand, they use smart client interface that means they will access the database server via their desktops or laptops.

- *Via Cradle using UTP cable*

The PDA can synchronize with the server using a cradle to which a Local Area Network cable is connected. This option allows a large bandwidth (100 Mbits/s). Unfortunately this option is not plausible for BRALIMA because taking off hundred PDAs from vehicles and putting it back again seems to be cumbersome.



3.5. Implementation cost

Table 3-1: Initial investment budget

Sales representatives and sales trucks - Enterprise onsite configuration			
Server license	Quantity	Budget (USD)	
Core	1	37 500.00	
Sales Ordering	1	6 250.00	
Total		43 750.00	
User licenses	Unit Price	Quantity	Budget (USD)
Managers	743.75	18	13 387.50
Core (Mobile users)	368.75	145	53 468.75
Sales Ordering	93.95	70	6 562.50
Dynamic Market Intelligence	93.95	75	7 031.25
Trade Marketing / Channel strategy	93.95	75	7 031.25
Total			87 481.25
Implementation	Unit Price	Hours	Budget (USD)
145 users	100	1286	128 600.00
Interface ISHA2JEM (Atos)	74 350€		96 655.00
Total			225 255.00
Hardware	Quantity	Budget (USD)	
Server	1	23 125.00	
MS Licences	2	12 500.00	
Mobile PDA (Intermec rugged)	70	122 335.68	
Mobile Printer (Zebra)	70	76 094.90	
Mobile hardware (non-ruggedized)	75	30 000.00	
SD cards	145	4 531.25	
Silicon Puches (non-rugged PDA's)	75	2 343.75	
SIM Cards/ Activation	145	1 812.50	
Total		272 743.08	
Grand total		629 229.33	

Source: Project Charter BRALIMA-JEM, 2008.

The table 3-1 presents the initial investment budget of the project for 145 users of mobile application. The implementation of the project required several components such as server acquisition, Operating System license, mobile devices, and mobile printers.

Table 3-2: Monthly cost of Billing System after Go Live

Heading	Cost (US \$)	Qty	Total (US \$)
IT Support	200	2	400
Data entry person BRALIMA	350	0.5	175
Software License	1,240	1	1240
GPRS	10	100	1,000
Printer papers	72	100	7,200
			10,015

Source: Human resources paid Office, Logistic Department, and IT Department

3.6. Cost benefit analysis

The cost benefit analysis is based on monthly operating cost of both systems: the old and the new one. Table 2-2 gives the monthly cost of MISHA SRD and Table 3-2 that of the Billing System after Go Live (fully implemented). The operation cost of the latter system is reduced roughly from \$12,900 to \$10,015 with a \$2,885 gain per month.

On the surface, this benefit looks insignificant when compared to the investment cost. However, the fraud reduction, capturing errors reduction, customer satisfaction, and faster availability of data for decision-making, the difference is very substantial. As introduced on chapter 1, SRD channel of distribution constitutes up to 60% of BRALIMA Kinshasa sales.

Kinshasa EBIT for 2008 describes in table 3-3 below shows that up \$17,531,011 BRALIMA incomes came through SRD channel of distribution.

Table 3-3: SRD channel of distribution EBIT in 2008

Kinshasa EBIT in 2008	Up to \$ 28,275,825
SRD Channel share in 2008	Up to 62%
Therefore SRD channel EBIT in 2008	Up to \$17,531,011

Source Kinshasa EBIT: Evaluation Cadre BRALIMA 2008

3.7. Confidentiality, Integrity, and Availability of the system

Through this section, attention will be paid to confidentiality, integrity and availability of data. These are represented on figure 3-3 as the tenets of the three fundamental principles of information security. All of the information security controls and safeguards and all of the threats, vulnerabilities, and security processes are subject to the CIA yardstick. (Krutz, R. & Dean, R. ,2003).

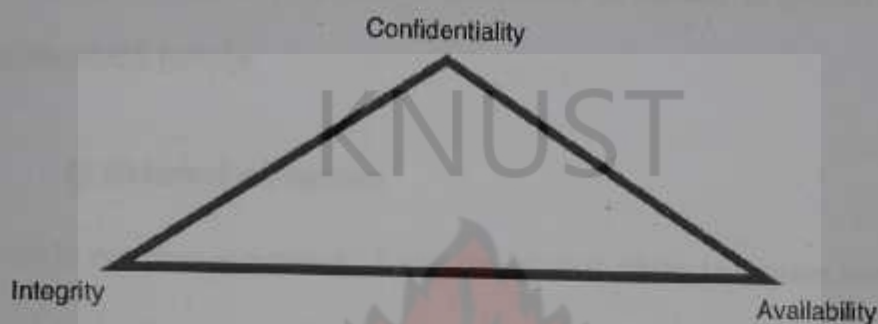


Figure 3-3: The C.I.A. triad

This section, the answers to the second and third research questions which are “how reliable is the system?” and “how safe or secure is this system?” will be found.

3.7.1. Confidentiality of data

According to Krutz and Dean, *the concept of confidentiality attempts to prevent the intentional or unintentional unauthorized disclosure of messages contents.* (Krutz, R. & Dean, R. 2003)

According to the New Encyclopaedia Britannica, *Security is another important database issue. Data residing on a computer is under threat of being stolen, destroyed, or modified maliciously. This is true whenever the computer is accessible to multiple users but is particularly significant when the computer is accessed over the network.* (The New Encyclopaedia Britannica, 2007).

~~In~~ this study, confidentiality of data must be prevented at two levels: internal and external.

a) Internal prevention

The use of login and password for authentication constitutes the first line of checking whether a user is authorized or not to access the database. The Administrator of database has the responsibility of creating user accounts according to the roles and permissions they are supposed to use in running the application. The restriction of roles and permissions as much as possible is important to reduce risk of data confidentiality and integrity. A physical prevention is needed to protect the server against unauthorized people.

b) External prevention

The software is run over a network. From the holistic view, two main inter-sections are distinguished: from the PDA to ZAIN Centre and from ZAIN Centre to BRALIMA LAN.

- At the first inter-section of PDA-ZAIN, the risks are mitigated by the use of Private Access Point Name.

If a Private APN is to be used, SIMS will need to be registered with the service provider in order to connect to the APN which will then provide a very high level of security. (Wikipedia, 2009d), (Anon, 2003).

- At the second inter-section ZAIN-BRALIMA LAN, the risks are mitigated by the use of VPN with IPSec which encrypt data and reduce or avoid eavesdropping or any disclosure of data in plain texts. IPSec services allow for authentication, integrity, access control, and confidentiality. With IPSec, the information exchanged between remote sites can be encrypted and verified. Both remote access clients and site-to-site VPNs can be deployed using IPSec. (Vijay, B., 2005). The security services that IPSec provides require shared keys to perform authentication and/or confidentiality. (Doraswamy, N., 2003).

➤ The PDA could be connected straight to the server (BRALIMA LAN) via Wi-Fi. The Wi-Fi could consist of a weak point of the network. According to Bruno Kerouanton Wi-Fi security problems (confidentiality, integrity) had been solved successfully. Therefore the implementation of the Wi-Fi for enterprise could be done without fear of this aspect. (Kerouanton, B., 2006). In fact, a proper setting of the Wi-Fi device could mitigate significantly the risk of intrusion by unwanted users for instance:

- *Disable the SSID broadcast:* to avoid Wi-Fi APN be visible at any device fitted with Wi-Fi connectivity. If the SSID is disabled, someone can be covered by your Wi-Fi, but their will not notice that, unless if the person use software which sniff for detecting Wi-Fi signal. However, their can even not try how strong your Wi-Fi setting is.
- *Strong password:* nowadays there is much software that tries to break down the security of the Wi-Fi by discovering fraudulently the Administrator's password. Among technologies used, there is *Dictionary-building attack*, (Krutz, R. & Dean, R. 2003), which tests every single word of the dictionary against the password. Therefore, the password should not be simple to find by the program. It should be long, mixed upper, lower cases, special characters and numerical characters; not a word who can be found in a dictionary. It is very important to change this password after each specific period.
- *Filter MAC addresses,* allow only MAC addresses of your own devices. Each PDA has its own MAC address that is unique; the Wi-Fi could be set up such that only those MAC addresses can be allowed to access the network. This enhances the security of the Wi-Fi network. But do not rely on this 100% because they are software which can spoof those MAC addresses and attribute them to other devices which not belong to your network.

- *Choice of specific channel*, Wi-Fi antenna can broadcast waves at different frequencies, but usually the Administrator of the network leaves this set up as it is by default. Consequently: many devices can access the Wi-Fi network. Therefore, if the Wi-Fi waves are broadcasting at a specific frequency, only devices that are set up at this particular frequency can access the network. This reduces the number of people who could harm the system.
- *Sometime fixed IP address in opposition with the DHCP*, when the IP addresses of devices are fixed, the Network Administrator could allow only those IP to access the network. On the other hand, if a DHCP server is used, any device in that area could request an IP address and the DHCP server can give it to the device. Consequence: many devices will have your range of address, so they can access your network.

Throughout this section, the research shows that the prevention measures considered seem to be strong enough to protect the system against unwelcome users.

- GPRS connection is secure by the use of private APN to ensure the security between PDA and ZAIN, on the other hand, the use of Virtual Private Network with IPSec encryption is used between ZAIN and BRALIMA.
- Wi-Fi connection security is enhanced by a proper setting (filtering MAC addresses, filtering IP addresses, disabling SSID, choosing a specific channel of broadcasting, strong password, etc.).

Therefore, the security improvement needs to follow up the trend of technology for the purpose of enhancement. Thus, the third research question found its answer here

by concluding that the mobile application is secure and safe. The following section will focus on the integrity of data.

3.7.2. Integrity of data

Krutz, R. and Dean, R., in *The Certified Information Systems Security Professional (CISSP) Prep Guide: Gold Edition* claim that *The concept of integrity ensures that:*

- ❖ *Modifications are not made to data by unauthorized personnel or processes*
- ❖ *Unauthorized modifications are not made to data by authorized personnel or processes*
- ❖ *The data are internally and externally consistent; in other words, that the internal information is consistent among all subentities and that the internal information is consistent with the real-world, external situation, (Krutz, R. & Dean, R. 2003).*

The New Encyclopedia Britannica wrote this about data integrity "*In general, the integrity refers to maintaining the correctness and consistency of the data*". (The New Encyclopaedia Britannica, 2007).

Data owners are primarily responsible for determining data sensitivity or classification levels. They can also be responsible for maintaining the information's accuracy and integrity. (Krutz, R. & Dean, R. 2003).

In this case of Billing System project, the Commercial Direction who is the data owner is responsible for determining the sensitivity of data and prepares the access right for users, so that roles and responsibilities of each user will be determined in the *segregation of duties* concept.

The Information Technology Department, as support, will guide the Commercial Direction on setting up these policies to enhance security and reduce threat due to high user permission.

3.7.3. Availability of the system

The reliability of computing information is often discussed in terms of the *availability* of a specific information technology (IT) service or system. (Lynda, M. et al., 2003). A system which is 98 percent available means that it is on average high and ready to use 98 percent time.

According to Ronald L. Krutz & Russel D. Vines, "*The concept of availability ensures the reliable and timely access to data or computing resources by the appropriate personnel. In other words, availability guarantees that the systems are up and running when needed*". (Ronald L. Krutz & Russel D. Vines, 2003)

The tolerance of availability rate or business outage can vary based on system and situation. Downtime that occurs in a large portion of time might be more of a problem than the same total amount of downtime occurring in a small portion of time. For instance, a two-hour outage of Internet connection every four days might be more of a problem than the same amount of downtime which does not exceed three minutes for the same period.

The availability of a system depends on different components and the way they are linked to one another.

a) *The availability of components in series*

Let us assume that a system is composed of 5 components combined in series as described by Figure 3-4 below, and each component has a probability of 98% to be up during a specific period. If the probability that the *component_i* to fail is independent of the *component_j*, ($i \neq j$), then the availability of the system is given by the probability of availability of component 1 and component 2 and component 3 and component 4 and component 5 which could be expressed mathematically by:

$$\begin{aligned} P_{\text{System}} &= P_{\text{Component 1}} \times P_{\text{Component 2}} \times P_{\text{Component 3}} \times P_{\text{Component 4}} \times P_{\text{Component 5}} \\ &= 0.98 \times 0.98 \times 0.98 \times 0.98 \times 0.98 \\ &= 0.90 \end{aligned}$$



Figure 3-4: Availability of components in series

When components are combined in series, the availability of the total system is lower than each component as demonstrated above. The overall service available is 90% whereas each component has 98% availability. More components are combining in series, less than the availability of the total system is.

b) The effect of redundancy on availability

Let us assume that we have 5 components connected in *parallel*, and each of the components can perform individually the task required, in addition if the same probability of availability is considered as mentioned in the previous case to 98% availability. It means that the probability of failure of each component is 2%. Therefore by the same reasoning, the probability of failure of the system is given by the probability of failure of the component 1 and component 2 and component 3 and component 4 and component 5 expressed mathematically by:

$$\begin{aligned}
 P_{\text{System}} &= P_{\text{Component 1}} \times P_{\text{Component 2}} \times P_{\text{Component 3}} \times P_{\text{Component 4}} \times P_{\text{Component 5}} \\
 &= 0.02 \times 0.02 \times 0.02 \times 0.02 \times 0.02 \\
 &= 0.0000000032
 \end{aligned}$$

Therefore, the probability of the availability of the system is given by:

$$\begin{aligned}
 P_{\text{System}} &= 1 - 0.0000000032 \\
 &= 0.9999999968
 \end{aligned}$$

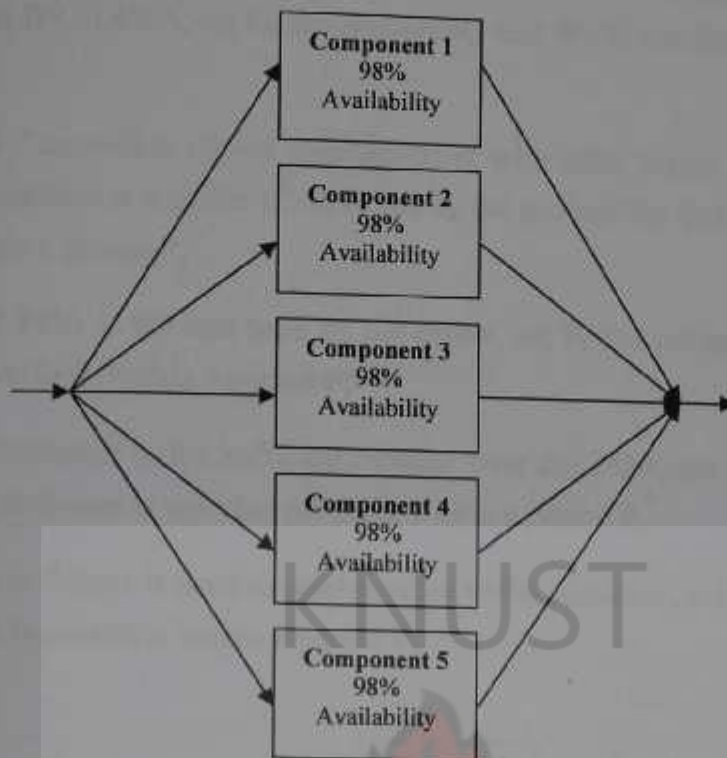


Figure 3-5: Availability of component in parallel

The general availability of these components combined in parallel is higher than the availability of each component. (Lynda, M. et al., 2003).

c) The availability of the Billing System

The availability of the Billing System is determined by the availability of the different components which are involved in its running process. Figure 3-6 below presents the different components and how they are linked to each other.

