Implementation of ERP in an Automobile Manufacturing Shop Floor

C.Madhan Kumar[1]*, M.Parthiban[2], A.Adhiyaman[2]

[1]PG Scholar, Department of Mechanical Engineering, PSG College of Technology, Coimbatore.

[2]Assistant Professor (Sl. Gr.), Department of Mechanical Engineering, PSG College of Technology, Coimbatore.

*E-Mail ID: madhan1007kumar@gmail.com, Mobile: 9994568864

ABSTRACT

The implementation of enterprise resource planning (ERP) systems has been known to be much more difficult than the development of a computer application supporting a single business function. This paper addresses the implementation of an ERP system in an automobile manufacture shop floor. This paper examines step by step procedure for implementing an ERP system within the shop floor and also looks improve business process and operations through good business communication system. The Development of a planning module by visual basic programming language were also discussed.

Keywords: Enterprise resource planning, Implementation, Benefits of ERP Implementation, implementation Risks, Open Source Software, Software Development.

1. INTRODUCTION

Firms around the world have been implementing ERP systems since the 1990s to have a uniform information system in their respective organizations and to re-engineer their business processes [1]. A successfully implemented ERP system has the advantages of reduced cost and high system quality [2]. It can also yield benefits to its customers not only because they can purchase products or goods at low prices resulting from the cost savings but also because they share the data of the production line in real time [3]. The benefit of ERP systems is highly dependent on the success of its implementation. In order to get the best out of ERP system the implementation must be managed as a program of wide ranging organizational change initiative rather than as a software installation effort [4].

Many business organizations that adopted ERP systems attained the benefits they sought [5]. After ERP systems were successfully implemented, companies could set up standards on financial management and operating procedures like managing inventory systems [6]. However, not all adopters had successful implementation, and some organizations failed because ERP system implementation was much more complex than just developing a computer application for a single business function. More than 90% of ERP implementations have been delayed and required additional budget amounts due to numerous changes in the original plan [7]. Even when a company realizes that its ERP implementation is not going to be successful, it is usually impossible to cancel the effort [8]. Such IT driven initiatives require change of the organization's socio-economic system,

which is intertwined with technology, task, people, structure, and culture [9]. Most literature on ERP implementation has focused on large enterprises that were considered to be appropriate for ERP systems [10]. However, the cost of ERP systems is rapidly decreasing to let small-size and medium-sized enterprises (SMEs) adopt the system [11]. Considering the importance of ERP in SMEs, an attempt has been made in this paper to analyze the implementation issues of ERP in a shop floor.

In reporting the case study this paper is organized as follows. In Section 2, the step by step procedure for implementing the ERP system has been presented. The benefits of implementing ERP system has been discussed in section 3. In section 4, The Development of a planning module by visual basic programming language is presented. Finally, summary is provided together with the conclusions in section 5.

2. ERP IMPLEMENTATION

2.1 ERP Scope

Implementing an ERP system will require significant changes on staff and work practices [12]. The consultants are responsible for the initial stages, training of employee's workflow study, customized interfaces, trouble shooting and assistance with ERP issues. As so many changes take place that affect almost everyone in the organization, it is important to involve them in the project to make and use the ERP system as a success.

There are four major reason for implementing ERP system in shop floor, they are

 To integrate financial data.
- To standardize manufacturing processes.
- To improve company growth.
- To make employee jobs easier.
- Available of right information on right time for better decision.

2.2 Basic ERP Modules

The advancement in information technology (IT) infrastructure is the backbone of ERP system implementation in any manufacturing industry. It is assumed the companies implementing ERP solutions may have multiple department and control. Hence on line data transfer is done across department where enabling technologies are used such as Workgroup, Workflow, Groupware, Electronic Data Interchange (EDI), Internet, Intranet and Data warehousing, to facilitate transactions. The ERP software is made up of many software modules selected based on both economic and technical feasibility for given manufacturing units.

ERP production planning module**:** this seeks to optimize the utilization of manufacturing capacity, parts, components and material resources using historical production data and sales forecasting.

ERP purchasing module**:** it streamlines procurement of required raw materials, as it automates the process of identifying potential suppliers, negotiating prices, placing orders to suppliers, and related billing processes.

ERP inventory control module: facilitates the process of maintaining appropriate level of stock in the warehouse through identifying inventory requirements, setting targets, providing

replenishment techniques and options, monitoring item usage, reconciling inventory balances and reporting inventory status.

