With the current Asia financial crisis and the slow down in construction and foundation industries in many of the Asian countries, many used equipment are now idling. Sales and rental of equipment are projected to slow down. Spare parts sales is also expected to be greatly affected due the idling of equipment and the slow down in the industry. The expected revenue for the year 1998 for the Bauer Far East is projected to be much lower than last year revenue of DM100 million.

With the reduction in sales of equipment and spare parts, a major portion of the stock holding will become non-moving. The inventory turnover which is computed as cost of goods sold divided by inventory will be lower for the year 1998 as compared with 1997. The low inventory turnover will become a heavy burden for the group if it is not taken care of as soon as possible.

5.0 Detailed Business Requirements

5.1 Identify Alternative Courses of Actions

Based on the survey results and the problems which were discussed and summarised in section 4.0, the following alternative courses of actions based on the Rational Decision-Making Process [11] were identified as follows:

5.1.1 Do nothing.

All the locations will continue to manage their inventories as before. Further enquiries about the inventory status will have to be made through fax and telephone calls. More frequent contacts have to be made or through the advantage of 'good relationship' with the local staff if information is needed urgently.

5.1.2 Propose a central location for inventory control

It is proposed that all the locations send their weekly or monthly inventory status to the central location for consolidation. The central location is chosen among the 6 Bauer Far East locations. The criteria for the choice of the central location shall be based on the experience and the availability of the staff related to inventory management. The transmission of the inventory status by each of the locations can be through fax, e-mail, mail or any other means as long as it is received by the central location before the due date.

The central location will design its own system to handle and manage the information received. It will then provide a weekly or monthly consolidated inventory status report for the group. Any further enquiries on the inventory status can be obtained from the central location, if needed.

5.1.3 Improve the inventory documentation to reduce human errors

In this option, a new inventory documentation system will be introduced in all the locations. The system shall have a standardised part ID for every equipment, tools and spare parts. All the inventory data shall be properly documented and an up-to-date inventory status shall always be maintained. For example, every part in the inventory store must have an ID, stock location, condition, manufacturing date, etc. Inventory status report must contain as much details as possible about the inventory for ease of identification and reference.

5.1.4 Proposed an integrated centralised inventory management system

A new integrated, centralised inventory management system will be proposed in this option to handle the management, consolidation and

dissemination of the inventory information for all the locations. The proposed system will have the following main features and capabilities:

- An integrated computerised inventory management system will be designed and developed by taking into consideration the requirements of the whole Bauer Far East group instead of the individual locations. This will ensure that the problems faced by the various locations are reduced to a minimum.

- All the Bauer Far East locations will use the same inventory management system for tracking and management of their inventory, i.e. equipment and tools inventory, and spare part inventory to ensure that data redundancy and duplication of works are reduced to a minimum.

- A standardised computer platform and system software will be installed in all the locations to ensure that any upgrading of application software in the future can be applied throughout the various locations with minimum interruptions and training to the local staff.

- All the equipment, tools and spare parts must have a part ID before they can be entered into the system. The system shall have an error checking feature to ensure data integrity.

- The whereabouts and other information of the equipment and tools such as Manufacturing Date, overall condition, major repair carried out (when and where), working hours of the equipment and tools are captured in the system. If possible, the latest picture of the equipment or tool is captured in the record such that whenever an enquiry is made, one can look at the picture to eliminate any possible error about the physical condition of the equipment or tools. In addition, a sales

can be concluded much faster as a customer can make a quick decision after getting a look at the picture of the equipment or tool.

- The local inventory databases will be linked to the central inventory database via Internet network as Internet connection is one of the most cost effective means of data communications and is readily available in almost all the countries in the world.

- Inventory management reports such as Inventory Status Report, Non-moving and Fast Moving Inventory Report, etc. will be developed and make available to all the locations to ensure that everybody is using the same reports with the same formats.

- A program will be written to download the inventory status and other information from the local inventory database and then send this information via Internet to the central computer. Another program will automatically update this information to the central inventory database. Figure 5.1 shows the links between the local and central databases.