- A: ISHA which is the BRALIMA Integrated System from which delivery notes are issued, set P_A the probability that ISHA is available within a period P ,
- B: ISHA2JEM is an interface between ISHA and JEM is a program that collects the delivery notes from ISHA database and sends them to JEM database, set P_B the probability that the interface ISHA2JEM is available within a period P ,
- C: JEM Server is the server where JEM database is located; set P_D the probability that this server is up within a period P ,

- D: the Wi-Fi connection allows synchronizing with JEM database via Wi-Fi devices set up into BRAIIMA, set P_D the probability that Wi-Fi connection is up within a period P ,
- E: the GPRS Connection allows synchronizing with JEM Server database via local telecommunication supplier (ZAIN), set P_E the probability that GPRS connection is up within a period P ,
- F: the rugged PDA is the one used by the driver, set P_F the probability that Rugged PDA is available within a period P ,
- G: the JEM Software is the software running over the PDA, set P_G the probability that JEM Software is working properly within a period P ,
- H: the Wireless Printer is used to print invoice to the customer, set P_H the probability that ISHA is available within a period P ,



Figure 3-6: Billing system components relationship

Set P_{BS} , as the availability of the Billing system within a period P ; this availability is given by:

$$P_{BS} = P_A \times P_B \times P_C \times (1 - P_D \times P_E) \times P_F \times P_G \times P_H$$

The result of the test period from 24/04/2009 to 21/05/2009 showed that:

$P_A = 0.9957$; $P_B = 1$; $P_C = 1$; $P_D = 0.8853$; $P_E = 0.0223$; $P_F = 0.9125$; $P_G = 0.9046$; $P_H = 0.9949$. See Appendix E for details.

$$\begin{aligned} \Rightarrow P_{BS} &= 0.9957 \times 1 \times 1 \times (1 - 0.1147 \times 0.9777) \times 0.9125 \times 0.9046 \times 0.9949 \\ &= 0.7260 \end{aligned}$$

d) Risk management

According to Dieter Gollmann, *"in a discussion of security, there are several reasons for mentioning other areas of computing like reliability, relating to (accidental) failures..."*. (Dieter, G., 2006).

The IPMA Competence Baseline (ICB) quoted by Hedeman, B. defines risk as *"the possibility that the project is not realised conforming to the objectives and the external conditions"*. (Hedeman, B. et al., 2006)

The following section aims to describe the accidental failures which could occur and how these could be handled.

Risk management is an activity directed towards the assessing, mitigating (to an acceptable level) and monitoring of risks. In some cases the acceptable risk may be near zero. Risks can come from accidents, natural causes and disasters as well as deliberate attacks from an adversary. (Wikipedia, 2009e).

To reduce risk to level zero is quite difficult and can be very expensive. This management aims to mitigate risk to tolerable levels. At this stage, the study will discuss risk identification, risk analysis and response planning.

❖ Risk identification

It is important to know which risks are likely to affect the BS & SFA project and how they can be handled. To facilitate risk identification, a description approach of project functionalities and components will be used.

- Hardware

- Rugged PDA frozen, charging failure (or down time)
- Rugged PDA stolen or lost,
- Printer charging failure, losing setup
- Printer stolen or lost
- Printer lack of paper

- Software

- ISHA database failure,
- JEM database failure,
- Interface between ISHA and JEM failure,
- Dysfunction of JEM installed into PDA

- Communication

- Lack of communication between PDA and BRALIMA: ZAIN GPRS/APN/VPN failure,
- Lack of communication between PDA and BRALIMA: Wi-Fi downtime,
- Lack of communication between BRALIMA and Frankfurt: T-System failure

- People

- Lack of user involvement
- Lack of executive management support
- Unclear statement of requirements
- Lack of competent staff
- Unrealistic expectation
- Improper planning

- Economic

- Excessive budget
- Project scope creeping

❖ **Risk analysis**

Risk analysis is the process of assessing qualitatively or quantitatively risks or uncertainties. This involves an estimation of both the uncertainty of the risk and of its impact on the project. (Schwalbe, K., 2007).

Since, Billing System like any project involves resources, it is reasonable to carry on a risk analysis.

The use of probability and impact matrix will help to illustrate risk rating assignment for identified risks. To do so, every risk is rated according to its probability of occurrence during the project life time and its impact upon the project objective.

Section 1: Hardware

In the current situation, high and medium risks concerning the availability of Billing system & Sales Force Automation are identified as follows:

1. Rugged PDA used by drivers could be lost, frozen or these could be, flat battery (any rugged PDA downtime),
2. Standard PDA used by sales force person could be lost, broken, frozen, or experience flat battery (any Standard PDA downtime),
3. Printer used by drivers (salespersons) could not be working (charging problem, setting loss)
4. Printer could be stolen or lost during the journey
5. Printer could lack paper

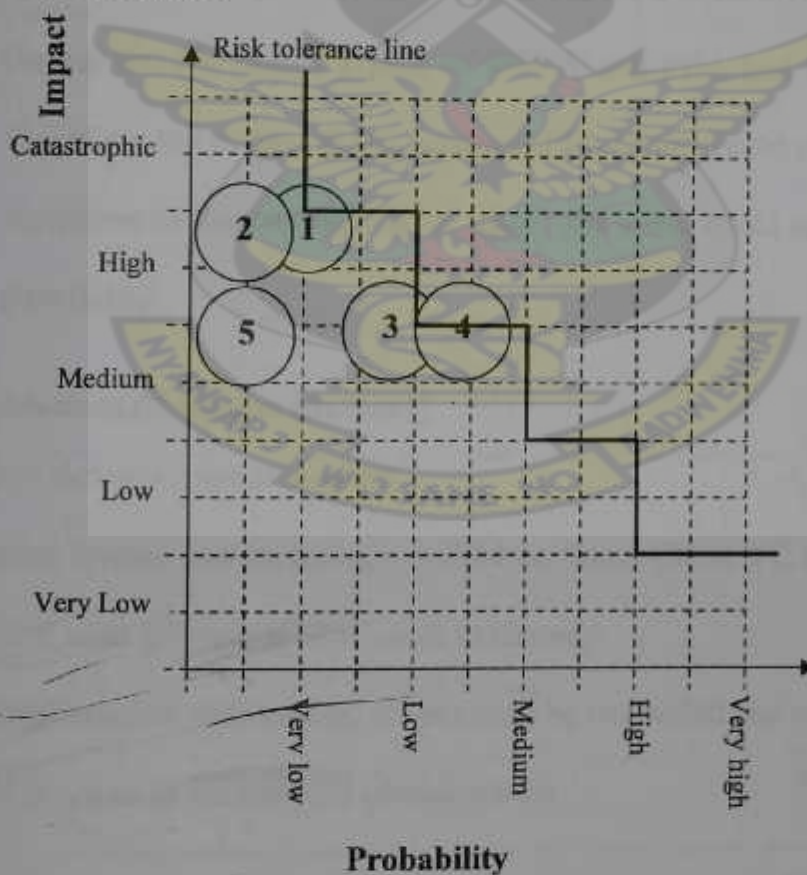


Figure 3-7: Hardware probability - Impact matrix

Source: Based on OGC-source, quoted by Hedeman, B. et al. (2006).

1. From the experimental period it is shown that the rate of frozen PDAs reached 20% a day.

Rugged PDA down time involves manual invoices that are a critical point for BRALIMA business because, manual invoices involve backlog input from data entry persons and constitute a source of errors, customer complaints, and delay in decision making, as describe in Chapter 1.

The probability of PDA being stolen is lower because of all security dispositions in operation on that purpose. A new mount kit has been built to be adapted to Kinshasa theft levels nowadays. Secondly, PDAs were intentionally chosen rugged to fit with drivers work environment. But there is one remaining point: presently the quality of Kinshasa roads is really bad and that could involve shocks to PDA while drivers are driving. During the test phase, a pick of 20% frozen PDA had been observed. Therefore, the rugged PDAs being used by drivers could not be available regardless of disposition took in place. The event could appear with low probability.

Recommendations (Response planning)

- Driver delivers manual invoices
- Manual invoices are capturing into JEM via Smart Client (PC at office)
- Drivers must give out JEM invoices to clients,
- Manual invoices delivered by drivers must be reconciled and controlled with JEM invoices by commercial administration

2. This second point which focuses on the assumption that *Standard PDA using by sales force person could be lost or broken* concerns the Sales Force Automation part of the project where sales force persons went to customers to collect information concerning quality of services, respect of price, availability of the products, and so on.

Standard PDA downtime leads to delay on data capture and data availability on the server. It is obvious that this leads to delay in decision making.

Recommendations (Response planning)

- Change the PDA or borrow PDA from another sales force person according to superior hierarchy.
- Sales force persons capture data manually from the customer point of sales

3. This case assumes that when the driver left the brewery, his printer was working perfectly but during the day, it ran down.
4. The fourth case assumes that the printer had been lost or stolen during the day. The driver could not deliver printed invoices at that time.
5. The fifth case talks about lack of paper due to stock rupture. This case assumes that there was a delay in the BRALIMA procurement process got.

Recommendations (Response planning)

Points 3 to 5 deal with printer downtime. It is clear that the likelihood of each event occurring is different but the impact on the business is still quite the same.

This can be summarized by *printer downtime*. Below are actions which can be

taken:

- Driver delivers manual invoice,
- Data entry persons capture the manual invoice into JEM by Smart Client interface,
- Manual invoices delivered by the drivers must be reconciled and controlled with JEM invoices delivered by Commercial Administration

Section 2: Software

The current section focuses on

1. ISHA database failure
2. JEM database failure
3. Interface between ISHA and JEM failure
4. JEM software dysfunction

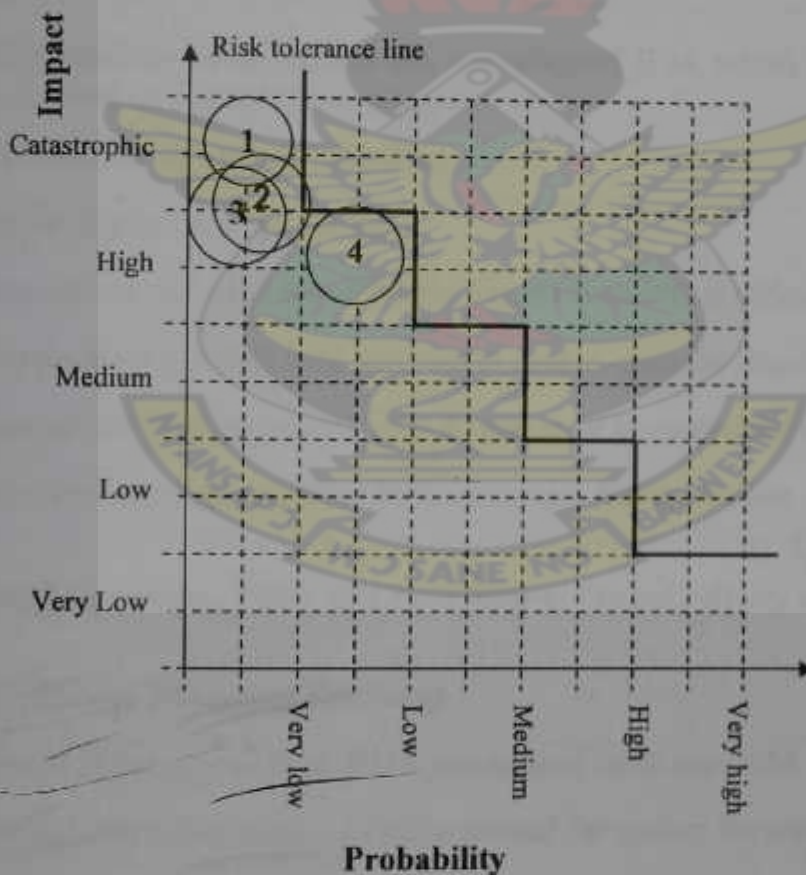


Figure 3-8: Software's probability - Impact matrix

1. **ISHA failure:** Manual Delivery Note from ISHA involves ISHA2JEM interface not available and JEM server not available for retrieving delivery notes.

Recommendations (Response planning)

- Provide an interface for manual delivery note input into JEM
- Delivery Note from JEM has to be printed and reconciled with ISHA delivery note,
- The security agent must control the printed list from JEM against the ISHA manual delivery note,
- If OK then Start Sales process with JEM device else Go back to reconcile and check again

2. **JEM database failure** means any downtime of JEM, which could be system or network or any other raisons.

Recommendations (Response planning)

- Driver delivers manual invoices
- Invoices are recorded into JEM via Smart Client (PC at office)
- Drivers must give out JEM invoices to clients, once the situation is repaired.
- Manual invoices delivered by the drivers must be reconciled and controlled with JEM invoices delivered by Commercial Administration

3. **Interface between ISHA and JEM failure:** Printed delivery note from ISHA

Recommendations (Response planning)

- Printed delivery note from ISHA and manual input into JEM
- The security agent must control the printed list against the manual delivery note,
- If OK then Start Sales process with JEM device else Go back to reconcile and check again

Section 3: Communication

1. Lack of communication between PDA and BRALIMA: ZAIN GPRS/APN/VPN failure
2. Lack of communication between BRALIMA and Frankfurt: T-System failure

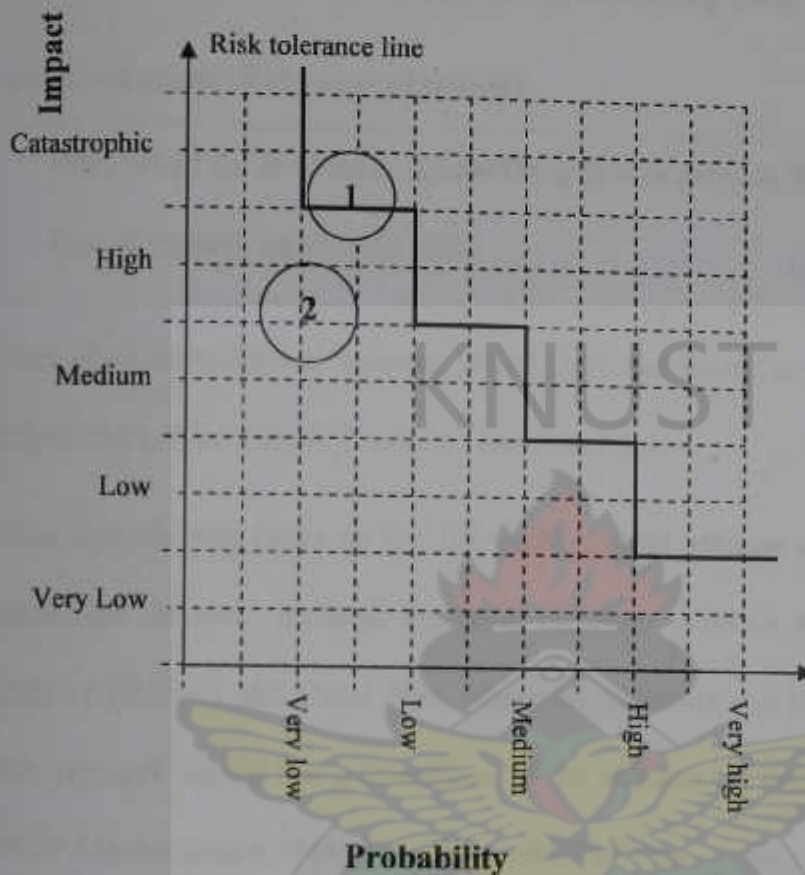


Figure 3-9: Communication probability - Impact matrix

1. The communication between PDA and BRALIMA network is provided by ZAIN.

The first service BRALIMA subscribes from ZAIN is mobile phone (Voice communication) for its staff; the second service is Circuit Switched Data (CSD) for data transfer using on Truck tracking project, the third service is GPRS for real time data transfer from trucks to BRALIMA database server used to Truck tracking project. For the Billing System project, BRALIMA also subscribes a GPRS service from ZAIN.

From the previous experience, it is important to consider downtime observed by ZAIN's services, especially GPRS service. The peak had reached three weeks, a

very serious downtime which needs a proper consideration. The BRALIMA Billing System project is more sensitive than its Truck tracking project. Therefore, a downtime of three weeks could not be tolerated by BRALIMA decision-makers. Source: Truck Tracking Server Log book, Internal

Recommendations (Response planning)

- Plan Wi-Fi for automatic upload once drivers get into Wi-Fi coverage area
- Use of manual upload via USB

2. Lack of communication between BRALIMA and Frankfurt can be at three levels: BRALIMA, BRALIMA-Frankfurt and Frankfurt.

This analysis will focus on the BRALIMA point because of availability of data. Based on Servers' Incident log book *Incidents 2008.xls* and *Incidents 2009.xls* until 16/02/2009 MS Excel files, where all incidents and problems are recorded, this research found out a downtime of 10 minutes on 06/07/2008 from 04:45 to 04:55 AM due to lack of electric power and UPS failure.

Indications are that, the link between BRALIMA and Frankfurt is already established via VSAT and works well. The last level is the availability of the system at Frankfurt site. According to BRALIMA top management, Frankfurt is much better than BRALIMA in terms of availability of the system.

Recommendations (Response planning)

- Plan a backup server into BRALIMA
- Plan daily synchronisation between Frankfurt server and BRALIMA server for making data up to date in both servers.