*ERP sales module***:** its key functions are order placement, order scheduling, shipping and invoicing. This is key as revenues from sales are the live blood of the organizations.

*ERP financial module***:** this the core module of ERP software systems, as it gathers financial data from various departments and generate reports such as balance sheet, general ledger, trial balance as well as quarterly financial statements.

ERP human resources (HR) module: it routinely maintains a complete a complete employee data base to include contact information, salary details, attendance, performance evaluation and promotion of all employees. It is key in optimizing the utilization of the expertise of all employees.

2.3 ERP Implementation

a) Planning

*Project team***:** Assign a project team with employees from sales, customer service, accounting, purchasing, operations and senior management. Each team member should be committed to the success of the project and accountable for specific tasks, i.e. developing a timeline, finalizing objectives, formulating a training plan.

*Examine current business processes***:** Have the team perform an analysis on which business processes should be improved. Gather copies of key documents such as invoices, batch tickets and bill of lading for the analysis. The team members should also conduct interviews with key personnel to uncover additional areas of improvement needed.

*Set objectives***:** The objectives should be clearly defined prior to implementing the ERP

*Develop a project plan***:** The team should develop a project plan which includes previously defined goals and objectives, timelines, training procedures, as well as individual team responsibilities. The end result of the project plan should be a "to do" list for each project team member.

b) Procedure Review

Develop standard operating procedures (SOPs) for every aspect of the industry. These procedures should be documented. Make sure that you modify the document as SOPs change.

c) Data Collection

*Convert data***:** we can't assume 100% of the data can be converted as there may be outdated information in the system. Determine which information should be converted through an analysis of current data.

*Collect new data***:** Define the new data that needs to be collected. Identify the source documents of the data. Create spreadsheets to collect and segment the data into logical tables

*Review all data input***:** After the converted and manually collected data is entered into the ERP database, then it must be reviewed for accuracy and completeness. Data drives the industry, so it is very important that the data is accurate.

***Data clean-up*:** unneeded information such as customers who haven't purchased in a while or are no longer in industry are cleaned up.

d) Training and Testing

The project team should practice in the test database to confirm that all information is accurate and working correctly. Use a full week of real transaction data to push through the system to validate output. Run real life scenarios to test for data accuracy. Occurring simultaneously with testing, make sure all necessary interfaces are designed and integration issues are resolved to ensure the software works in concert with other systems.

e) Evaluation

Develop a structured evaluation plan which ties back to the goals and objectives that were set in the planning stage. In addition, a post-implementation audit should be performed after the system has been up and running for the first week for reconciliation purposes and industry benefits are being realized.