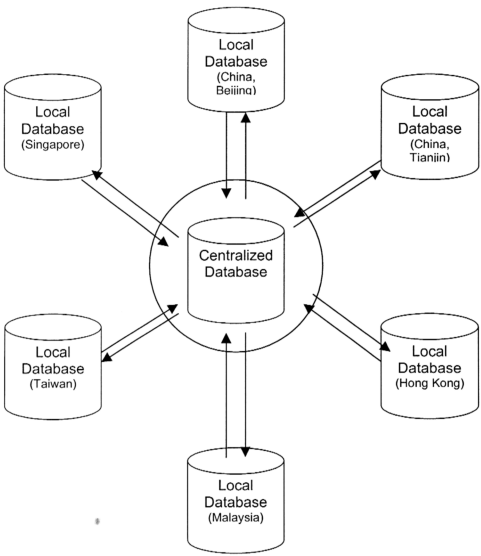

Figure 5.1: Proposed links between local and centralised databases

The proposed system will consist of two separate modules, the first module to handle the inventory management of the equipment and tools, and the second module to handle the inventory management of spare parts. The main reason of having two separate modules is due to the fact that the information required for the equipment and tools, and the spare parts are fundamentally different.

5.1.4.1 Basic Information of Equipment/Tools

Some of the basic data required for equipment or tools are as follows:

a. Type of Equipment/Tools:

This field will determine the type of equipment or tool. It can be used to sort for any particular type of equipment if needed.

For example:

BG	- Bauer Boring Rig
BC	- Bauer Cutter
MBC	- Bauer Mini Cutter
KY	- Kelly Bar
TL	- Tools
BV	- Oscillator
KDK	- Rotary Drive
BE	- Desander
KP	- Grouting Equipment
HD	- Hydraulic Power Pack
HG	- Hydraulic Grab
AR	- Top Vibrator, and
Others	

b. Machine/Equipment Model:

The machine/equipment model represents the capacity of the equipment . For example, BG14, BG15, BC30, etc.

c. Equipment Serial Number

A unit number for every type of equipment or tool., e.g. #38, #129, #138, etc.

d. Working Hours (if applicable)

The working hours of the equipment at the current time of inspection. This information is important to determine how long the equipment has been actually working.

e. Manufacturing Date

This is the date of manufacturing the equipment or tool. This information will allow the user to calculate the age of the equipment or tool.

f. Manufacturer

This is the name of the original manufacturer of the equipment or tool. For example, the base machine of the Bauer BG can be manufactured by Sennebogen, Liebbher or O & K but the engine can be manufactured by Caterpillar or Duetz.

g. Equipment Capacity

The equipment capacity determines the loading amount the machine can accommodate. It is measured in tons.

h. Main Winch Capacity (if applicable)

Main winch is a major component of the Bauer equipment. The capacity of the main winch is important for the calculation of overall loading factor. It is measured in tons.

i. Mast Height (if applicable) or Length (for Kelly Bar)

The total height of the equipment or the Kelly Bar. It is measured in meters.

j. No. of Sections (for Kelly Bar)

The total number of sections that the Kelly Bar has, usually a kelly bar has 3, 4 or 5 sections.

k. Outer Diameter (for Kelly Bar)

This is the outer diameter of the outer section of the kelly bar. It is measured in mms.

Besides the physical information of the equipment or tools, the current information or conditions of the equipment or tools are very useful as well. Some of them are as follows:

l. Current Owner

The field captures the present owner of the equipment or tool. This is an important piece of information as equipment can be traced back to its owner and the number of equipment owned by the same owner can also be computed.

m. Current Location

The field captures the present location of the equipment or tool. It will provide information about the where about of the equipment or tool.

n. Previous Owner

It captures the previous owner of the equipment or tool which provides the user the ability to trace the history of the equipment.

o. Condition of Equipment

It provides the current condition of the equipment or tool. This can be a useful information to the sales force. For example, we can code the condition of the equipment or tool as follows:

01 - Brand new
02 - New, stored > 6 months
03 - Demo unit, used item
04 - Fully overhauled
05 - Used and repaired
06 - Used and not repaired
07 - Used and in questionable condition
08 - Rented out

If the equipment or tool is rented out, the information of the customer, job site also can be recorded.

5.1.4.2 Basic Information of Part

In comparison, the basic information required for the spare parts are quite different. Some of these basic information are mentioned as follows:

a. Part ID

This is the identification code of the part. Every spare part has a unique ID number.

b. Description of the part

This gives a brief description about the part.

c. Manufacturer name

It is the name of the manufacturer of a particular part. It would be easier for the user to trace back the original manufacturer if necessary.

d. Manufacturer ID

It is the manufacturer's number assigned by Bauer. Every manufacturer will have an ID.

e. Cost of part

The field captures the cost of the parts.

f. Sales Tax

It provides the sales tax information for the part. It will be used for selling price computation.

g. Custom Duty

This captures the custom duty for the part. It is used for selling price computation.

h. Weight of part

It is the weight of the part. It is useful for computation of freight charges and other shipping purposes.

i. Dimension of part

It is the physical dimension of the part. It is useful for computation of freight charges and other shipping purposes.

j. Supplier name & ID

This is the primary name of the supplier who supplied the part. Every supplier will be assigned with a supplier ID and it is unique.

k. Lead time of purchasing

This is lead time that the supplier can deliver the part. It is useful for spare part planning purposes.

l. Unit of Measure

This is unit of measure for part. For example, the unit of measure can be in kg, meter, piece, etc.

m. Quantity

The field contains the quantity of a particular part. It is a variable field and changes constantly.