Section 4: People

1. No Executive management support
2. No user involvement
3. No clear statement of requirements
4. No competent staff
5. No realistic expectation
6. No proper planning

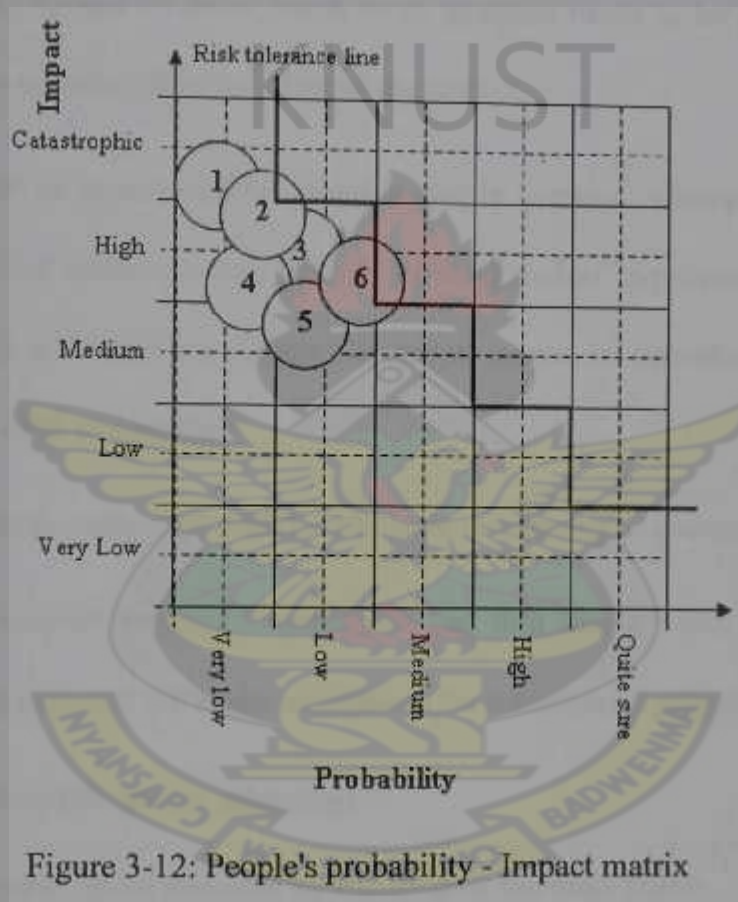


Figure 3-12: People's probability - Impact matrix

1. The support from management is a key factor in project success. Fortunately, the BRALIMA Billing System project is fully supported by the Executive management bearing in mind the impact of this project. Therefore, there is nothing to worry about.

2. User involvement is an important issue which can be considered. For this project, users are divided into three main parts:

- Drivers as main *Billing System* end-users,
- Sales Force persons as main *Sales Force Automation* end-users,
- Data analysts (decision makers) using both Billing system and Sales Force Automation parts of the project.

From these three groups of users, much more attention needs to be paid to drivers because they are considered as the heart of the project.

3. This point can be understood by asking a simple question: what could happen if the requirement statement was fuzzy? Without a clear requirement the project will be vague and therefore, difficult to operate assess, set up milestones and as a result, difficult to accomplish.
4. The project needs competent staff for effective monitoring to guarantee success.
5. The project without realistic expectations can turn into a white elephant. The project scope is one of the major constraints for a successful project.

Recommendations (Response planning)

- Avoid project scope creeping by focusing on the main points
- Focus on the main points of the project

Section 5: Economic

1. Excessive budget
2. Project scope creeping

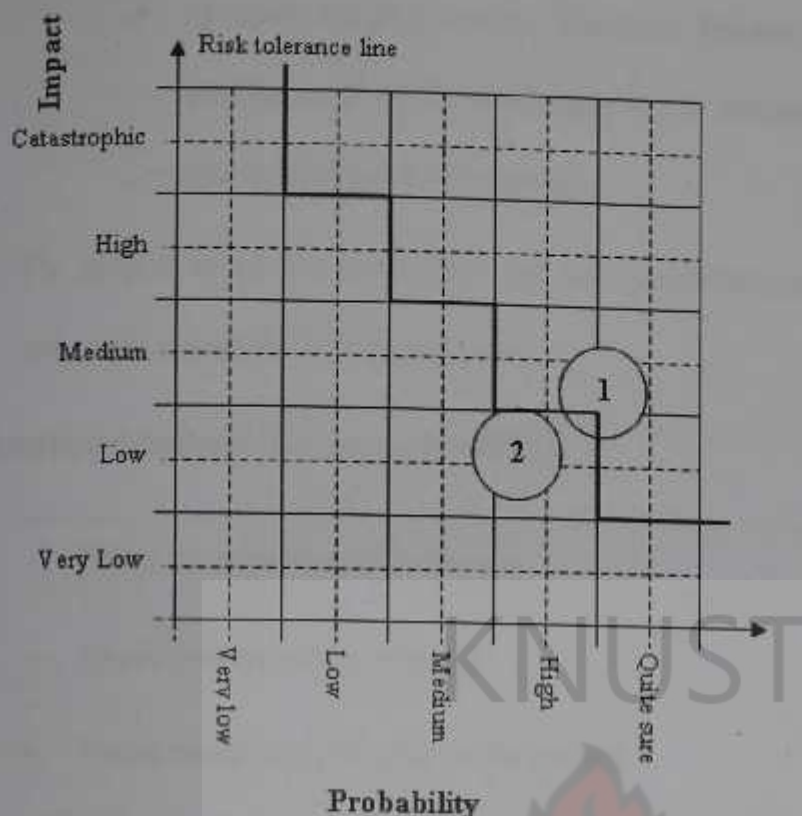


Figure 3-13: Economic's probability - Impact matrix

1. Kathy Schwalbe in *Information Technology Project Management* wrote "... many information technology project cost estimates are still very inaccurate, especially those involving new technologies or software development." This observation seems to be the case with this Billing System due to unexpected parameters that set in after the project started. (Schwalbe, K., 2007). Such as:

- ✱ Setting up the Wi-Fi in BRALIMA, which was not planned initially, involves cost for procurement of routers and Open door Antenna, cost for configuration of routers,
- ✱ Additional IT support for the project,
- ✱ Underestimating the procurement cost of hardware devices (new DRC customs rules) increased project budget,
- ✱ Scope creeping increasing development budget of the software,

- * Misunderstanding of the Business Process at the early stages of development by the third party led to reorganization of the analysis, and became time consuming.
2. The project scope had been crept and both points (excessive budget and project scope creeping) are firmly correlated.

Recommendations (Response planning)

- Better management of resources
- Avoid project scope creeping
- Focus on the original plan of the project

e) Conclusion of the availability of the system

In this section 3.7.3, a major attention has been paid to the availability of the system, which involves its reliability. The research found that the availability of the system is much more based on three things: Network, JEM software and PDAs qualities.

Upon further examination, based on the result on the field during the test phase, network problems had been split into:

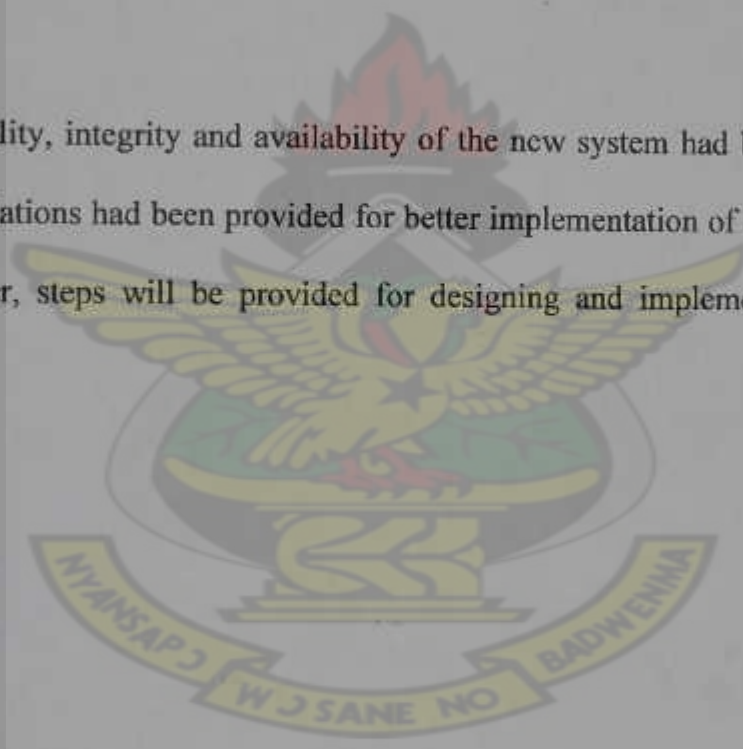
- lack of communication between PDA and server,
- long synchronization of PDA this last caused by the size of database which is growing bigger. It is found that the network problem could be improved by a proper control of the database size to retrieve from the JEM server

It is apparent that, JEM software and PDA have the major responsibility of the availability of this system. Once the software is well developed and the PDA properly handled, the project will be successful. Thus, the second research question found its answer.

3.8. Partial conclusion

Throughout this chapter, the research found that there is an opportunity of a new system for BRALIMA's drivers using PDAs in which mobile application is installed. This gives competitive advantage by reducing data entry errors which after led to customer complaints, consequently customers' disappointment with BRALIMA service quality.

The confidentiality, integrity and availability of the new system had been analyzed and recommendations had been provided for better implementation of the system. In the next chapter, steps will be provided for designing and implementing mobile application.



Chapter 4: Design and implementation of a mobile application

The design and the implementation constitute the practical part of this project. Chapters two and three, describe the critical analysis of the current system and analysis of the opportunity of a new system based on mobile application respectively.

This chapter will focus on the design and the implementation of a mobile application for a commercial company. Which of an in-house development and outsourcing the solution from a third company will be a better option for BRALIMA will be determined. In case of in-house development, we will find out the requirements (technical skills, infrastructure), while in the case of outsourcing the solution, efforts will be made to determine what steps will be followed to get the desired results.

4.1. In-house development of the solution

A company with an IT department is free to develop on its own, a mobile application to address its need. This requires a team with technical skills as well as infrastructure requirements. These are advantages and disadvantages.

4.1.1. Software Development Life Cycle (SDLC)

The development of mobile application requires phases and skills from different areas. We shall first describe the software development life cycle phase by phase. The literature shows that these are several models for software development life cycle. The following is just one way of looking at the cycle.

a) Initiation

This stage begins when a need or an opportunity is identified by a sponsor to create new software. Within a commercial company like BRALIMA, this sponsor could be the Commercial and Financial departments.

b) Software concept development

This stage defines the scope or boundary of the concept, analyses the cost/benefit, risk management, assesses required resources, and plans a feasibility study.

c) Planning

The planning stage develops a project management plan, provides a time schedule, resources availability, creates Work Breakdown Structure (WBS), sequences activities, and estimates of activities and establishes a development schedule.

d) Requirements analysis

At this stage, a business analyst works as a liaison among stakeholders in order to elicit, analyze, communicate and validate requirements for changes to business processes, policies and information systems. The business analyst understands business problems and opportunities in the context of the requirements and recommends solutions that enable the organization to achieve its goals. (Wikipedia, 2009f).

The business analyst creates a detailed functional requirements document.

e) Design

The input at the design stage is the requirements document. Each requirement has a set of one or more design elements that will be generated as an outcome of interviews, workshops, and/or prototype efforts.

Design elements describe the desired software features in detail, and generally include functional hierarchy diagrams, screen layout diagrams, tables of business rules, business process diagrams, pseudocode, and a complete entity-relationship diagram with a full data dictionary.

f) Development

This stage converts the design into complete software. The input involved at the development stage comes from the Design stage. This thesis focuses on Windows mobile applications development. Therefore, skills below are required for the development team:

- Windows Operating System
- Programming language: C Sharp (C#) or Visual Basic (VB)
- Dot Net framework for mobile application
- Web Services: defined by the W3C as "a software system designed to support interoperable machine-to-machine interaction over a network"
- Internet Information Service (IIS): a set of Internet-based services for servers created by Microsoft for use with Microsoft Windows
- Internet protocols: FTP, FTPS, SMTP, HTTP/HTTPS
- Structured Query Language (SQL)
- SQL Server: administration tasks and functionalities
- Windows CE: Windows Embedded Compact is Microsoft's operating system for minimalistic computers and embedded systems. (Anon, 2008).
- SQL Server Compact Query Analyzer

g) Integration and test

This stage shows that the development was executed according to expressed requirements. The Quality Assurance staffs and users conduct this stage, test reports and other functionalities of the software.

h) Implementation and acceptance

This stage prepares the installation into the production environment, at this point; all test cases are run to verify the accuracy and completeness of the software.

Once end-user has verified that the initial production data load is accurate and the test suite has been executed with acceptable results, the end-user accepts the delivery of the software.

i) Maintenance

The IEEE cited by (Gerardo, C. and Aniello, C., 2000), defines software maintenance as “Software maintenance is the process of modifying a software system or component after delivery to correct faults, improve performances or other attributes, or adapt to a changed environment.”

4.1.2. Infrastructure requirement

The development requires server, Wi-Fi or GPRS connection, Smart Phone or Personal Digital Assistant, in addition to Visual Studio and SQL Server software licenses.

4.1.3. Advantages and disadvantages of in-house development

a) Advantages

- Reduces the total software acquisition and implementation costs through the life cycle if skills needed to develop the software could be found internally.

(Twinomurizi, H. 2007).

- Continuity: Internal staff has a history with the firm that provides them with a better understanding of clients' businesses, strategies, people, cultures and politics.

With the expectation of continuity, people know they will be around to deal with the consequences of their actions. (Ronald, L. Krutz & Russel, D., 2003).

b) Disadvantages

- Lack of experience can lead to the deadline not being met,

- Lack of necessary skills can become a burden for the staff,

4.2. Outsourcing of the solution

The development of Windows mobile application is not a straightforward task. It involves a lot of skills as mentioned in section 4.1.1. f). Bearing in mind the complexity of mobile application development and in view of BRALIMA's urgent need for handling sales via a mobile application, the outsourcing of the solution was the better option for the implementation of the Billing System project. Outsourcing has its key advantages in cost savings and getting access to a wide variety of skills outside the domain of a business.

The focus of outsourcing is usually on the outcome and not the process of reaching the outcome. (Twinomurizini, H. 2007).

4.2.1. Choice of suppliers

The implementation of the solution requires suppliers from different areas, such as software supplier, infrastructure suppliers (PDAs, printers) and service provider. In the following paragraphs the choice contexts of each of them are described.

a) Software supplier

BRALIMA's choice of *JustEnough Management* (JEM) is based on their experience in mobile software development and proven case studies with Heineken (South Africa, Namibia, Republic of Congo). (Mizele, P., 2009).

The headquarters of JustEnough is located in the United States with offices worldwide. The one BRALIMA is dealing with is located at:

Waterford House 2,

Waterford Place, Century City,

Cape Town 7446, South Africa

Phone: +27 (21) 552-4008

Fax: +27 (86) 613-2479

Website: www.justenough.com

b) Rugged mobile hand-held terminals

The choice of rugged mobile hand-held terminals has been recommended by the software development company. From their experience so far, *JustEnough Management* software development is working well with Intermec products. *The Intermec CN3 Hand-Held terminal is the same one that has been deployed for Cadbury SA and has been in use for 18 months with flawless performance to date.* Anon, (2008b).

BRALIMA needed rugged PDA because of the working conditions of its drivers as salespersons who work in different environments; selling over cities, and serve many

clients. Bearing in mind that the PDA can fall down easily, and that the heat in truck cabs can reach 40°C, rugged PDA are designed work in harsh environments. Rugged PDAs are suitable for the Billing System project.

BRALIMA rugged PDAs are supplied by ProScan System located in South Africa. Those PDAs were delivered with English Operating System. All of them were translated into French to facilitate end-users device handling, as DRC is a French speaking country.

Proscan can be reached at:

P.O.Box 15336, Impala Park, 1462

ProScan House, 30 Derrick Coetzee Road, Jet Park, 1469

Tel: +27 (011) 397-3779 Fax: +27 (011) 397-3867

Website: www.proscan.co.za

E-mail: info@proscan.co.za



Figure 4-1 : Intermec Rugged PDA CN3

Operating System

Windows Mobile 5.0®

Microprocessor

Intel® XScale PXA270, 520 MHz

Memory and Storage

RAM Memory: 128MB

Flash ROM: 256MB

Customer-accessible miniSD slot for removable

memory cards up to 2GB

Integrated Radio Options

Wireless WAN: GSM/GPRS/EDGE
or

CDMA/1xRTT/EV-DO

Wireless LAN (standard):

Standards Compliant:

IEEE 802.11g (2.4 GHz)

IEEE 802.11b (2.4 GHz)

Data rates: Up to 54Mbps for 802.11g
ODFM.