Here are some workspace Fig (1 – 4) of an ERP system implemented in shop floor.
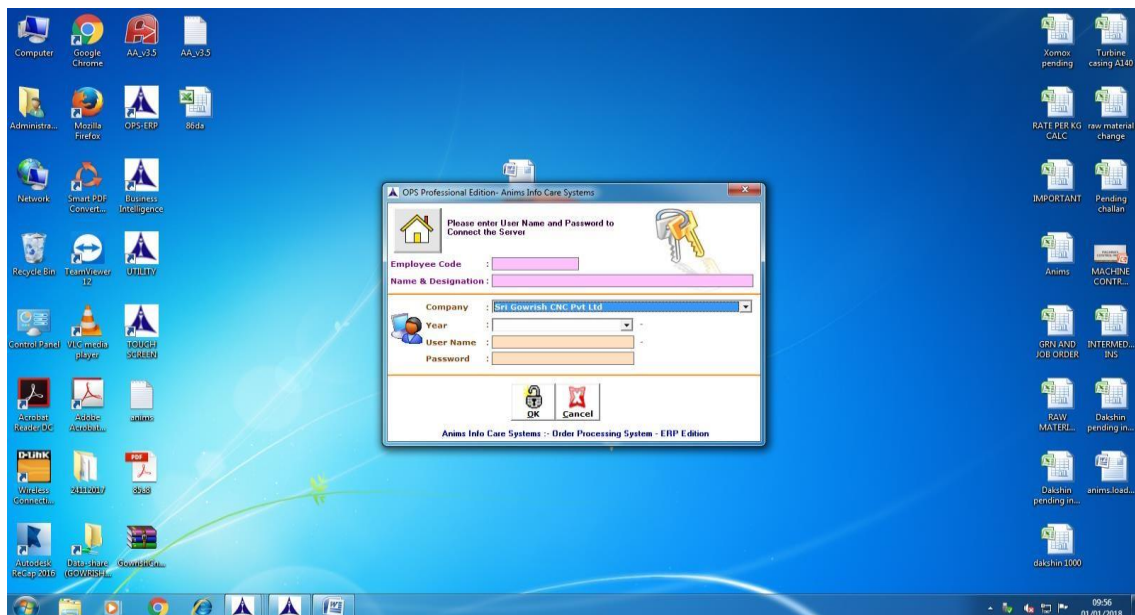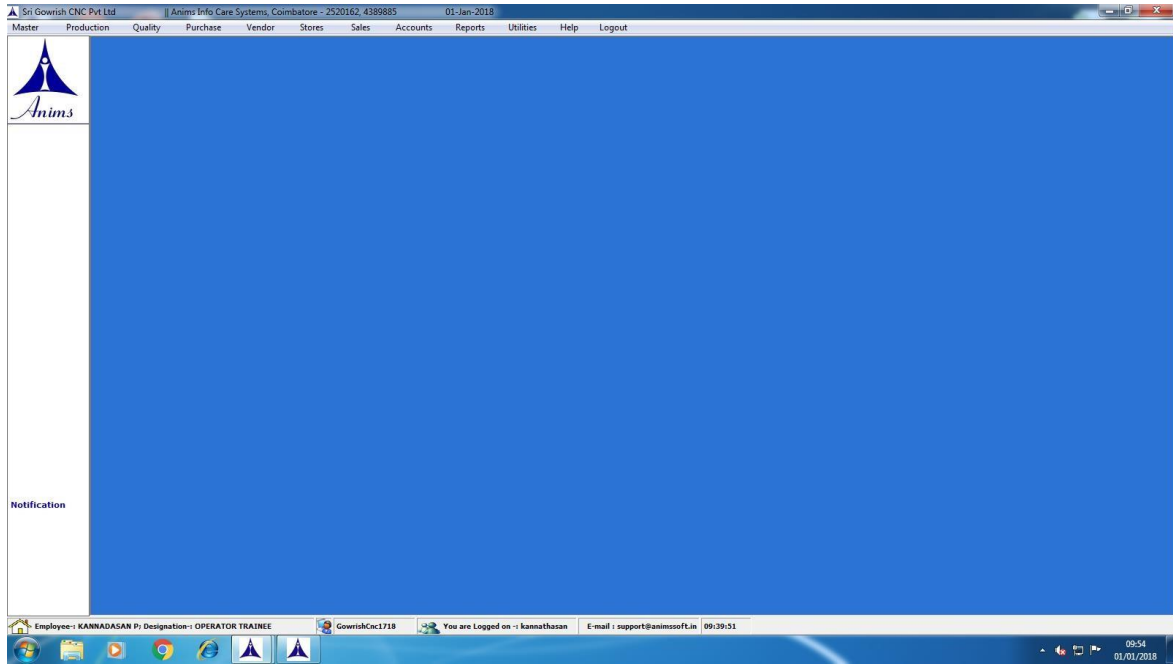