5.1.4.3 System Requirements for the Proposed System

The system requirements for the proposed system are as follows:

i) Every location must have an Internet connection, which is one of the economic means of data communication currently.

ii) The system will be developed using MS Office 97 Professional application, which means that every location must have at least a copy of MS Office 97 Professional Version.

iii) As most of the companies within the group already have PCs with MS Office 97 Professional and Internet connection, the requirement of purchasing new hardware and software will be minimum. Cost of the system will be mainly limited to development, implementation of the system and the setting up of a web site for the Internet access to the system.

Bauer Equipment Malaysia (BEM) will be chosen as the site responsible for the implementation of the proposed system which includes detailed feasibility study, system design and development, implementation, installation and training. BEM is chosen because of the following reasons:

i) since it is the only location in the Far East region to have an Information Technology department.
ii) It has the personnel who are experienced in managing and implementing large scale IT projects for the multi-national company.

In addition, BEM will also serve as a central location to handle the centralised management and consolidation of inventory databases, and dissemination of inventory information to other Bauer locations.

The proposed system will provide clear visibility of the inventory of the group, for example, the status of the inventory can be enquired from every where in the world as long as it has logged on to the centralised inventory database. Productivity and efficiency of the company will be improved with more accurate information, timely responses to enquiries, reduced telephone and fax contacts and more useful management reports.

5.2 Evaluate Alternative Courses of Actions

Bauer can select several alternative courses of actions, they are as follows:

5.2.1 Do Nothing

This will not work as the problems will still exist no matter how hard or persistent the management of Bauer tries to push. They will try initially but once they cannot get any positive result, they will give up eventually.

It will not be a good decision as nothing has been done to improve the whole situation.

5.2.2 Propose a central location for inventory control

It is a better solution than doing nothing to it. But inventory consolidation is not an easy job for the following reasons:

- Every location used their own inventory management system which makes it very difficult to consolidate the data.

- Inventory data and information are received via all types of transmission media. These information and data have to be keyed into the database or spreadsheet before any consolidation can be done. The process of keying all this information is very time consuming and error prone.

- Because of different part ID used in different location, it is difficult for the staff in the central location to assign the correct ID to the part or equipment. Consolidated Inventory status may not be correct.

- The information can only be received once a week or a month and probably this information will take another week to be consolidated before it can be published. By this time, the information may have become obsolete and may not be very useful to the sales force. Counter checking of inventory will still have to be done with the original inventory location to ensure that the information received is correct. A lot time is wasted and the communication cost is high.

- Management reports such as Non-moving High Value Inventory, Fast Moving Inventory, etc cannot be produced easily.

It is foreseen that with the implementation of this proposal, many fundamental problems will still remain unresolved. Thus, this cannot be a proper solution for Bauer.

5.2.3 Improve the inventory documentation to reduce human errors

The system will improve the documentation of inventory management of the locations. Response to the enquiry about the inventory status can be very much faster, and consolidation of inventory can be done easier due

to proper documentation and hence better inventory management. But, there are short falls as well, for example:

- It still requires a lot of manual preparation before consolidation of inventory can be achieved if non-standard inventory management systems are used by all the locations.

- Duplication of works and data redundancy due to the fact that if there is a new inventory information, it has to be recorded again in all the locations.
- Staff training is difficult due to non-standardised system. Every location has its own training program which is very inefficient and not cost effective.

- Overall, the efficiency and productivity of the company does not improve significantly.

In view of the above, this option does not significantly contribute to the overall inventory management of the group. It may only form part of the whole system.

5.2.4 Proposed an integrated centralised inventory management system

Before we make any decision whether or not this option is a viable solution, we will look at the advantages and disadvantages of the proposed system.

The advantages of the proposed system are as follows:

- A standardised system will be used throughout the locations in terms of system hardware, software and application systems. This will provide ease of implementation, training and maintenance.

- An economy of scale can be achieved as only one standardised system is developed as it can be used by all the locations. Cost of development is reduced as it is shared by all the locations.

- A better inventory documentation and reporting systems can be achieved when every location is using the same system. New reports if required, have to be requested through the central location. The central location will have the opportunity to review through the requests to ensure that the new requested reports benefit everyone. And once they are developed, they can be implemented in all the locations.