Up to 11Mbps for 802.11b DSSS

Radio Power Output: 100mW
maximum

Security: WEP, WPA, 802.11x (EAP-
TLS, TTLS, LEAP, PEAP), 802.11i

Certifications: Wi-Fi, WPA2, Cisco

Compatible (CCX)

Wireless PAN (standard): Integrated
Bluetooth™ Class

2, V2.0 compatible module for
wireless

c) Standard PDA

As the rugged PDA, the standard PDA supplier has been recommended by the development company, JustEnough Management for the same reason as previously. The Htc TYTN II is dedicated to Sales Force Automation part of the project and supplied by Leaf International Communications (Pty) Ltd located in South Africa.

CedarSquare Shopping Centre, First Floor

Corner Cedar Avenue and Willow Avenue

PO Box 246 Randburg 2125 South Africa

Website: www.leaf.co.za

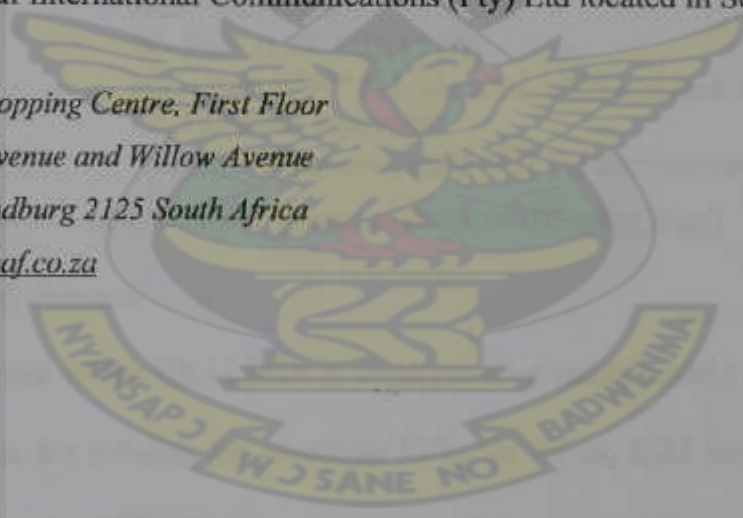




Figure 4-2: Standard PDA HTC TYTN II

Main specifications

Processor	Qualcomm® MSM7200TM, 400MHz
Operating System	Windows Mobile® 6 Professional
Memory	ROM: 256MB RAM: 128MB SDRAM
Display	2.8 inch, 240 X 320 QVGA TFT-LCD display with adjustable angle and backlight
Network	HSDPA/UMTS: Tri-band 850, 1900, 2100 MHz HSDPA: Up to 384kbps for upload and 3.6Mbps for download UMTS: Up to 384kbps for upload and download GSM/GPRS/EDGE: Quad-band 850, 900, 1800, 1900 MHz (The device will operate on frequencies available from the cellular network)
Connectivity	Bluetooth® 2.0 Wi-Fi®: IEEE 802.11 b/g HTC ExtUSB™ (11-pin mini-USB and audio jack in one) GPS antenna connector
Expansion Slot	microSD™ memory card (SD 2.0 compatible)

Source: [<http://www.htc.com/www/product/tytnii/specification.html>]

d) Printers

The Billing system which BRALIMA is implementing needs mobile device for data entry and printer for printing out customer bills. To do so, JEM recommended for BRALIMA a supplier called Barcape which provides wireless printers.

Wireless printers are the best choice for this project because of their mobility. Most important, these printers are provided with cradles which can help to fix them strongly on the truck and can absorb road shocks.



Figure 4-3: Wireless printer Zebra RW 420 and RW 220

PRINT CHARACTERISTICS

Print method: Direct thermal

Resolution: 203 dpi/8 dots per mm

Maximum print speed: 3"/76.2 mm per second

MEMORY

4 MB Flash, 8 MB DRAM

Networking and Connectivity

Bluetooth® v. 1.2

802.11b

Motorola's Symbol® Compact Flash

802.11b/g Zebra Value Radio

Native wireless security support: VPN,

WPA/WPA2, WEP, Kerberos, WPA-

PSK, EAPTLS,

EAP-TTLS, EAP-FAST, LEAP,

PEAP, 802.11i

RW 420 can be configured with dual radios

(Bluetooth and WLAN)

Environment

Meets IP54 certification

Operating Temp. -4° F/-20° C to 131°

F/55° C

Storage/Environ. -22° F/-30° C to 149°

F/65° C

Operating Humidity 10-90% non-condensing

Storage Humidity 10-90% non-condensing

Here the full address of Barcape Company:

Johannesburg

Tel: +27 (0) 11 682 1344

Fax: +27 (0) 11 682 3366

Unit 3 Bassonia Office Park,

Cnr Hans Meyer and Cussonia Drive

Bassonia Estate, Bassonia

Website: www.specsystems.co.za

e) Telecom supplier

The service provider chosen for this project is ZAIN DRC. This choice is based on its experience in telecom services and reliability of the service provided to BRALIMA to date.

f) Server

The servers are supplied by a local HP dealer. The specifications for those servers are:

Mark: HP

Model: ProLiant 150 G5

Processor: Xeon 2.5 Ghz

RAM: 4.0 Ghz

HDD: 200 Gb

4.2.2. Proof of concept

a) Definition

In the business world, "proof of concept" is a demonstration where entrepreneurs and startups demonstrate that a model or a concept is feasible.

The online encyclopedia Wikipedia defines the proof of concept as *"a short and/or incomplete realization (or synopsis) of a certain method or idea(s) to demonstrate its feasibility, or a demonstration in principle, whose purpose is to verify that some concept or theory is probably capable of exploitation in a useful manner. A related (somewhat synonymous) term is "proof of principle".*

The proof of concept is usually considered a milestone on the way to a fully functioning prototype." (Wikipedia, 2009g)

A proof of concept can refer, in software development, to a partial solution where small users can test whether the solution satisfies the requirements.

b) Goal of proof of concept

Basically, a proof of concept is done to minimize or to reduce the amount of uncertainty involved by implementing a new project or acquisition. From the advantages provided by the proof of concept, it was wise for BRALIMA to perform one to guarantee the viability of the project. The proof of concept helps you to make sure that the project or the proposed solution fits well into your core business.

c) BRALIMA's steps of proof of concept

- 1. Creation of private APN in ZAIN GPRS network, to collect all the traffic from mobile devices:**

In each PDA a SIM card had been placed to enable GPRS connectivity between PDA and BRALIMA's LAN via ZAIN.

- 2. This APN will be reached only by HEINEKEN (BRALIMA) billing mobile systems**

They are up to 3 million customers which could be connected to ZAIN GPRS network. Consequently, that can be an open door for malicious users if BRALIMA should use public APN. The private APN will restrict access and facilitate traffic in the line.

- 3. Deployment of a dedicated line (128 Kbps) to create a VPN connection between ZAIN GPRS network and BRALIMA Kinshasa LAN**

The solution requires a minimum bandwidth of 128Kbps. A VPN is created between ZAIN and BRALIMA with IP Sec v.6 for security encryption.

- 4. Only traffic from HEINEKEN (BRALIMA) billing mobile system will be able to pass through this VPN tunnel.**

A firewall is setup between ZAIN and BRALIMA LAN for package filtering to mitigate risk.

- 5. HEINEKEN will set up a routing configuration to forward the traffic from BRALIMA Kinshasa LAN to T-System in Germany through the existing private WAN**

The final version of the system is to set up a server in Frankfurt (Germany) while end-users are working in Kinshasa (DRC). A WAN is already set up between Kinshasa and Frankfurt; the challenge is to bring data to BRALIMA LAN in Kinshasa, and after which it will be relayed to Frankfurt.

6. Test of synchronisation between PDA and BRALIMA server (Kinshasa/DRC)
7. Test of synchronisation between PDA and Frankfurt server (Germany)
8. Test of connectivity from extreme points of the region (Kinshasa)

4.2.3. Infrastructure procurement, networking and communication setup

a) Hardware and device procurement

The procurement of a device such as Rugged Mobile Hand-Held Terminals and its accessories, wireless printers, standard PDA was from Republic of South Africa.

This process was accomplished by BRALIMA's Logistic Department.

Concerning hardware procurement, the project necessitates three servers load balancing.

b) Network devices

- Router for VPN : CISCO 2811
- Router for Wi-Fi : CISCO 1811
- Wi-Fi antenna: 802.11g Wireless Outdoor AP With Bridge / 54Mbps WAP-6000

4.2.4. Software development by third party

The development of the software by third party turns BRALIMA managerial focus on an initial phase where a project charter was signed between a vendor and BRALIMA, the integration phase, the delivery of the product, test and acceptance, installation, and maintenance.

a) Initial phase

The initial phase centers of attention were:

- Project charter agreement between software supplier and BRALIMA
- Expressed requirement
- Scope definition
- Time constraint

- Budgeting

b) Integration phase

The integration phase focuses mainly on the interface between BRALIMA Integrated System called ISHA (Information System Heineken for Africa) and JEM database apart from drivers, brands, and many other details. This interface has the main task to read Delivery Notes created in ISHA and populate JEM database for use in JustEnough software installed into PDAs.

The interface converts COBOL file into XML and sends it to JEM SQL Server 2005 database

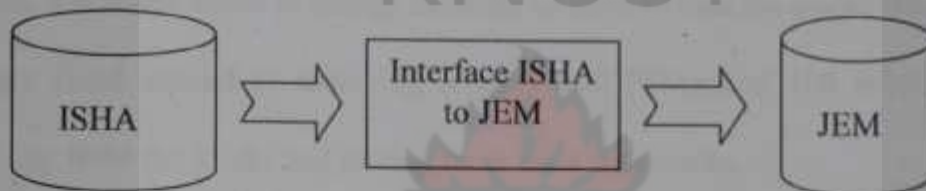


Figure 4-4: Interface ISHA to JEM

c) Delivery phase

The full package as agreed in the project charter is not delivered at once. The delivery is done gradually as JustEnough is making it available to BRALIMA, according to an agreed schedule.

d) Test and acceptance phase

As soon as BRALIMA received a new release from JEM, it is installed into the Test Server called SandBox. Some Super-users from IT and Commercial departments test the release. Depending on the satisfaction level, the release will be either put into Production or not. In both cases, a feedback will be sent to the developer company.

e) Go Live phase

The “Go Live” will be effective when all major issues are solved by the software supplier and end-users are able to handle properly the project and IT is ready to support the continuity of the project.

4.2.5. Installations

a) Devices installation into trucks

The printers and PDAs are installed on the electrical circuit of the truck. Even though PDAs and wireless printers could be charged under electric power, for BRALIMA context, it is much easier to charge batteries of devices into the trucks where they are strongly fixed instead of removing roughly 100 PDAs and 100 wireless printers every day from the trucks and putting them back into trucks.

The figure below describes the circuit schema of the installation of PDAs and wireless printers into the trucks.

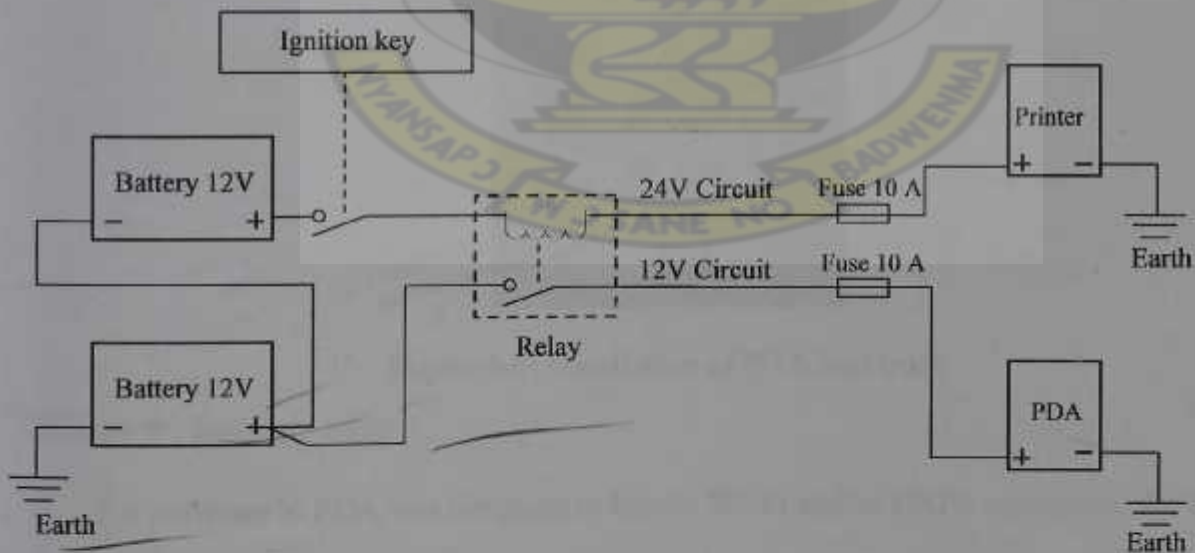


Figure 4-5: PDA and Wireless printer electric schema of installation

Two 12 Volts batteries are connected in serials to get 24 Volts for running truck electric circuit. The wireless printer is working under 24 Volts and the PDA requires 12 Volts. While the Ignition key is turned on, the relay is incited and closed the 12V circuit of PDA and at the same time, the printer circuit is alimented. The PDA could be easily plugged on the lighter circuit for vehicles using 12V circuit like cars, vans.

b) Rugged Mobile Hand-Held Terminals for Truck Drivers

❖ Hardware installation

The mobile hand-held terminals could be handled in the palm or mounted on a cradle which is fixed onto the truck. This project adopted the mounting on a cradle solution.

A local mounted cradle has been designed to make difficult the extraction of the PDA from the cradle where it is installed into the truck. The main motivation of this local cradle is to reduce the risk of PDA theft. The original cradle was designed to be fixed on smooth area like windscreens by using a vacuum.



Figure 4-6: Installation of PDA into truck

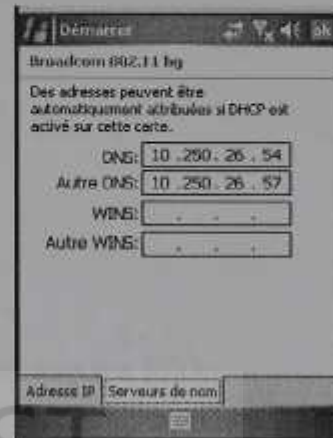
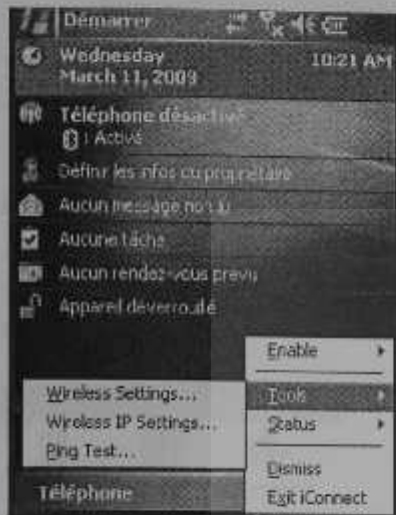
❖ Software setup

The software in PDA was designed to handle Wi-Fi and/or GRPS connection for data transfer to the server, and Bluetooth connection for taking charge of wireless printers.