Fig. 1. ERP Workspace
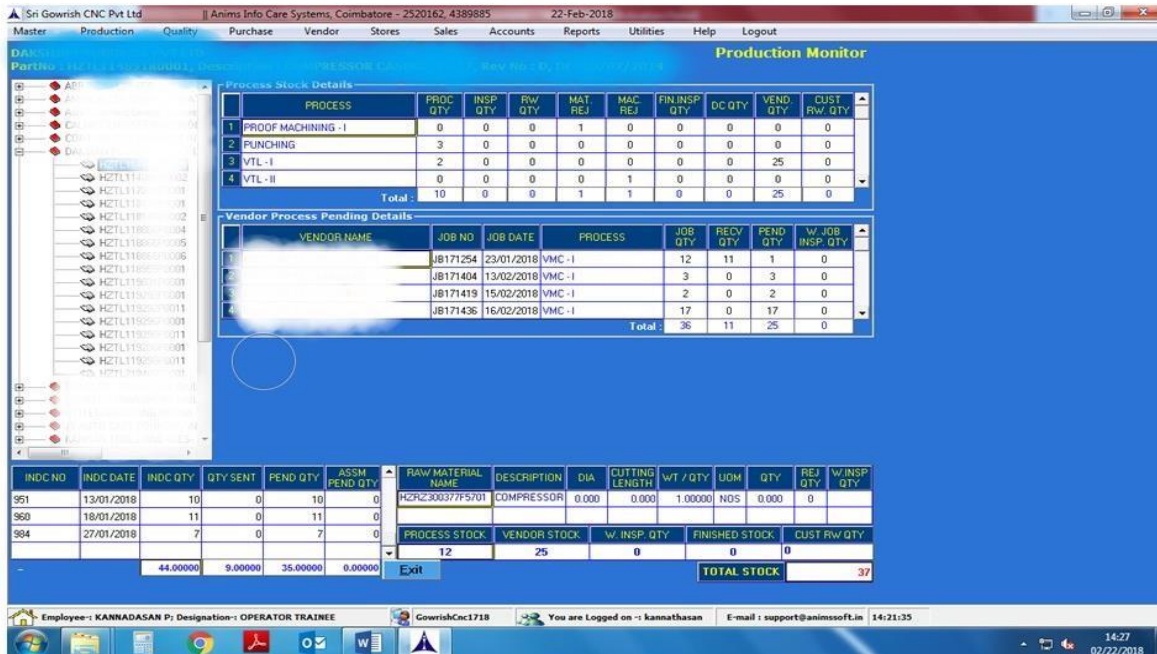
Fig. 2.   Modules of ERP

Fig. 3.   Production Monitor

Fig. 4.   Machine Master

2.4 Information Flow

An information flow diagram (IFD) is a diagram that shows how information is communicated (or "flows") from a source to a receiver or target. Fig 5 shows the information flow in an automobile manufacture industry.
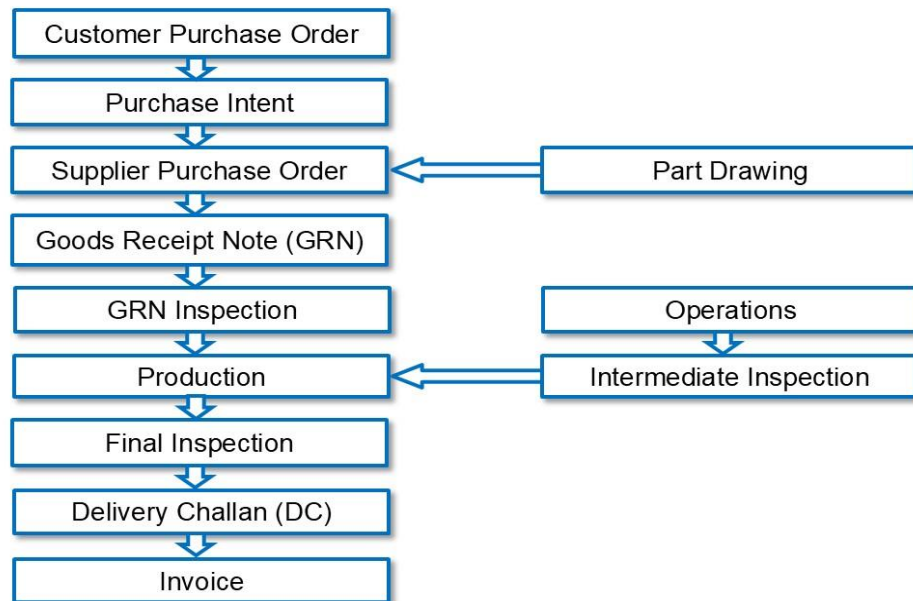
Fig. 5.   Information flow in industry

