DESIGN OF USER INTERFACES FOR JOB SHOP ENVIRONMENT

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ABSTRACT—User-computer interface development has gone through rapid development in recent years. These developments, however, have not yet been fully implemented in management information system (MIS) design for job shop manufacturing situations. Most of the commercially available MISs are operationally inflexible and do not support management in report generation and decision making, particularly in job shops. This paper describes a framework in developing system-user interfaces for job shop manufacturing situations to highlight how a generic information system can be made more useful to managerial decision making. Object-oriented programming technology has been used to provide flexible access to information stored by a generic MIS. Twenty interfacing programs have been developed. For illustration, only three of those interface programs relating to generation of strategic level management reports are discussed here.

Key Words: Interface Design Programs, Management Information System, Job Shop Manufacturing.

1. INTRODUCTION

A MIS should be operationally simple and must present the right amount of information in the right format to the management for decision making. But this aspect of MIS design is often neglected and MIS designers rarely take the interfacing of software tools to users (man-machine interaction) seriously. This is one of the major reasons for poor utilisation of MIS in the manufacturing area. Production management may ignore the most accurate scheduling system if it is difficult to produce or access the results. Even when production of schedules is simple, if the output is presented in a manner that is difficult to read, it may be ignored.

MIS programs typically gather, organise and store vast quantities of data from all areas of a company - shopfloor, purchasing, sales, estimation, quality, stores, and even from management. Access to data and system outputs are typically system designated. To get a certain set of results, or an analysis of information, a user has to run through a system-designated set of steps. More often than not these steps lead to a result that is not exactly what is required. Unfortunately, procedural methods are still the emphasis of generic MIS design. Often little consideration is given to the flexibility and usefulness of reports generated for different levels of management.

From managers' point of view a MIS development should be integrated with the overall operation of a company. A MIS should not be looked upon only as a means of gathering data and generating reports, but also as a means of enhancing managerial effectiveness and employee participation. The impact of increased effectiveness of a MIS can be explained in terms of two positive feedback loops (A+ve and B+ve) as shown in Figure 1. The causal loop diagram, based on system dynamics [1,2], shows that if MIS becomes more
The survey also showed that 49 percent of the responding companies that did not have client/server strategies planned to boost their purchases of mainframes.

There is a definite view in the manufacturing arena that it is necessary to remain up to date with evolving computer hardware technology, and that it is not clear as to what type of platform, client/server or mainframe, is best suited to MIS development. The roles of computer technology in manufacturing are evolving as the technology itself evolves.

3. SUITABILITY OF MAJOR INFORMATION SYSTEMS TO MANUFACTURING INDUSTRY NEEDS

There are a large number of commercial software packages geared towards the needs of manufacturing companies. The significant few are R/3(SAP), MAPICS XA, BPCS, Movex, Tritan (Baan IV), Manugistics, GEMMS and ManuSoft [8]. Most of these packages are being programmed or re-programmed in object-oriented languages and most now employ external databases. The majority of larger applications can run on many different external databases such as Oracle, DB2, Informix, and SQL. The larger application developers place great importance on keeping up with the latest available technology, but smaller developers such as ManuSoft can often fall behind.

From the array of available products and solutions it is obvious that no one software, or even one method of obtaining a software solution, can satisfy all business requirements. It is also unlikely that any single developer will meet all of a company’s computing requirements.

One of the fastest ways to distinguish among systems and find a ‘best fit’ to an individual company is to find out what is required to adapt the software to a particular (and sometimes peculiar) method of doing business. Flexibility translates into the ability to customise fields, screens and relationships of data. The systems by the large developers, offer full customisation of fields, screens and layout. As flexibility increases, price tends to go up. But low price does not always translate into loss of flexibility. Many systems at the low end of the price range have some flexibility. The names of miscellaneous fields may be changed, or perhaps unwanted items can be masked, and in some cases custom screens can be added. But, how much customisation does an organisation truly need? Today companies are forced to distinguish between “must have” requirements and “nice to have” components [9].