○ Wi-Fi

Below are steps for setting the Wi-Fi parameters into the PDA:

i) Tap on the Network icon on the bottom-right corner of the PDA. Select Tools/Wireless Setting



IP address set: ranged from 192.168.1.2 to 192.168.1.254, the default Gateway address is the one set up into the router connect to the Wi-Fi antenna (192.168.1.1).



iii) Service Set Identifier (SSID) a 32-character unique identifier attached to the header of packets sent over a WLAN. All wireless devices on a WLAN must employ the same SSID in order to communicate with each other.



ii) Domain Name Server parameter; name server addresses may be automatically assigned if DHCP is enabled on this adapter.

iv) Security parameters: Association: Wi-Fi Protected Access (WPA), Encryption: Temporal Key Integrity Protocol (TKIP), Pre-shared Key: Kept Secret

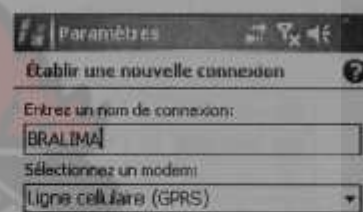


○ GPRS

Below are steps for setting up the GPRS configuration into the PDA:

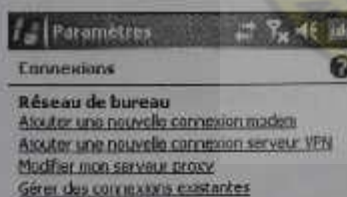
i) Tap **Start / Parameters/ Connexions**

modem: Cellular line (GPRS), tap Next

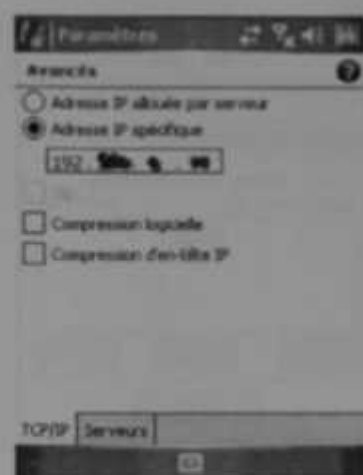
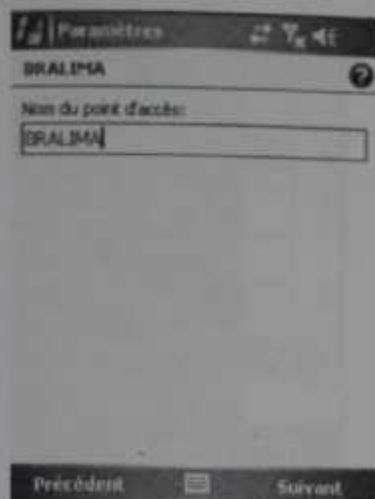


ii) Tap **Add New connexion Modem**

iv) Input the name of APN (Access Point Name) BRALIMA, has been chosen as any private APN by ZAIN tap Next

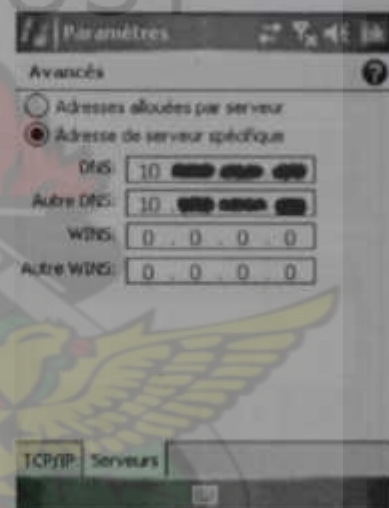
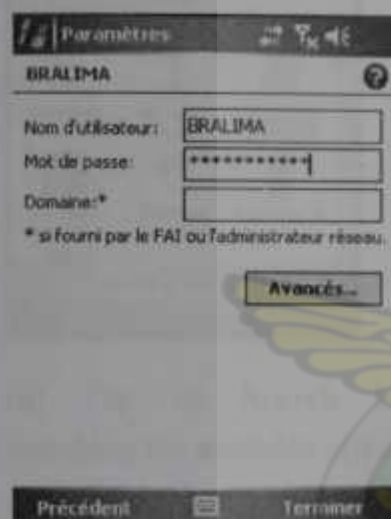


iii) Input the name of the Connection, for instance BRALIMA, Select



v) Input User login and Password as set up by Telecom provider (ZAIN), tap on Advance button

vii) Input Domain Name Server IP addresses and tap on OK, on the Top-right corner.



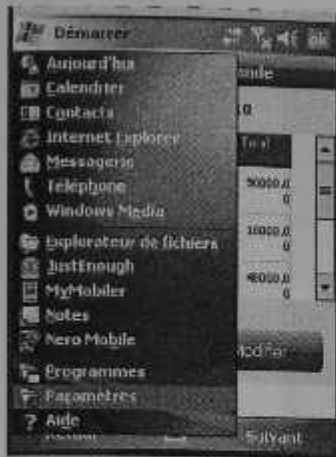
The setting is done.

vi) Input the IP address of the PDA and tap on Servers tab,

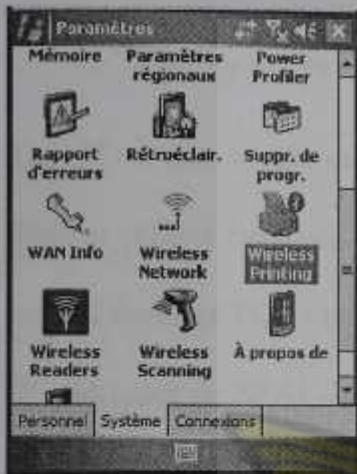
○ Wireless printer

The setting of the wireless printer is done through these steps. Make sure that the printer is on and the Bluetooth is on in the PDA before going further.

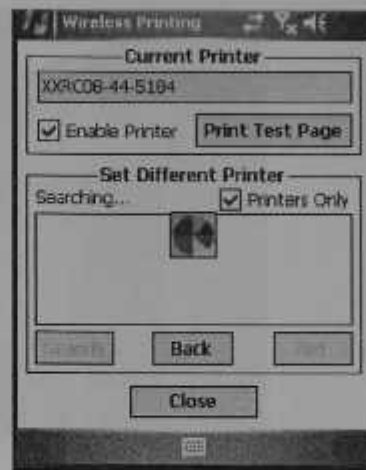
i) Tap Start/ Parameters/System



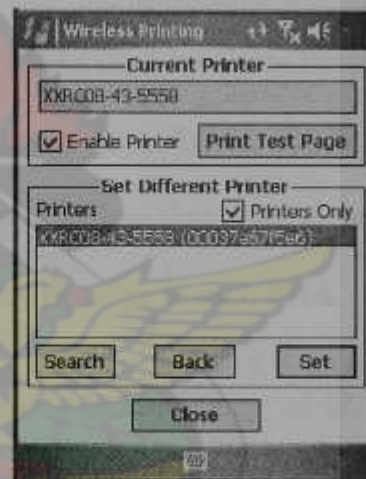
ii) Tap Wireless Printer



iii) Tap on Search button for searching the available printer.



iv) After searching, the PDA will find the available PDA. Select it and tap Set. You can Print Test Page for confirmation.



If the printer prints a small text, the transaction is completed and tap on Close.

c) Printers

The wireless printer could be carried in small bag or mounted on a cradle which is fixed into the truck. BRALIMA's option is to mount it on a cradle which is fixed by rivets on a metal case serving as *Driver's Safe*. This safe is a local design allowing the driver to keep money safe during his journey.

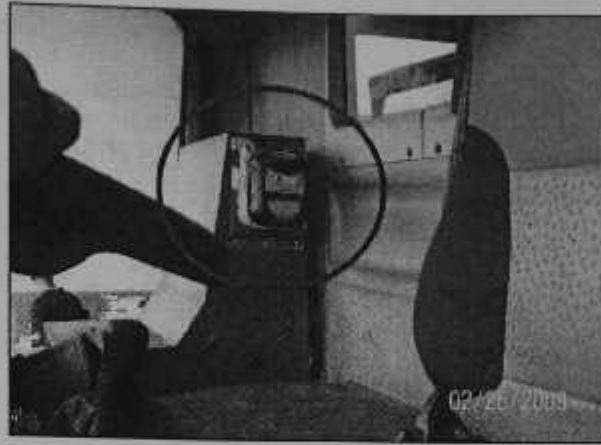


Figure 4-7: Wireless printer installed into truck

d) Wi-Fi

The PDA can synchronize with the server via a Wi-Fi connection. The Billing System project involves around 100 rugged PDAs used by Sales Persons (Drivers) and 70 standard PDAs used by Sales Force Agents. Actually, the number of available IP addresses in BRALIMA Local Area Network is less than 170, therefore it is not possible to allocate an IP address in BRALIMA IP range to each PDA.

There was a need to create a new network using another range of IP addresses. A WLAN is created using a range from 192.168.1.2 to 192.168.1.254 with a subnet of 255.255.255.0.

The figure below describes the scenario.

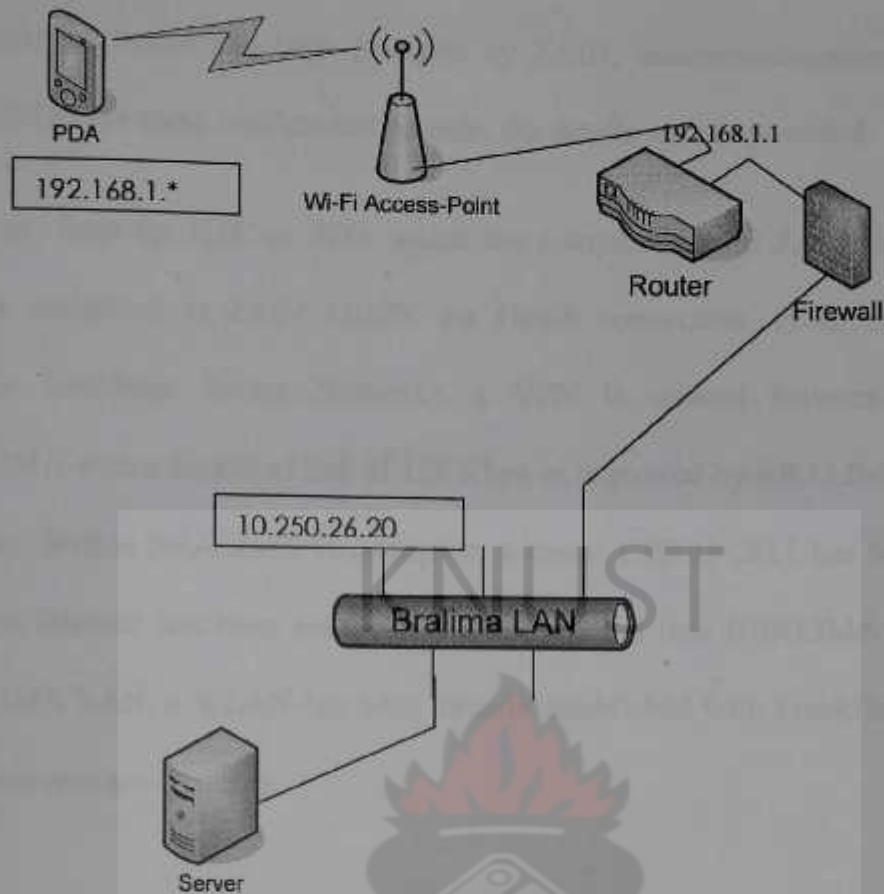


Figure 4-8: Wi-Fi installation schema

The figure above describes the traffic from the PDA to the server via network devices.

PDA's are set up with IP addresses ranging from 192.168.1.2 to 192.168.1.254, connected to the Wi-Fi Access-Point (802.11g Wireless Outdoor AP with Bridge / 54Mbps WAP-6000) which is reachable at 192.168.1.1 IP address, regardless of other parameters. From the Wi-Fi, the package is sent to Router Cisco1811 which plays the role of gateway and package filtering by applying Firewall properties. From the router (include Firewall), the package is sent into BRALIMA LAN which uses a range of 10.250.26.20 IP addresses.

Source: ZAIN-DRC, Service Level Agreement of BRALIMA Billing System Project
Figure 4-9: Network structure from PDA (in RDC) to server (in Germany)

f) Software in PDA

The installation of the software (Just Enough) into PDA could be done by establishing connection to PDA via GPRS or Wi-Fi. It is also possible to be connected to the server via a specific cradle which is connected to the LAN by cable. The connection is established with the Internet Explorer Browser, by browsing http://ServerIP_Address/FolderName. Once the connection is established with the server, some prerequisites Microsoft components patches are installed before the proper installation of Just Enough software. JEM consists also by an IIS application server. It has been used to set up web pages with JEM software packages which could be downloaded on PDA for installation.

It is important to notice that software is installed in a SD Card plugged in the PDA. This is done for the main reasons that:

- the built-in storage capacity of the PDA which is small than the SD card would not be sufficient enough to hold databases created for different drivers. (Storm, S. 2009).
- PDA memory loses data when flat internal battery.

Below are some screens of Just Enough software installed in rugged PDA.

User Login and Password

JustEnough

JUSTENOUGH

Nom
n11978

Mot de passe:

Login

Avancé

Client sales order

Place Order

Lignes de commande

N15991 - DEPOT MONZALI
Bon de Sortier: 2522852009.03.10

Product	Qty	SOH
CPR34: PRIMUS 3/4-EACH	10	110
CTU23: TURBO KING 2/3-EACH	2	71
CMU13: MUTZIG 1/3-EACH	4	80

OK Annuler

Augmentation de la quantité de produit:
CTU23: Quantité: 2

Retour Suivant

Main Menu

JustEnough

JUSTENOUGH

Activités

Plan de voyage

Mettre à jour

Quitter JustEnough

Avancé

Printed client order

Place Order

Valider et imprimer la commande

N15991 - DEPOT MONZALI
Bon de Sortier: 2522852009.03.10

Vérifiez la commande

A été l'impression de la commande avec succès?

Oui Non

CMU13: MUTZIG 1/3-EACH 4 80000.00

Total 156000.00

Confirmer Modifier

Retour Suivant

Clients by Route

Feuille de Route

Route: 02.1 - KINGABWA - POID

Detail	Client	Address
DEPOT MONZALI	N15991	AV. MBAXADI St. Kéle N15991
MBAYO BRIGITTE	N16485C	AV. KINGABWA 1941 ITS N16485C
MBAYO BRIGITTE	N16489D	AV. KINGABWA 80 Anet TP N16489D
MOPEPE	N16623A	AV. KINGABWA BAT N16623A
Chez Youn		AV. TSHAYI Q.

Vendre Détails

Fin du voyage

Client order

g) Smart client software installation

The smart client is a user interface which allows end users to connect to the server database via desktop or laptop. The current smart client has three main workspaces: interface for capturing manual invoice, interface for capturing broken, missed, chipped, interchange bottles and the interface for consulting reporting.

❖ Interface for capturing manual invoices

When a driver is not working for any reason like frozen PDA, JEM software not responding or embarked printer doesn't work, the procedure requests to the driver to deliver manual invoices to the customers. Once they are back, those manual invoices are captured to the JEM database server via a workspace called *Interface for capturing Manual Invoices*.

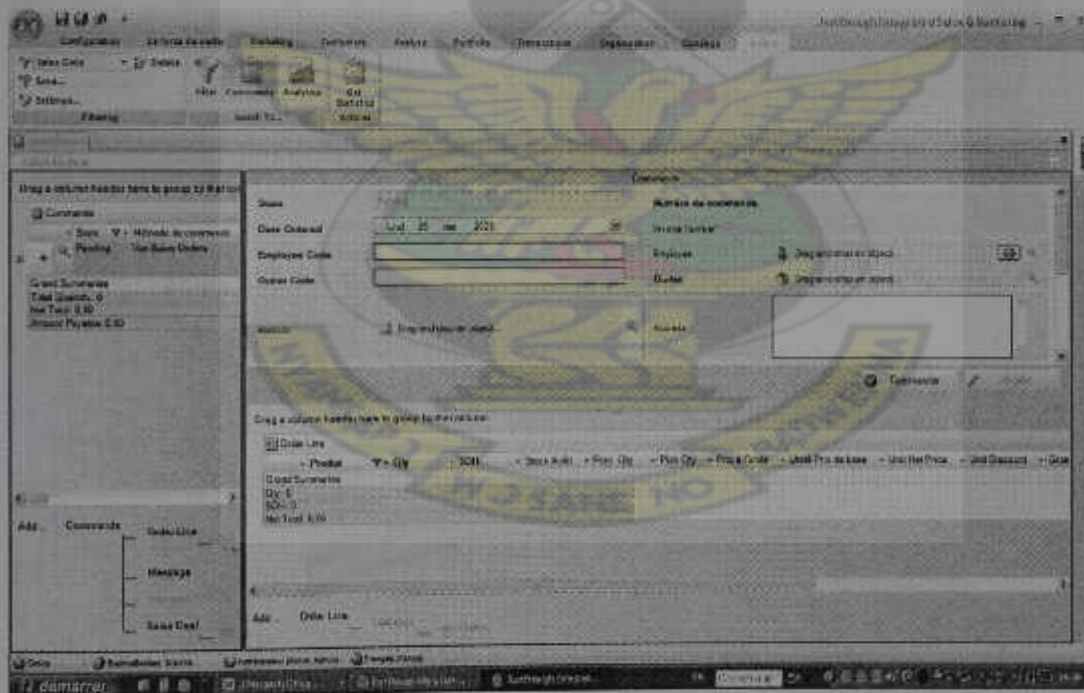


Figure 4-10: Interface for capturing manual invoices

❖ Interface for capturing Broken and Missed bottles

BRALIMA manages a large vehicle park. When drivers come back from sales, they declare theoretically the amount of quantities sold and not sold. BRALIMA has a team which checks crate by crate to ascertain broken, missed, chipped, and interchanged bottles. This control is done to make sure that the quantities declared by the drivers are confirmed. Those quantities are linked to respective delivery notes.