2.5 Before and After ERP

Before ERP the communication between the departments will be step by step process, after ERP communication will be common with a dataset. Fig 6 shows the information flow between departments before ERP and Fig 7 shows after ERP.
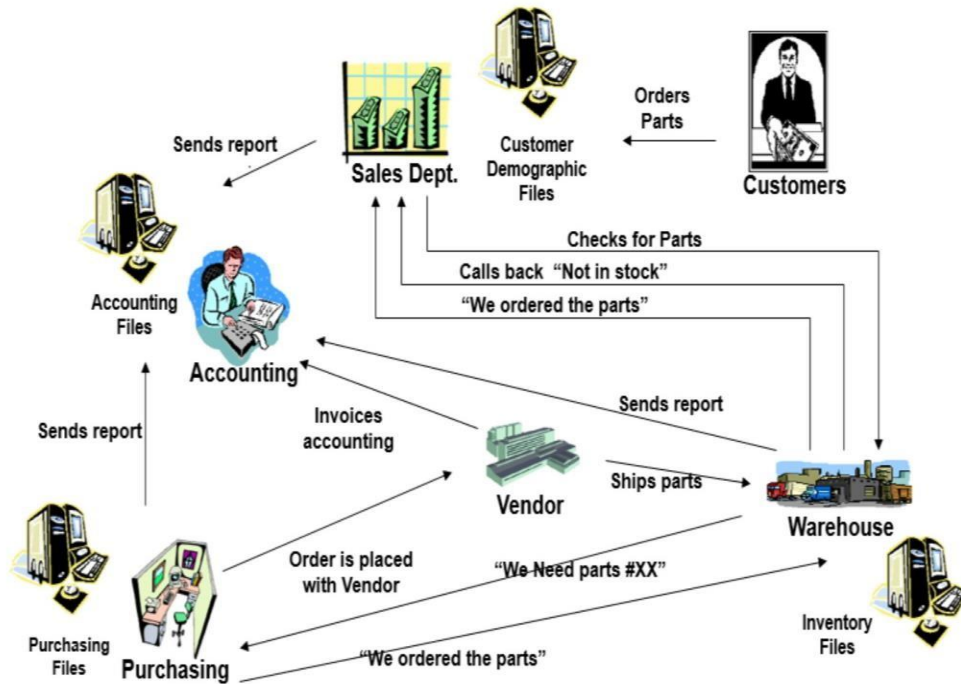
Fig 6. Before ERP
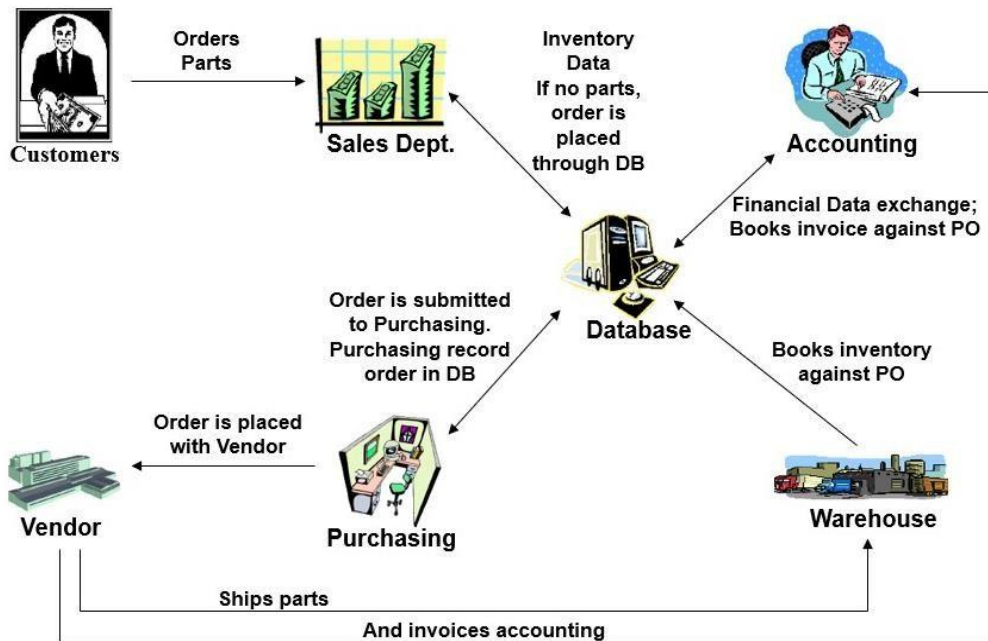
Fig 7. After ERP

3. BENEFITS OF ERP

- Improved Integration between the Departments.
- Provide more reliable delivery dates and higher service to customer.
- Improved the Information speed.
- Status of each department can be known by Top Level Management.