Along with the operation of the MIS, companies must decide which MIS tools are important (e.g. financial management, materials control, personnel management or production control), and choose or develop a MIS that suits their specific needs. It must also always be kept in mind that a MIS is a management information solution, not a management solution.
small press tools, mould tools, refurbishment and repairs, design only, and major projects. Approximately 65% of parts are produced on a one-off basis for a wide variety of industries in the manufacturing arena.

4. INTERFACING TO MANAGEMENT REQUIREMENTS

To aid in the investigation of information requirements, ABC Engineering as a business was divided into three levels as suggested by Cheng & Simmons [10]. The levels are strategic, planning and operations. Staff at ABC Engineering were interviewed to discuss reporting requirements and preferences at each level. The requests for information showed that the ManuSoft system caters well for the operations level of the business, but the strategic and planning levels required a great deal of work.

In total, 20 program files were developed to meet the shortfalls of information requirement. Table I provides a brief description of the program purpose and file names. Programming codes of all the files are available from the authors on request. To describe the development of the interface programs and their operation this section examines three examples; Delivery performance, Production by cost centre and Invoicing performance.

Table I. Developed Interface Programs.

<table>
<thead>
<tr>
<th>Program Number</th>
<th>Program Description</th>
<th>Program File Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>Work by cost centre</td>
<td>COST CEN.XLS</td>
</tr>
<tr>
<td>3</td>
<td>Delivery details for a period</td>
<td>DESP R2.XLS</td>
</tr>
<tr>
<td>5</td>
<td>Invoices by product code for a period</td>
<td>INVOICE.XLS</td>
</tr>
<tr>
<td>8</td>
<td>Hours by product code with orders, reworks and invoices</td>
<td>NIGHTLY.XLS</td>
</tr>
<tr>
<td>9</td>
<td>Monthly order intake report</td>
<td>ORDER.XLS</td>
</tr>
<tr>
<td>11</td>
<td>Hours, rework, invoices and orders by planner for a period</td>
<td>PLANNERS.XLS</td>
</tr>
<tr>
<td>12</td>
<td>Hours, rework, invoices and orders by product code for a period</td>
<td>PRD CODE.XLS</td>
</tr>
<tr>
<td>14</td>
<td>Progress claim information for a period</td>
<td>PROGRESS2.XLS</td>
</tr>
<tr>
<td>15</td>
<td>Financial information on completed jobs for a period</td>
<td>RJS COMP.XLS</td>
</tr>
<tr>
<td>20</td>
<td>Open orders at a point in time, with data on costs and sales.</td>
<td>OPENSEAL.XLS</td>
</tr>
</tbody>
</table>

Planning level

<table>
<thead>
<tr>
<th>Program Number</th>
<th>Program Description</th>
<th>Program File Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Highlights sub-assemblies on the order book for which the final-assembly has been despatched. Such sub-assemblies must be removed manually.</td>
<td>SUBASS.XLS</td>
</tr>
<tr>
<td>4</td>
<td>Find the planner given a job number</td>
<td>FIND PL.XLS</td>
</tr>
<tr>
<td>6</td>
<td>Download labour list from ManuSoft</td>
<td>LABOUR.XLS</td>
</tr>
<tr>
<td>10</td>
<td>Download parts and processes from ManuSoft</td>
<td>PARTDWN.XLS</td>
</tr>
<tr>
<td>13</td>
<td>Manufacturing production sheets</td>
<td>PROCESS3.XLS</td>
</tr>
<tr>
<td>16</td>
<td>Information on hours worked by sub contractors for a period</td>
<td>SUBBIES.XLS</td>
</tr>
<tr>
<td>17</td>
<td>Presents the hours spent by employees on non-productive work activities such as cleaning machines, training and maintenance</td>
<td>ZEROP2.XLS</td>
</tr>
<tr>
<td>18</td>
<td>Presents machine loading and work scheduled to a chosen work centre in a graphical format.</td>
<td>SCHED2.XLS</td>
</tr>
<tr>
<td>19</td>
<td>Highlights by responsible planner, discrepancies between hours estimated and actual hours taken to produce the job on the shopfloor.</td>
<td>EST01.XLS</td>
</tr>
</tbody>
</table>