AP #	Product	V. Line Quantity	25' 100' 150' 200' 250' 300' 350' 400' 450' 500' 550' 600' 650' 700' 750' 800' 850' 900' 950' 1000'	1000' 1050' 1100' 1150' 1200' 1250' 1300' 1350' 1400' 1450' 1500' 1550' 1600' 1650' 1700' 1750' 1800' 1850' 1900' 1950' 2000'	2000' 2050' 2100' 2150' 2200' 2250' 2300' 2350' 2400' 2450' 2500' 2550' 2600' 2650' 2700' 2750' 2800' 2850' 2900' 2950' 3000'	3000' 3050' 3100' 3150' 3200' 3250' 3300' 3350' 3400' 3450' 3500' 3550' 3600' 3650' 3700' 3750' 3800' 3850' 3900' 3950' 4000'	4000' 4050' 4100' 4150' 4200' 4250' 4300' 4350' 4400' 4450' 4500' 4550' 4600' 4650' 4700' 4750' 4800' 4850' 4900' 4950' 5000'	5000' 5050' 5100' 5150' 5200' 5250' 5300' 5350' 5400' 5450' 5500' 5550' 5600' 5650' 5700' 5750' 5800' 5850' 5900' 5950' 6000'	6000' 6050' 6100' 6150' 6200' 6250' 6300' 6350' 6400' 6450' 6500' 6550' 6600' 6650' 6700' 6750' 6800' 6850' 6900' 6950' 7000'	7000' 7050' 7100' 7150' 7200' 7250' 7300' 7350' 7400' 7450' 7500' 7550' 7600' 7650' 7700' 7750' 7800' 7850' 7900' 7950' 8000'	8000' 8050' 8100' 8150' 8200' 8250' 8300' 8350' 8400' 8450' 8500' 8550' 8600' 8650' 8700' 8750' 8800' 8850' 8900' 8950' 9000'	9000' 9050' 9100' 9150' 9200' 9250' 9300' 9350' 9400' 9450' 9500' 9550' 9600' 9650' 9700' 9750' 9800' 9850' 9900' 9950' 10000'	10000' 10050' 10100' 10150' 10200' 10250' 10300' 10350' 10400' 10450' 10500' 10550' 10600' 10650' 10700' 10750' 10800' 10850' 10900' 10950' 11000'	11000' 11050' 11100' 11150' 11200' 11250' 11300' 11350' 11400' 11450' 11500' 11550' 11600' 11650' 11700' 11750' 11800' 11850' 11900' 11950' 12000'	12000' 12050' 12100' 12150' 12200' 12250' 12300' 12350' 12400' 12450' 12500' 12550' 12600' 12650' 12700' 12750' 12800' 12850' 12900' 12950' 13000'	13000' 13050' 13100' 13150' 13200' 13250' 13300' 13350' 13400' 13450' 13500' 13550' 13600' 13650' 13700' 13750' 13800' 13850' 13900' 13950' 14000'	14000' 14050' 14100' 14150' 14200' 14250' 14300' 14350' 14400' 14450' 14500' 14550' 14600' 14650' 14700' 14750' 14800' 14850' 14900' 14950' 15000'	15000' 15050' 15100' 15150' 15200' 15250' 15300' 15350' 15400' 15450' 15500' 15550' 15600' 15650' 15700' 15750' 15800' 15850' 15900' 15950' 16000'	16000' 16050' 16100' 16150' 16200' 16250' 16300' 16350' 16400' 16450' 16500' 16550' 16600' 16650' 16700' 16750' 16800' 16850' 16900' 16950' 17000'	17000' 17050' 17100' 17150' 17200' 17250' 17300' 17350' 17400' 17450' 17500' 17550' 17600' 17650' 17700' 17750' 17800' 17850' 17900' 17950' 18000'	18000' 18050' 18100' 18150' 18200' 18250' 18300' 18350' 18400' 18450' 18500' 18550' 18600' 18650' 18700' 18750' 18800' 18850' 18900' 18950' 19000'	19000' 19050' 19100' 19150' 19200' 19250' 19300' 19350' 19400' 19450' 19500' 19550' 19600' 19650' 19700' 19750' 19800' 19850' 19900' 19950' 20000'	20000' 20050' 20100' 20150' 20200' 20250' 20300' 20350' 20400' 20450' 20500' 20550' 20600' 20650' 20700' 20750' 20800' 20850' 20900' 20950' 21000'	21000' 21050' 21100' 21150' 21200' 21250' 21300' 21350' 21400' 21450' 21500' 21550' 21600' 21650' 21700' 21750' 21800' 21850' 21900' 21950' 22000'	22000' 22050' 22100' 22150' 22200' 22250' 22300' 22350' 22400' 22450' 22500' 22550' 22600' 22650' 22700' 22750' 22800' 22850' 22900' 22950' 23000'	23000' 23050' 23100' 23150' 23200' 23250' 23300' 23350' 23400' 23450' 23500' 23550' 23600' 23650' 23700' 23750' 23800' 23850' 23900' 23950' 24000'	24000' 24050' 24100' 24150' 24200' 24250' 24300' 24350' 24400' 24450' 24500' 24550' 24600' 24650' 24700' 24750' 24800' 24850' 24900' 24950' 25000'	25000' 25050' 25100' 25150' 25200' 25250' 25300' 25350' 25400' 25450' 25500' 25550' 25600' 25650' 25700' 25750' 25800' 25850' 25900' 25950' 26000'	26000' 26050' 26100' 26150' 26200' 26250' 26300' 26350' 26400' 26450' 26500' 26550' 26600' 26650' 26700' 26750' 26800' 26850' 26900' 26950' 27000'	27000' 27050' 27100' 27150' 27200' 27250' 27300' 27350' 27400' 27450' 27500' 27550' 27600' 27650' 27700' 27750' 27800' 27850' 27900' 27950' 28000'	28000' 28050' 28100' 28150' 28200' 28250' 28300' 28350' 28400' 28
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Figure 4-11: Interface for capturing Broken and missed bottles

❖ Interface for consulting reports

To consult reports, decision-makers use an interface instead of using PDA; so that a workspace has been developed to allow decision-makers to consult reports.

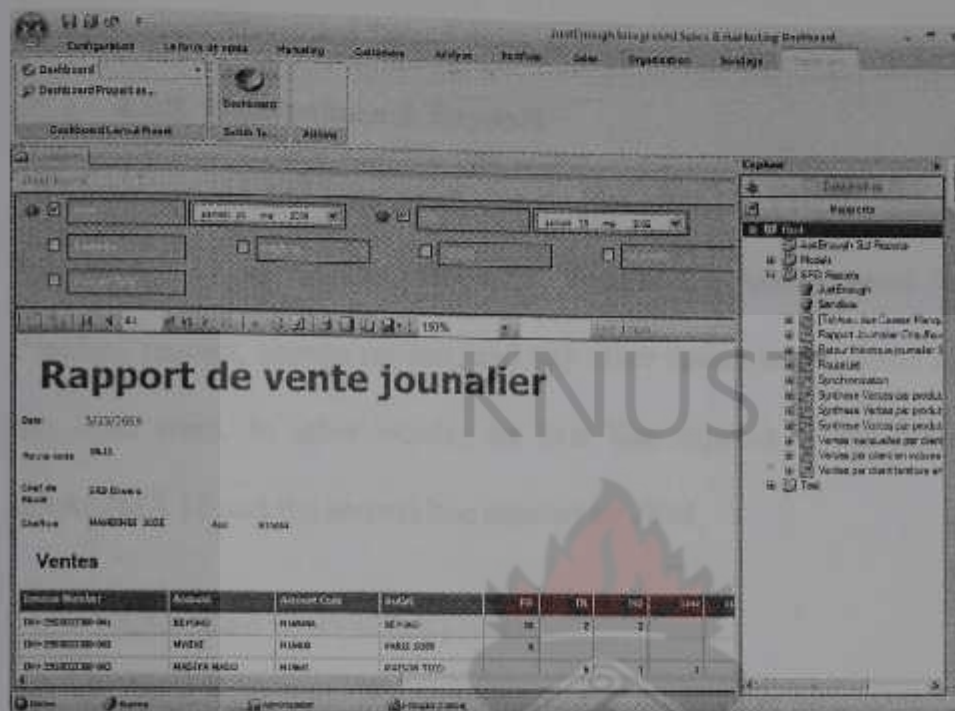


Figure 4-12: Interface for consulting reports

4.2.6. Quality Assurance

The project quality assurance is done at different levels: operational, functional and strategic. Internally, a software supplier tests each package before sending it to the client (BRALIMA). In BRALIMA's side, tests are conducted to make sure that the project keeps in line with set goal and each delivery meets the requirement. At the strategic level, a steering committee is set up, comprising top managers who undertake a high level quality assurance assessment.

4.2.7. Training

The project training is done at two levels:

- a) Super users: comprise some IT and Commercial staff,
- b) End users: Drivers and Sales Forces agents

4.2.8. Maintenance & Support

The maintenance and support of this project after Go Live is under the control of BRALIMA IT department. However, JustEnough Management is in charge of Problem request, change request, and any other issues which could not be solved by the local team. In other words, the first line support of the project is done by BRALIMA IT and the second line support by JEM.

4.2.9. End-users involvement

The better strategy to involve fully the end-users (mainly drivers), in the project is to show up properly the benefits they can get by using such a system and how it can facilitate their daily task. This strategy had been communicated during a drivers and driver supervisors training session.

a) Drivers

Drivers issue manual invoices daily to customers, and at the end of the day, draw up the daily recap for each delivery note. So, an invoice contains: date, route, driver ID number, driver name, customer account number, customer name, delivery note number, at least one item is recorded on the invoice, and for each item: item name, unit price, quantity, total and at the end, grand total. At the end of each rotation, drivers calculate the sum of all products. Each invoice is issued in triplicate.

By using a Billing System project, the driver inputs his account number once; from the account number his name is retrieved automatically. The route is chosen once, the date is already set up into the PDA, and the driver just chooses the customers' name and account number, selects a product and adds quantity wanted by the customer. Once he presses on "Print" button, all calculations are done automatically (quantity sum up, amount to be paid by the customer). At the end of the rotation, just press on the button "End of rotation" and all recaps are done.

This simple strategy has a huge impact to the drivers' attitude toward the new project and the result shows that drivers are enthused about using the Billing system. See Appendix D for details.

b) Customers

Customers are sensitized by drivers and driver supervisors about the implementation of the new Billing System. Key ideas during this task are:

- bring up invoices capturing problem: delays in dispatching discount, errors sensitivity and all that lead to complaints and dissatisfaction,
- Authenticity of the invoices: fake invoices are issued either by some drivers or customers make difficult the reconciliation between BRALIMA and customers.

c) Decision-makers

The implication of the decision-makers is based on the speed at which they could access information and how consistent it is. They show the benefits of implementing such a system and how it facilitates their daily task.

4.2.10. Advantages and disadvantages of outsourcing solution

a) Advantages

- Cost reduction,
- Available skills : an outsourcing company could provide the client with skills that the client does not have in-house,
- Quality improvements,
- Risk sharing,
- Less time in development than in-house.

b) Disadvantages

- Expensive during the software life cycle (software license, yearly maintenance cost, change request, etc.) if required skills could be found in-house,
- The change request process could be longer,

4.3. Partial conclusion

This chapter focuses on the implementation of the mobile application for a commercial company. BRALIMA chooses to outsource the solution for getting rapid results. The implementation steps are provided in this chapter. The next chapter will focus on the result of this implementation to find out, if it met BRALIMA's expectations or not.

Chapter 5: Evaluation of the new system

Looking at the goals stated in section 1.2, not all of them are reached to date. But it is fair to say that the main goals are reached even though some need improvement and an implementation process is adopted to ensure the goals are achieved.

BRALIMA has implemented the mobile application for its salespersons (drivers) who are equipped with PDAs in which mobile software had been installed by a third company. Nowadays, drivers can perform order via PDA and print out invoices by using a wireless printer installed in the vehicle. Sales data are sent to the server via Wi-Fi connection once drivers come back to the brewery.

At this stage, it is too early to replace the old system of capturing manual invoices; therefore, both systems are running in parallel for data comparison before Go Live.

Section 3.6 shows an approximate monthly reduction of operating cost from \$12,900 to \$10,015 (\$2,885 gained). Like many new challenges, this implementation of mobile application brought up some unexpected expenses paying like new IT Support staff. This is a temporary support, just the time to fix issues related to the implementation phase, and give the application the time to run smoothly.

From the survey made with drivers who are using the new system, 97.82% are satisfied with using the new system called Billing System. Through out report is not yet completed. The data available makes interesting revelation about the viability of the Mobile Application system.

Analyses done during the test period from 24/04/2009 to 21/05/2009 is outlined below:

Table 5-1: Availability of Billing system during the period from 24/04/2009 to 21/05/2009

Components		Average's Availability (%)
Hardware	Printer	99.49
	PDA	91.25
Software	JEM server	100.00
	JEM	90.46
	ISHA	99.57
	ISHA2JEM	100.00
Network	GPRS	02.23
	Wi-Fi/Connectivity	88.53
	Wi-Fi/Data received	87.91

Listed vehicles

88

See detail in Appendix E for details.

From this availability and the way components are related, the availability of the Billing System had been evaluated at 72.60%. See section 3.7.3 for details.

Even though wireless connection from the PDA allows users to connect to BRALIMA LAN, a router Cisco1811 had been configured to manage risk from Wi-Fi connection, (See Appendix C for details). Another router Cisco2811 had been configured to manage risk from GPRS connection (this configuration had been kept by the GPRS provider).

This new implementation solved the problem of database storage capacity brought up in section 2.3. That means, the old database capacity of 1 GB of MS Access is changed to a larger capacity of MS SQL 2005. This is a significant advantage.

Chapter 6: Conclusions and further research

The implementation of mobile application for a commercial company is feasible and brings a lot of benefits within a company. Nevertheless, this implementation goes through different steps which need to be considered properly.

The implementation of the mobile application involves a lot of resources (time, people, and money), so a good assessment of the current system is very important to make sure that the cost benefit-analysis is kept on line. In this way, a company could see whether it is worth to invest into this area or not. In the case of BRALIMA, an assessment of the current system has brought out its weaknesses. Hence, mobile application its found to be a viable alternative.

The solution could be developed in-house or outsourced; this thesis focused on the outsourcing solution. However, the choice of supplier is critical for a successful implementation of the solution. To mitigate risk on the choice of supplier, proof of concept had been conducted.

During the implementation, we came across different issues which should be handled properly for a successful implementation:

- Frozen PDA,
- Database size increased into the PDA leads to long synchronization,
- Network problem sometime due to important number of PDAs to synchronize at a peak time (morning), leads to a congestion of the line,

In addition, the delay in procurement phase, the project's scope creeping and the software development supplier's slowness lead to missing of some of the benefits and pushed away the Go Live. Thus, the implementation of the mobile application for a commercial company is a new challenge which needs a meticulous analysis before launching into.

6.1. Recommendations

- ❖ Section 3.7.3 contains a couple of recommendations for each scenario relative to risk analysis. Those recommendations have been provided at that time for a better follow up.
- ❖ Manual capturing of invoices in case of PDA failure: this changes the way components are related and therefore change the availability of the Billing System. The component I (Manual Invoice) and J (JEM Smart Client) are added to the previous schema.