4. DEVELOPMENT OF PLANNING MODULE

In the an automobile manufacture industry planning the job for the machines is done manually. Planning for the machine is done automatically by developing planning module with the help of visual basic programming language. Fig 8 shows the excel format for planning the job.
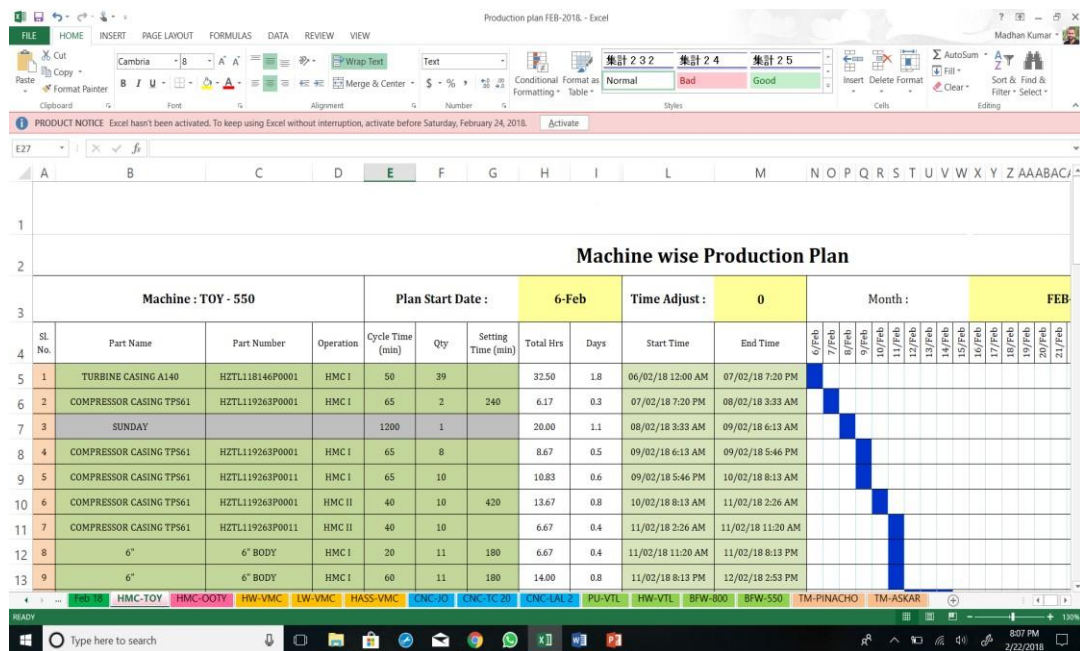
Fig. 8. Machine wise production plan

Visual Basic Programing language: Visual Basic is a third-generation event-driven programming language and integrated development environment (IDE) from Microsoft for its Component Object Model (COM) programming model first released in 1991 and declared legacy during 2008. Microsoft intended Visual Basic to be relatively easy to learn and use. Visual Basic was derived from BASIC, a user friendly programming language designed for beginners, and it enables the rapid application development (RAD) of graphical user interface (GUI) applications, access to databases using Date Access Objects, Remote Data Object, or ActiveX Data Objects, and creation of ActiveX controls and objects.

A programmer can create an application using the components provided by the Visual Basic program itself. Over time the community of programmers developed third-party components. Programs written in Visual Basic can also use the Windows API which requires external function declarations.

The Visual Basic Programming Language user SQL Language for Coding. SQL stands for Structured Query Language is the language used in Visual Basic. SQL is a standard language for storing, manipulating and retrieving data in a databases.