- As all the necessary information about the equipment, tools or spare parts of all the locations can be retrieved readily via the central inventory database, this will reduce sales enquiry turn around time and thus, provide faster response to the customers.

- The cost of data communication can be reduced significantly through the centralised inventory management system. It is no longer necessary to call the local offices for information regarding the inventory.

- The proposed system will improve pre and after sales service due to fact that the sales personnel would be able to provide faster response to the needs of the customers. Customer satisfaction and relationship will be greatly enhanced and sales turnover will be increased in the long run.

- Inventory turnover for the group will be improved as the proposed system can provide better visibility about the inventory. There is no necessity to over stock any spare parts or run into out-of-stock position. The overall stock amount shall be reduced due to the enhanced visibility and greater mobility within the locations.

- With the information captured in the centralised inventory management system, it is now possible for Bauer to take advantage of the data captured over the period by analysing the databases. For example, by analysing the inventory transaction patterns, Bauer will be able to generate a better inventory planning requirement; the fast and slow moving items, and the buying patterns of inventory in different locations, etc.

- The proposed system will be developed by Bauer Equipment Malaysia which has the experienced personnel who know the business requirements and who can handle the whole project development work.

In comparison, the main disadvantages of the proposed system are as follows:

- Initial cost of system hardware and software can be quite high especially for those locations which still do not have the prescribed standard hardware and software.

- As it is a new system, training for all the staff in all the locations is necessary. Initial cost of training can be quite substantial.

- Time taken to develop the new software can be as long as 6 months to a year. It will be a big challenge to convince the management to

approve the initial amount of investment and the time taken to develop the application software.

- During the implementation stage, there will be some strong rejections from some of the staff to use the new system. It is probably due to fear of learning new skills, afraid of failure and job security for example.

- Initial implementation of the new system may face a number of teething problems and this can be quite discouraging if the problems are not resolved immediately.

By reviewing the advantages and disadvantages of the proposed system discussed above, we could find that the advantages and benefits which Bauer can derive from the proposed system in the long-term will be much more than the disadvantages which the company may needs to face. In conclusion, the proposed system is a viable alternative course of action for Bauer to solve their inventory problems in the long-term.

5.3 Recommendation and Conclusion

The criteria of recommendation for an alternative or a combination of alternatives discussed in sections 5.1 and 5.2 will largely depend on a few main factors [10] as mentioned below:

i) How much of the problems encountered by each of the Bauer locations and as a whole, have been addressed by the proposed system.

ii) The cost of implementing the proposed option/s in terms of capital equipment, labour and its associated costs in comparison with the benefits derived from the system.

iii) The length of implementation for the whole project. Too long to implement a project of this scale will not be feasible as it will have a negative impact and a wrong perception to the Bauer management and other members of the staff.

iv) The tangible and intangible benefits which the company can gain from the implementation of the proposed system in the short-term and long-term.

v) The right kind of personnel who can work under pressure to handle and co-ordinate the whole project which involves multiple locations, dealing with multiple languages and cultural differences, and overcoming rejections from certain section of the staff in the process of development and implementation of the project.

With the guidelines mentioned above and the comparison data summarised in Table 5.1, we would strongly recommend Bauer to implement the Integrated Centralised inventory management system discussed in sections 5.1.4 and 5.2.4. The proposed system shall be initiated through Bauer Equipment Malaysia as it already has the IT infrastructures in placed and the staff with enough experience to oversee the development and implementation of the whole project. If the proposed system is developed and implemented according to specifications and planned, Bauer would be able to resolve most of the current inventory problems. In addition, it will enhance the operational efficiency of the company and gain competitive advantage over its competitors. Besides that, with the implementation of the proposed IT infrastructures for each of the locations, Bauer would be able to develop new application systems in the future to benefit the whole region of Bauer without much investment in system hardware and software.

Table 5.1: Comparison of the Alternatives 1, 2, 3 and 4

Item		1	2	3	4
1	Standardization of system, hardware and software for uniform development, ease of implementation and training				x
2	Centralised database management for inventory		x		x
3	Good documentation to enhance inventory record management			x	x
4	Information and data are captured at source				x
5	Good management reports for making management decision				x
6	Reduce duplication works and data redundancy				x
7	Speed of implementation	x	x	x	
8	Cost of development and implementation in short term	x	x	x	
9	Cost reduction in the long term				x
10	Enhance operational efficiency and improve productivity				x
11	Improve inventory turnovers			x	x
12	Response to customer needs				x
13	Database information for product and marketing planning				x

Note:

1. Do nothing
2. Central location for inventory control
3. Improve inventory documentation to reduce human errors
4. Integrated centralised inventory management system