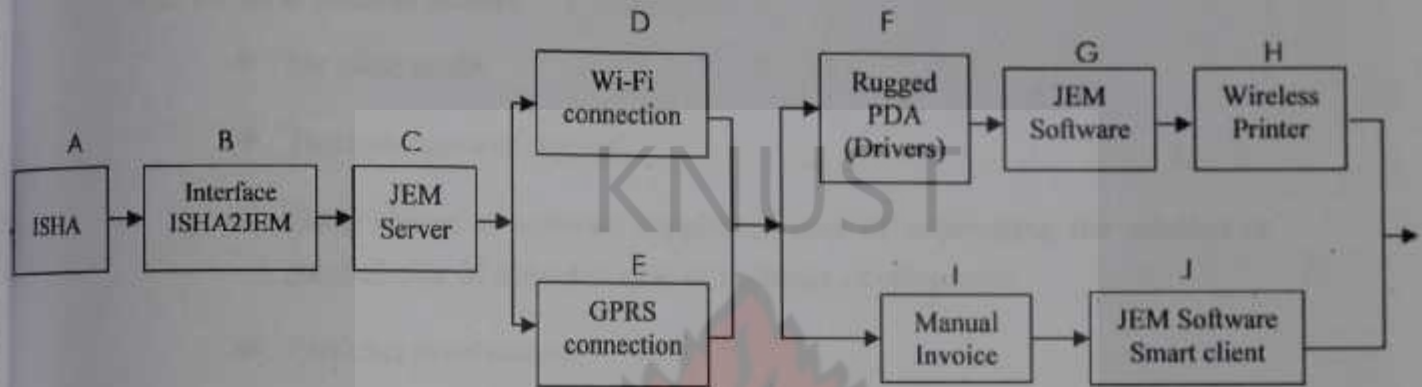


Figure 6-1: Billing system components

Set P_{BS} , the availability of the Billing system within a period P , this availability is given by:

$$P_{BS} = P_A \times P_B \times P_C \times (1 - P_D \times P_E) \times (1 - P_F \times P_G \times P_H \times P_I \times P_J)$$

The result of the test period from 24/04/2009 to 21/05/2009 showed that:

$$P_A = 0.9957; P_B = 1; P_C = 1; P_D = 0.8853; P_E = 0.0223; P_F = 0.9125; P_G = 0.9046; P_H = 0.9949; P_I = 1; P_J = 1$$

$$\begin{aligned}
 P_{BS} &= 0.9957 \times 1 \times 1 \times (1 - 0.1147 \times 0.9777) \times ((1 - (1 - 0.9125 \times 0.9046 \times 0.9949) \times 1 - (1 \times 1))) \\
 &= 0.9957 \times 1 \times 1 \times (1 - 0.1147 \times 0.9777) \times ((1 - (1 - 0.9125 \times 0.9046 \times 0.9949) \times 0)) \\
 &= 0.9957 \times 1 \times 1 \times (1 - 0.1147 \times 0.9777) \times ((1 - 0)) \\
 &= 0.9957 \times 1 \times 1 \times (1 - 0.1147 \times 0.9777) \\
 &= 0.8840
 \end{aligned}$$

By adding those two components, the availability of the system is increased to 15.80%.

❖ Enhance Wi-Fi security by:

- Filtering MAC address of PDA,
- Disable the broadcast of SSID,
- Analyze how to chose a specific channel

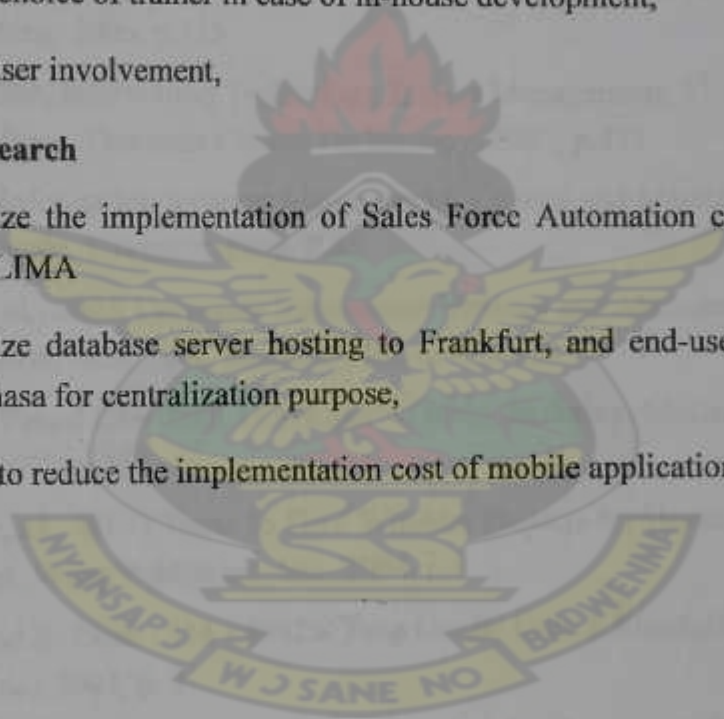
❖ Make sure that the “proof of concept” has been properly done before choosing a software supplier.

6.2. Critical success factors

- ❖ Set clear goals,
- ❖ Top management support,
- ❖ Good choice of software supplier in case of outsourcing the solution or good choice of trainer in case of in-house development,
- ❖ End user involvement,

6.3. Further research

- Finalize the implementation of Sales Force Automation case study for BRALIMA
- Finalize database server hosting to Frankfurt, and end-users located in Kinshasa for centralization purpose,
- How to reduce the implementation cost of mobile application



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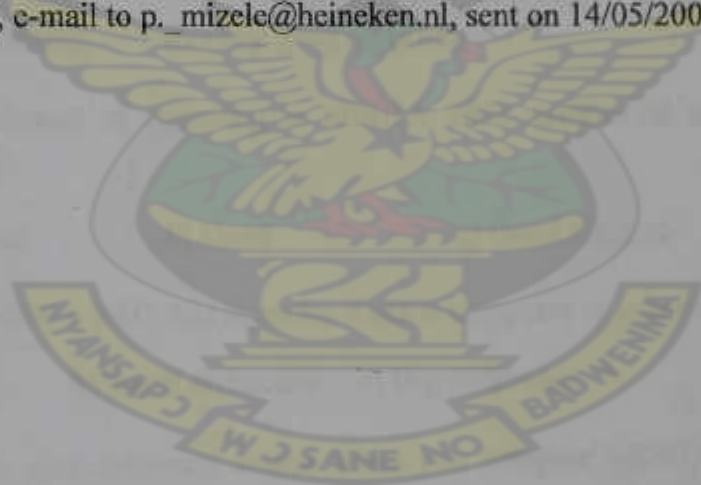
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Appendices

Appendix A: English version of questionnaire used during the survey

Questionnaire for assessment of MISHA SRD

I. Performance

1. Do you satisfy about MISHA SRD response time?

- a) Highly satisfactory b) Satisfactory c) Unsatisfactory

2. Do you satisfy about the MISHA SRD availability, I mean, MISHA SRD is available when you would like to access in?

- a) Highly satisfactory b) Satisfactory c) Unsatisfactory

II. Information and data

1. Information and data coming from MISHA SRD are they consistent for your analysis?

- a) Poor reporting b) Good enough reporting
c) Good reporting d) Very good reporting

2. Is the format of reporting in MISHA SRD suitable or useful for your analysis?

- a) Very good b) Good c) Good Enough d) Bad

3. Does MISHA SRD data accurate when it compares to other sources?

- a) Accurate b) Small difference c) Big difference

4. What is your reference source when you compare MISHA SRD data to other source?

- a) MISHA SRD b) Other source c) Other
answer.....

5. In your opinion, are data in MISHA SRD up to date faster or not?

- a) Fast b) Quiet fast c) Slow d) very slow

6. Do you need some data for your analysis that are not available in MISHA SRD?

a) Yes, Which
 b)
 No

III. Economy

What do you think about the maintenance & development cost of MISHA SRD?

- a) Cheaper b) Normal c) Expensive d) Very expensive

IV. Control and security

1. How do you judge MISHA SRD security level, that means prevent data access or modification from unauthorised users?

- a) Very Strong b) Strong c) Weak d) Very weak

2. Do you already come across a case of inconsistency of data, which means from the same database MISHA SRD, found same kind of reports with are different values? E.g details are different from recap.

- a) Yes b) No c) Never hear about

V. Users and procedures efficiencies

1. Do you have enough time for performing your input data task?

- a) Yes b) No c) Other answer

2. What is your opinion about the current procedure established for access to MISHA SRD: fill out a demand form, signature of demander's Director, ICT department signature?

- a) Normal b) Slow down the process c) Other
 answer.....

Comment

.....

VI. Service

1. Does MISHA SRD been easy to learn or use?

a) Yes b) No c) Other answer
.....

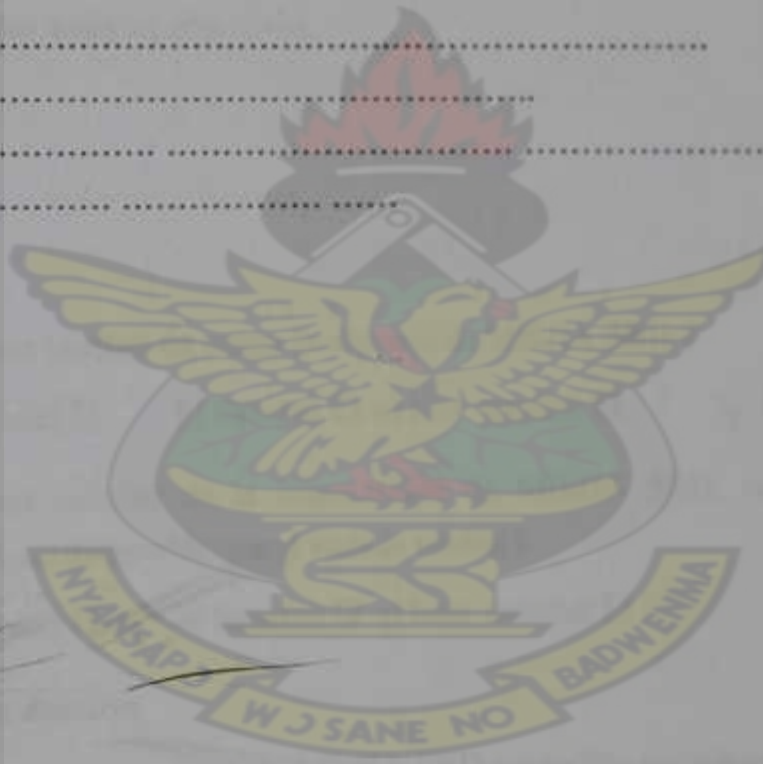
2. Is MISHA SRD compatible with other systems or software?

a) Yes b) No c) Other answer
.....

General

comment

KNUST



Appendix B: French version of questionnaire used during the survey

Questionnaire d'enquête pour l'évaluation de MISHA SRD

Cher (e) Collègue,

Dans le souci de mieux vous servir, nous avons préparé ce formulaire d'enquête afin d'évaluer les fonctionnalités (avantages et faiblesses) de MISHA SRD.

Votre contribution est de remplir correctement ce formulaire afin que nous soyons en mesure de faire des analyses objectives.

Département

I. Performance

1. Etes-vous satisfait du temps de réponse de MISHA SRD ?

a) Très satisfait ☐ b) Satisfait ☐ c) Non satisfait ☐

2. Etes-vous satisfait de la disponibilité de MISHA SRD, c'est-à-dire l'accès à MISHA est disponible quand vous le voulez ?

a) Très satisfait ☐ b) Satisfait ☐ c) Non satisfait ☐

II. Information et données

1. Les informations venant de MISHA SRD sont-elles consistantes pour vos analyses ?

a) Les reportings sont pauvres ☐ b) Les reportings sont assez bons ☐
c) Les reportings sont bons ☐ d) Les reportings sont très bons ☐

2. Le format de présentation de données dans MISHA SRD est-il convenable pour vous ?

a) Très bon ☐ b) Bon ☐ c) Assez bon ☐ d) Mauvais ☐

3. Est-ce que les données dans MISHA SRD sont-elles précises ou correctes lorsque vous les comparez à d'autres sources ?

- a) Très correctes ☐ b) Correctes ☐ c) Différence acceptable ☐
d) Différence non acceptable ☐

4. Lorsque vous comparez les données de MISHA SRD avec une autre source, laquelle vous sert de référence ?

- a) MISHA SRD ☐ b) Autre source ☐ c) Autre réponse

5. Comment jugez-vous la mise à jour de données dans MISHA SRD ?

- a) Rapide ☐ b) assez rapide ☐ c) lente ☐ d) très lente ☐

6. Pensez-vous qu'il y a certaines données qui devraient faire partie de MISHA SRD que vous ne voyez pas ?

- a) Oui ☐ Lesquelles
..... b) Non ☐

III. Economie

Que pensez-vous du coût de maintenance de MISHA SRD ?

- a) Moins cher b) Raisonnable c) Cher d) Très cher

IV. Contrôle et sécurité

1. Comment jugez-vous le niveau de sécurité dans MISHA SRD c'est-à-dire, prévenir un utilisateur non autorisé à accéder aux données, soit en lecture ou en écriture ?

- a) très fort ☐ b) fort ☐ c) faible ☐ d) très faible ☐

2. Avez déjà relevé un cas d'inconsistance de données dans MISHA SRD ? Par exemple, des chiffres qui se contredisent provenant d'une même base de données.

- a) Oui, personnellement ☐ b) Non ☐ c) Jamais entendu ☐

V. Efficacité des utilisateurs et des procédures

1. Avez-vous assez de temps pour accomplir votre tâche de saisie dans MISHA SRD ?

a) Oui ☐ b) Non ☐ c) Autre réponse
.....

2. La procédure établit pour l'accès à MISHA SRD est-elle souple pour vous ?

a) Oui ☐ b) Non ☐ c) Autre réponse
.....

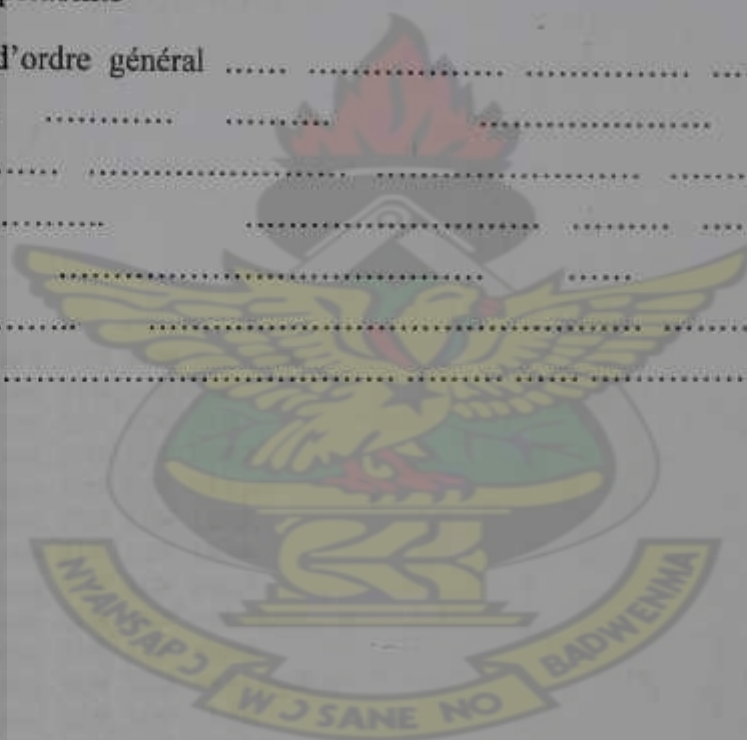
VI. Service

1. Est-ce l'usage MISHA SRD est-il facile ?

a) Oui ☐ b) Non ☐ c) Autre réponse
..... ;

2. Interopérabilité

Commentaire d'ordre général
.....
.....
.....
.....
.....
.....
.....



Fait à Kinshasa, le / /

Appendix C: Router Cisco1811 configuration

Building configuration...