SQL Coding to develop the planning module is shown below:

```
Imports System.Data.SqlClient
Imports System.Data
Public Class Form1
    Dim con As New SqlConnection
    Dim cmd As New SqlCommand
    Dim adp As New SqlDataAdapter
    Dim str As String
    Dim dr As SqlDataReader
    Dim a, b, c, d As Integer
    Dim f As Double
    Private Sub Form1_Load(sender As System.Object, e As System.EventArgs) Handles MyBase.Load, Button1.Click
        ComboBox1.Items.Add("SGC-04-(HMC-TOY)")
        ComboBox1.Items.Add("SGC-05-(HW-VMC)")
        ComboBox1.Items.Add("SGC-06-(PU-VTL)")
        ComboBox1.Items.Add("SGC-07-(HW-VTL)")
        ComboBox1.Items.Add("SGC-08-(BFW-800)")
        ComboBox1.Items.Add("SGC-09-(LW-VMC)")
        ComboBox1.Items.Add("SGC-10-(HWC-OOTY 40)")
        ComboBox1.Items.Add("SGC-11-(CNC-JO)")
        ComboBox1.Items.Add("SGC-12-(CNC-LAL2)")
        ComboBox1.Items.Add("SGC-13-(CNC-TC20)")
        ComboBox1.Items.Add("SGC-14-(HASS-VMC)")
        ComboBox1.Items.Add("SGC-47-(TM-PINACHO)")
        ComboBox1.Items.Add("SGC-48-(BFW-550)")
        ComboBox1.Items.Add("SGC-49-(TMASKAR)")
        TextBox7.Text = Format(Now, "MM/dd/yyy hh:mm:ss")
    'TextBox8.Text = Format(Now, "mm/dd/yyy hh:mm:ss")
        con = New SqlConnection("Data Source=.\SQLEXPRESS;AttachDbFilename=D:\Project\production
plan\DataBase\production.mdf;Integrated Security=True;Connect Timeout=30;User Instance=True")
        con.Open()
        str = "SELECT * FROM production"
        Dim dscmd As SqlDataAdapter = New SqlDataAdapter(str, con)
        Dim ds As DataSet = New DataSet()
        dscmd.Fill(ds)
        DataGridView1.DataSource = ds.Tables(0)
    con.Close()
        Me.WindowState = FormWindowState.Maximized
    End Sub
     Private Sub ComboBox1_SelectedIndexChanged(sender As System.Object, e As System.EventArgs) Handles
ComboBox1.SelectedIndexChanged
       End Sub
     Private Sub TextBox5_TextChanged(sender As System.Object, e As System.EventArgs) Handles TextBox5.TextChanged
       End Sub
     Private Sub TextBox5_Click(sender As System.Object, e As System.EventArgs) Handles TextBox5.Click
    a = (Convert.ToInt32(TextBox2.Text) * Convert.ToInt32(TextBox3.Text))        b = a +
Convert.ToInt32(TextBox4.Text)        f = b / 60
       TextBox5.Text = f.ToString("0.00")
     End Sub
      Private Sub TextBox6_Click(sender As System.Object, e As System.EventArgs) Handles TextBox6.Click        TextBox6.Text = (f /
   18).ToString("0.00")
     End Sub
```

```
 Private Sub TextBox8_Click(sender As System.Object, e As System.EventArgs) Handles TextBox8.Click
 'TextBox8.Text = Format(Now, "dd/MM/yyy hh:mm:ss")
        TextBox8.Text = DateTime.Now.AddHours(18)
        'TextBox8.Text = (Format(DateTime.Now.AddHours(18))("dd/MM/yyy hh:mm:ss"))
      End Sub


     Private Sub Button6_Click(sender As System.Object, e As System.EventArgs) Handles Button6.Click
        End
      End Sub
     Private Sub Button2_Click(sender As System.Object, e As System.EventArgs) Handles Button2.Click        con.Open()
        str = "insert into production values('" & ComboBox1.Text & "','" & TextBox9.Text & "','" & TextBox1.Text & "','" & TextBox10.Text
& "','" & TextBox2.Text & "','" & TextBox3.Text & "','" & TextBox4.Text & "','" & TextBox5.Text & "','" & TextBox6.Text & "','" &
TextBox7.Text & "','" & TextBox8.Text & "')"
      cmd = New SqlCommand(Str, con)
     cmd.ExecuteNonQuery()
     MsgBox("Successfully Added")
          con.Close()
        End Sub


      Private Sub Button3_Click(sender As System.Object, e As System.EventArgs) Handles Button3.Click
          str = "update production set machine_no='" & ComboBox1.Text & "',part_name='" & TextBox1.Text & "',operation='" &
TextBox10.Text & "',cycle='" & TextBox2.Text & "',qty='" & TextBox3.Text & "',time='" & TextBox4.Text & "',hour='" & TextBox5.Text &
"',days='" & TextBox6.Text & "',start='" & TextBox7.Text & "',end_time='" & TextBox8.Text & "'where part_no='" & TextBox9.Text & "'"
      cmd = New SqlCommand(str, con)
          con.Open()
     cmd.ExecuteNonQuery()
     con.Close()
          MsgBox("Updated Successfully")
        End Sub


      Private Sub Button4_Click(sender As System.Object, e As System.EventArgs) Handles Button4.Click
     str = "delete from production where part_no='" & TextBox9.Text & "'"        cmd = New
     SqlCommand(str, con)
          con.Open()
     cmd.ExecuteNonQuery()
          con.Close()
          MsgBox("Deleted Successfully")
        End Sub


     Private Sub Button5_Click(sender As System.Object, e As System.EventArgs) Handles Button5.Click
     con.Open()
          str = "SELECT * FROM production where part_no='" & TextBox9.Text & "'"
          Dim dscmd As SqlDataAdapter = New SqlDataAdapter(str, con)
          Dim ds As DataSet = New DataSet()
     dscmd.Fill(ds)
          DataGridView1.DataSource = ds.Tables(0)
     con.Close()
        End Sub
       Private Sub Button7_Click(sender As System.Object, e As System.EventArgs) Handles Button7.Click
          ComboBox1.Text = ""
          TextBox1.Text = ""
          TextBox9.Text = ""
          TextBox10.Text = ""
          TextBox2.Text = "0"
          TextBox3.Text = "0"
          TextBox4.Text = "0"
          TextBox5.Text = ""
          TextBox6.Text = ""
          TextBox7.Text = ""
          TextBox8.Text = ""
        End Sub
     End Class
```