Operations level

<table>
<thead>
<tr>
<th>Program Number</th>
<th>Program Description</th>
<th>Program File Name</th>
</tr>
</thead>
<tbody>
<tr>
<td>7</td>
<td>Adjust Nightshift Clock-offs to the correct period</td>
<td>NIGHT.XLS</td>
</tr>
</tbody>
</table>

4.1 Delivery Performance Interface (Program 3)

The delivery performance program file is an example of early interface development. The program simplifies the production of the required reports immensely. To explain the sequence of codes development, the program structure is given in Appendix 1. The full program listing is available on request.
Various management divisions such as the Board of Directors or General Manager require data from the Accounts department on cost centre hours for company evaluation. This data may be required at any time depending on its application and usually it is required instantly. Often the Accounts department is tasked with providing evaluations for specific time periods with durations of anything from days to years. The report provides data for each workcentre. All data required for this report is contained in the ManuSoft JOBCOST.DAT file and as such requires only a simple program to extract the data. There is not even a need to use the ManuSoft indexing system.

To gather the information from the ManuSoft system would require the running of 27 reports (one for each cost centre) from the job cost reporting section then transferral of data to a spreadsheet. Each report from that particular section of ManuSoft takes approximately 15 minutes to run (a total of approximately 7 hours), while accessing the data through this interface takes only 15 minutes in total. The logic of the program is simple. It compares the operation dates recorded in the jobcost file, for each of nine possible operations, in every jobcost record. If a date falls between the user defined reporting dates, the program then records the work centre of operation and converts the time, recorded in base 90 code, to hours. Finally the work centre is located on the report spreadsheet and the converted time is added to any time previously recorded.

4.3 Invoicing Performance Interface (Program 5)

The invoicing performance report reflects the development of auxiliary programs allowing the design of interfaces that automatically access a number of the ManuSoft data files. This program draws on data from three different data files, sorts, summarizes and presents the final report through a 'one-touch' interface.

The senior management of a jobbing shop requires data from the invoice reporting system to help answer many important questions. For example, is there enough money this period to pay everyone? Is there a strong market for product C, or should the business concentrate on product D? The data on invoicing alone cannot answer all of the questions, but it can provide information on money due to come into the business. This information can then be compared with data from cost reporting systems to give an indication of financial progress.
ACKNOWLEDGEMENT

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REFERENCES


APPENDIX 1: VISUAL BASIC V5.0 CODE

This appendix serves as a guide to the style of programming used to develop the management interfaces. The sequence of sub-programs for delivery performance is provided here. The actual program codes are available from the authors on request.

Program Code: Delivery Performance

'~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
'DECLARATIONS FOR DELIVERY REPORTING CODE
'~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Option Base 1 'Sets the basis for arrays to 1 instead of 0
'Storage for each product code and delivery category
Public Calculation, Category As Integer
Dim OpenFile, FileSheet As String
Public Const OnTime = 1, JustLate = 2, Late = 3, VeryLate = 4
'Dynamic storage variables
'~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~~
Sub CONTROL_MACRO()
'Set up to run through the code twice, once for the
'monthly data then once for the year to date data
Range("D3:G24").Select
Selection.ClearContents
'Clears data from the last report run
OpenFile = "DESP_MTH." 'Sets the file variable for monthly data
End Sub

'******************************************************************************
Sub CLOSE_DATA_FILES()
    'Redundant ManuSoft data files are closed
    If OpenFile = "DESP_YTD." Then
        Workbooks("DESP_YTD.").Close saveChanges:=False
    Else
        Workbooks("DESP_MTH.").Close saveChanges:=False
    End If
    Windows("DESP_R2.XLS").Activate
    ActiveWindow.Zoom = 100
End Sub

'******************************************************************************