Current configuration : 7288 bytes

```
!  
version 12.4  
service timestamps debug datetime msec  
service timestamps log datetime msec  
service password-encryption  
!  
hostname BRALIMA  
!  
boot-start-marker  
boot-end-marker  
!  
no logging buffered  
enable secret 5 $1$InzN$FHLuh4AnyGg7b5rZxqBoI/  
enable password 7 14141B180F0B7B  
!  
no aaa new-model  
!  
resource policy  
!  
!  
!  
ip cef  
!  
!  
ip inspect name SDM_LOW cuseeme  
ip inspect name SDM_LOW dns  
ip inspect name SDM_LOW ftp  
ip inspect name SDM_LOW h323  
ip inspect name SDM_LOW https  
ip inspect name SDM_LOW icmp  
ip inspect name SDM_LOW imap  
ip inspect name SDM_LOW pop3  
ip inspect name SDM_LOW netshow  
ip inspect name SDM_LOW rcmd  
ip inspect name SDM_LOW realaudio  
ip inspect name SDM_LOW rtsp  
ip inspect name SDM_LOW esmtp  
ip inspect name SDM_LOW sqlnet  
ip inspect name SDM_LOW streamworks  
ip inspect name SDM_LOW tftp  
ip inspect name SDM_LOW tcp  
ip inspect name SDM_LOW udp  
ip inspect name SDM_LOW vdlive  
!  
!  
crypto pki trustpoint TP-self-signed-3711399136  
  enrollment selfsigned  
  subject-name cn=IOS-Self-Signed-Certificate-3711399136  
  revocation-check none  
  rsakeypair TP-self-signed-3711399136  
!  
!  
crypto pki certificate chain TP-self-signed-3711399136
```



```

certificate self-signed 01
3082023F 308201A8 A0030201 02020101 300D0609 2A864886 F70D0101
04050030
31312F30 2D060355 04031326 494F532D 53656C66 2D536967 6E65642D
43657274
69666963 6174652D 33373131 33393931 3336301E 170D3039 30353132
31353234
35335A17 0D323030 31303130 30303030 305A3031 312F302D 06035504
03132649
4F532D53 656C662D 5369676E 65642D43 65727469 66696361 74652D33
37313133
39393133 3630819F 300D0609 2A864886 F70D0101 01050003 818D0030
81890281
8100B661 DEF6D3E6 83F3309A 103DAC47 2F3FB9F9 20C5175F 2AAD90BE
D41D2B01
2F3C17D4 6B773305 35AA4E0C C99AD8AD 3B2BE5E7 5FEC0C1B F5DE2AE6
D644A482
65AE26FD 2FE66911 C7BA8351 306540D7 253DB650 F617F6B5 C6BCCF4B
0F91EB40
814009A4 D0B04F89 1738B196 85C2A9EA 77D66422 C9A92E73 A649AD86
0CE0786D
01A70203 010001A3 67306530 0F060355 1D130101 FF040530 030101FF
30120603
551D1104 0B300982 07427261 6C696D61 301F0603 551D2304 18301680
146C13FE
1938F687 44D9E8C8 62E6BADF 03CAF6FD 9C301D06 03551D0E 04160414
6C13FE19
38F68744 D9E8C862 E6BADF03 CAF6FD9C 300D0609 2A864886 F70D0101
04050003
8181003E 8F439E34 29687099 02555E37 60714CBA D7850D4C FEC412BD
EF65B17E
997B837F 119B2638 870E94D7 DD10C946 B3340F7F BF8E5CC0 42ED54AA
F47F6096
B7DD3FE3 8E1F0A7B 554ABD72 57C51D91 1B300F20 4BB22A7B 9A468FB4
023D1575
58D18180 02056DA0 0095124E 7271C3E6 210C61FD 67C48841 C4E3BFF2
3FA96E47 2D9B80
quit

```

```

username stephanemakengo privilege 15 view root secret 5
$1$ng/f$eUVFF5IO95AXisBHikwuB0
username ciscoadmin privilege 2 view SDM_Monitor secret 5
$1$8Nbe$qpV1LmqulDCVsYx56A5v31
!
!
!
!
!
!
!

```

```

interface FastEthernet0
description $FW OUTSIDE$
ip address 10.250.27.250 255.255.254.0
ip access-group 102 in
ip verify unicast reverse-path
ip nat outside
ip inspect SDM_LOW out
ip virtual-reassembly
duplex auto
speed auto
!
interface FastEthernet1

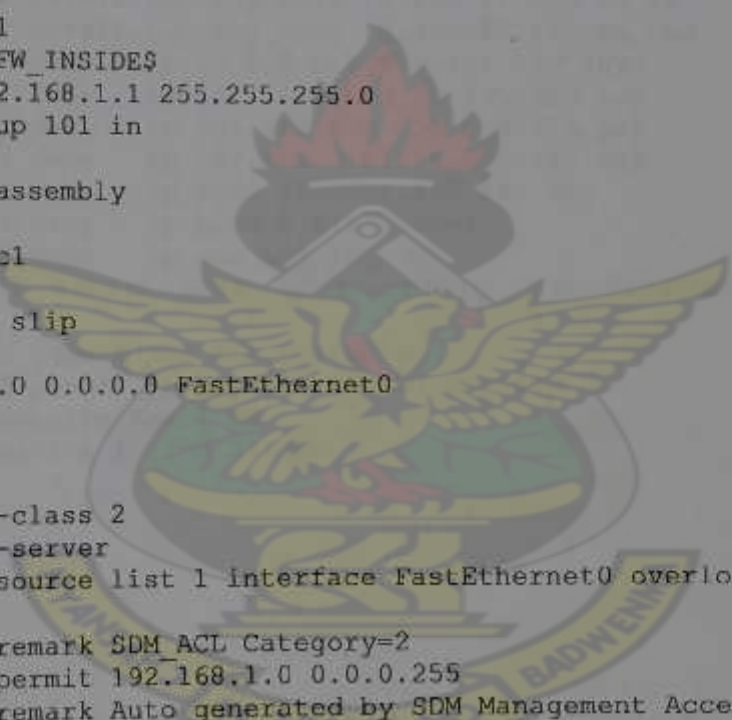
```

```

no ip address
shutdown
duplex auto
speed auto
!
interface FastEthernet2
!
interface FastEthernet3
!
interface FastEthernet4
!
interface FastEthernet5
!
interface FastEthernet6
!
interface FastEthernet7
!
interface FastEthernet8
!
interface FastEthernet9
!
interface Vlan1
description $FW INSIDES
ip address 192.168.1.1 255.255.255.0
ip access-group 101 in
ip nat inside
ip virtual-reassembly
!
interface Async1
no ip address
encapsulation slip
!
ip route 0.0.0.0 0.0.0.0 FastEthernet0
!
!
ip http server
ip http access-class 2
ip http secure-server
ip nat inside source list 1 interface FastEthernet0 overload
!
access-list 1 remark SDM_ACL Category=2
access-list 1 permit 192.168.1.0 0.0.0.255
access-list 2 remark Auto generated by SDM Management Access feature
access-list 2 remark SDM_ACL Category=1
access-list 2 permit 10.250.27.251
access-list 100 remark Auto generated by SDM Management Access
feature
access-list 100 remark SDM_ACL Category=1
access-list 100 permit ip host 10.250.27.251 any
access-list 101 remark auto generated by SDM firewall configuration
access-list 101 remark SDM_ACL Category=1
access-list 101 deny ip 10.250.26.0 0.0.1.255 any
access-list 101 deny ip host 255.255.255.255 any
access-list 101 deny ip 127.0.0.0 0.255.255.255 any
access-list 101 permit ip any host 10.250.26.22
access-list 101 permit ip any host 10.250.26.21
access-list 101 permit ip any host 10.250.26.20
access-list 101 permit ip any host 10.250.26.18
access-list 101 permit ip any host 10.193.2.199
access-list 101 permit ip any host 10.250.27.251

```

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```

access-list 101 deny ip any any
access-list 102 remark auto generated by SDM firewall configuration
access-list 102 remark SDM_ACL Category=1
access-list 102 permit tcp host 10.250.27.251 host 10.250.27.250 eq
telnet
access-list 102 permit tcp host 10.250.27.251 host 10.250.27.250 eq
22
access-list 102 permit tcp host 10.250.27.251 host 10.250.27.250 eq
www
access-list 102 permit tcp host 10.250.27.251 host 10.250.27.250 eq
443
access-list 102 permit tcp host 10.250.27.251 host 10.250.27.250 eq
cmd
access-list 102 permit udp host 10.250.27.251 host 10.250.27.250 eq
snmp
access-list 102 deny ip 192.168.1.0 0.0.0.255 any
access-list 102 permit icmp any host 10.250.27.250 echo-reply
access-list 102 permit icmp any host 10.250.27.250 time-exceeded
access-list 102 permit icmp any host 10.250.27.250 unreachable
access-list 102 permit tcp any host 10.250.27.250 eq 443
access-list 102 permit tcp any host 10.250.27.250 eq 22
access-list 102 permit tcp any host 10.250.27.250 eq cmd
access-list 102 deny ip 10.0.0.0 0.255.255.255 any
access-list 102 deny ip 172.16.0.0 0.15.255.255 any
access-list 102 deny ip 192.168.0.0 0.0.255.255 any
access-list 102 deny ip 127.0.0.0 0.255.255.255 any
access-list 102 deny ip host 255.255.255.255 any
access-list 102 deny ip host 0.0.0.0 any
access-list 102 deny ip any any log
access-list 103 remark Auto generated by SDM Management Access
feature
access-list 103 remark SDM_ACL Category=1
access-list 103 permit ip host 10.250.27.251 any
snmp-server community Brall RO
snmp-server location 10.250.27.251
!
!
!
!
!
!
control-plane
!
!
line con 0
line 1
modem InOut
stopbits 1
speed 115200
flowcontrol hardware
line aux 0
line vty 0 3
access-class 103 in
password 7 02050D480809
login
transport input telnet ssh
transport output none
line vty 4
access-class 100 in
password 7 00071A150754

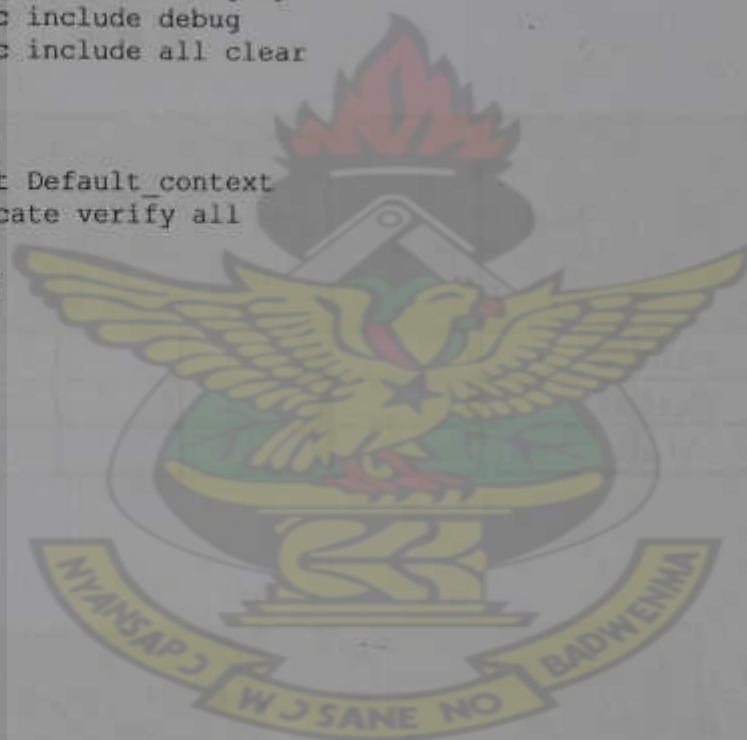
```



```

login
transport input telnet ssh
transport output none
parser view SDM_Monitor
secret 5 $l$YAmI$2gP7ECs1X.09pGWqYeDqn/
commands configure include end
commands configure include all interface
commands exec include dir all-filestystems
commands exec include dir
commands exec include all crypto ipsec client ezvpn
commands exec include crypto ipsec client
commands exec include crypto ipsec
commands exec include crypto
commands exec include all ping ip
commands exec include ping
commands exec include configure terminal
commands exec include configure
commands exec include all show
commands exec include all debug appfw
commands exec include all debug ip inspect
commands exec include debug ip
commands exec include debug
commands exec include all clear
!
!
!
webvpn context Default_context
ssl authenticate verify all
!
no inservice
!
end

```



Appendix D: Result of the survey about drivers satisfaction level during the test phase

Satisfaction level	Count	
Highly satisfy	29	63,04
Satisfy	16	34,78
Not satisfy	1	2,17

Easy-to-use	Count	%
Empty	1	2,17
Very easy	29	63,04
Easy	16	34,78

Satisfaction level	Easy-to-use			Total	%
	No response	A : Very easy	B : Easy		
Highly satisfy		22	7	29	63,04
Satisfy	1	6	9	16	34,78
Not satisfy		1		1	2,17

Top 5 rates

General comment	Count	% according to top 5	% according to Total
Synchronisation problem	10	36%	22%
Frozen PDA	6	21%	13%
Facilitate sales process	6	21%	13%
Delay on printing recap	4	14%	9%
Full SD card memory	2	7%	4%
Total top 5	28	100%	61%
Grand Total	46		

Appendix E: Result of Billing System test period 24/04/2009 to 21/05/2009

Dates		Hardware		Software			Network		Business	Listed vehicles
		Printer	PDA	JEM	ISHA	ISHA2JEM	Wi-Fi/ Data error	Wi-Fi/ Data not received		
24/04/2009	Issue	2	39	10			2	0	8	87
	Avail %	97,70	55,17	88,51	100,00	100,00	97,70	100,00	90,80	
25/04/2009	Issue	2	18	14			6	3	7	87
	Avail %	97,70	79,31	83,91	100,00	100,00	93,10	96,55	91,95	
26/04/2009	Issue	1	18	12			6	0	9	89
	Avail %	98,88	79,78	86,52	100,00	100,00	93,26	100,00	89,89	
27/04/2009	Issue	1	16	10			3	11	7	88
	Avail %	98,86	81,82	88,64	100,00	100,00	96,59	87,50	92,05	
28/04/2009	Issue	0	6	15			3	12	7	87
	Avail %	100,00	93,10	82,76	100,00	100,00	96,55	86,21	91,95	
29/04/2009	Issue	2	6	9			13	15	11	87
	Avail %	97,70	93,10	89,66	100,00	100,00	85,06	82,76	87,36	
30/04/2009	Issue	0	9	9			10	10	9	87
	Avail %	100,00	89,66	89,66	100,00	100,00	88,51	88,51	89,66	
01/05/2009	Issue	0	7	7	10		5	10	7	87
	Avail %	100,00	91,95	91,95	88,51	100,00	94,25	88,51	91,95	
02/05/2009	Issue	0	3	7	0		6	29	7	87
	Avail %	100,00	96,55	91,95	100,00	100,00	93,10	66,67	91,95	
03/05/2009	Issue	0	6	11	0		4	12	5	89
	Avail %	100,00	93,26	87,64	100,00	100,00	95,51	86,52	94,38	
04/05/2009	Issue	1	5	10	0		6	24	7	88
	Avail %	98,86	94,32	88,64	100,00	100,00	93,18	72,73	92,05	
05/05/2009	Issue	0	4	8	0		31	12	3	87
	Avail %	100,00	95,40	90,80	100,00	100,00	64,37	86,21	96,55	
06/05/2009	Issue	0	8	8	0		19	10	6	87
	Avail %	100,00	90,80	90,80	100,00	100,00	78,16	88,51	93,10	
07/05/2009	Issue	1	5	4	0		25	10	4	87
	Avail %	98,85	94,25	95,40	100,00	100,00	71,26	88,51	95,40	
08/05/2009	Issue	0	4	7	0		9	6	3	91
	Avail %	100,00	95,60	92,31	100,00	100,00	90,11	93,41	96,70	
10/05/2009	Issue	0	6	16	0		21	14	1	88
	Avail %	100,00	93,18	81,82	100,00	100,00	76,14	84,09	98,86	
11/05/2009	Issue	0	5	13	0		9	16	0	89
	Avail %	100,00	94,38	85,39	100,00	100,00	89,89	82,02	100,00	
12/05/2009	Issue	0	5	10	0		11	18	1	90
	Avail %	100,00	94,44	88,89	100,00	100,00	87,78	80,00	98,89	
13/05/2009	Issue	1	2	3	0		13	13	3	87
	Avail %	98,85	97,70	96,55	100,00	100,00	85,06	85,06	96,55	
14/05/2009	Issue	0	5	8	0		10	8	0	87
	Avail %	100,00	94,25	90,80	100,00	100,00	88,51	90,80	100,00	
15/05/2009	Issue	0	1	4	0		11	0	1	90
	Avail %	100,00	98,89	95,56	100,00	100,00	87,78	100,00	98,89	
16/05/2009	Issue	1	4	4	0		10	11	1	89

Dates		Hardware		Software			Network		Business	Listed vehicles
		Printer	PDA	JEM	ISHA	ISHA2JEM	Wi-Fi/ Data error	Wi-Fi/ Data not received		
	Avail %	98,88	95,51	95,51	100,00	100,00	88,76	87,64	98,88	
17/05/2009	Issue	0	1	2	0		8	0	1	90
	Avail %	100,00	98,89	97,78	100,00	100,00	91,11	100,00	98,89	
18/05/2009	Issue	0	7	6	0		7	13	1	91
	Avail %	100,00	92,31	93,41	100,00	100,00	92,31	85,71	98,90	
19/05/2009	Issue	0	9	5	0		12	15	3	91
	Avail %	100,00	90,11	94,51	100,00	100,00	86,81	83,52	96,70	
20/05/2009	Issue	0	7	10	0		5	16	2	90
	Avail %	100,00	92,22	88,89	100,00	100,00	94,44	82,22	97,78	
21/05/2009	Issue	0	2	5	0		8	0	2	88
	Avail %	100,00	97,73	94,32	100,00	100,00	90,91	100,00	97,73	
Result	Average Avail	99,49	91,25	90,46	99,57	100,00	88,53	87,91	95,10	88,33