The developed planning module in the software is shown in Fig 9. In this module we need to enter the Machine No to plan for the particular machine, if we choose the Part No the part name, cycle time, setting time, quantity must be updated from the database. Total hours, Days, Start Time, End Time are all calculated by automatically.

Fig. 9. Planning Module

5. CONCLUSION

This study presents experiences that are obtained from a successful ERP implementation project in an automobile manufacture shop floor.

Automobile Manufacture Industry has understood the business, cultural and technical difficulties of such a large project, and has developed a solid core implementation team. The team has used the specialist skills of consultants and the partnership with the consultant has produced a sound architectural framework for the project.

An immediate benefit that will be achieved by the system will be the ability to promise and then deliver to the customer on time. This was something that the older systems could never achieve. The ability to deliver on time will improve customer satisfaction and also improve customer confidence, which should lead to an increase of orders in the future. The system will also improve the relationship in the supply chain, as transactions will be made easier via the use of electronic communications. The development of planning module was also scheduled job orders according to the machines.

As a conclusion, studies towards reporting successful ERP implementation projects should be encouraged. It is the best way to share successful experiences among companies of similar nature.

REFERENCES

[1] Palaniswamy Rajagopal, P., 2002. An innovation-diffusion view of implementation of enterprise resource planning (ERP) systems and development of a research model. Information & Management 40, p. 87.

[2]   Lucas, C., Walton, J., Ginzberg, J., 1988. Implementing packaged software. MIS Quarterly, p. 537.

[3]   Ifenedo, P., 2007. Interactions between organizational size, culture, and structure and some IT factors in the context of ERP success assessment: an exploratory investigation. Journal of Computing Information Systems 47(4), p. 28.

[4]   Huang, Z., Palvia, P., 2001. ERP implementation issues in advanced and developing countries. Journal of Business Process Management 7(2), p. 276.

[5]   Hitt, M., Wu, D., Zhou, X., 2002. Investment in enterprise resource planning: business impact and productivity measures. Journal of Management Information System 19(1), p. 71.

[6]   Langenwalter, A., 2000. Enterprise Resource Planning and Beyond—Integrating Your Entire Organization. St. LuciePress, Boca Raton, FL.

[7]   Wang, G., Chen, F., 2006. The influence of governance equilibrium on ERP project success. Decision Support System 41, p. 708.

[8]   Bingi, P., Sharma, K., Godla, G., 1999. Critical Issues Affecting an ERP Implementation. Information Systems Management 16(3), p. 7.

[9]   Hong, K., Kim, G., 2002. The critical success factors for ERP implementation: an organizational fit perspective. Information & Management 40, p. 25.

[10]   Chien, W., Tsaur, M., 2007. Investigating the success of ERP systems: case studies in three Taiwanese high-techindustries. Computing Industries 58(8/9), p. 783.

[11]   Quiescenti, M., Bruccoleri, U., Commare, U., Diega, S., Perrone, G., 2006. Business process oriented design of enterprise resource planning (ERP) systems for small and medium enterprises. International Journal of Production Research 44(18), p. 3797.

[12]   Chen C. Taiwan Enterprise Data Operation Requirement Analysis: Manufacturing Version, 2003. MIC Research report.