ANALYSIS AND EVALUATION
MANUFACTURING COST USING A DATABASE FOR TALLERES Y MONTAJES LUNA S.L.

Trabajo Final de Grado
Grado en Ingeniería Mecánica

Autor: Sergio Francés Sánchez
Tutor: Miguel Jorge Reig Perez
Manuel Llorca Alcón

Convocatoria de defensa: Junio 2016
The project is based in developing a database with the excel software, using Macros and VBA, in order to achieve an interactive application for automate the management manufacturing process control (input for job, worker name, length hour, task description, platform and crane and other cost). It has been develop inside of a company, denominate Talleres y Montajes Luna S.L.

The application stores the inputs in order to have all the information in a database, so on, the completely job report can be done instantly, screening by job, operator, day, customer.

This quick information is a powerful tool for the management because they can know where has been working each worker every day and every hour; they can know all the cost invested in every customer and even better, they can know exactly how well is going each job, using the money as a key performance indicator.

The benefits from this application has been worthy because of implementation in Talleres y Montajes Luna S.L. For stating some benefits we can say; an indirect labour hour saved; fast and instant information; much control of the business from the beginning of the job up to the end; information in digital format (before it was in a paper format); control and follow stock and purchasing material.

Keywords: excel, macros, VBA, mechanical business, manufacturing control cost, improvement, savings, small and medium enterprise.
1. Abstract .......................................................................................page 5

2. Acknowledgements ........................................................................page 6

3. Introduction or background............................................................page 7

4. State of art.......................................................................................page 10

5. List of programme .................................................................page 11
   5.1 Register materials.................................................................page 11
   5.2 Register jobs........................................................................page 11
   5.3 Cancel jobs............................................................................page 14
   5.4 Job report. Main tool..............................................................page 16
   5.5 Operator report.......................................................................page 25
   5.6 Register task............................................................................page 27
   5.7 Register suppliers.................................................................page 29
   5.8 Go to register operators.........................................................page 29
   5.9 Go to menu............................................................................page 29
   5.10 Go to active operators..........................................................page 29
   5.11 Save as.................................................................................page 30
   5.12 Register purchasing materials..............................................page 30

6. Methodology .................................................................................page 32
   6.1 Inputs......................................................................................page 32
      6.1.1 Inputs for the task.............................................................page 32
6.1.2 Inputs for creating a job ........................................ page 36
6.1.3 Inputs for closing finished job.................................. page 37
6.1.4 Inputs for creating a new operators and updating within the actual organization ............................................ page 38
6.1.5 Inputs for platforms and crane .................................. page 38
6.1.6 Inputs for defining materials and consumer goods .......................................................... page 39
6.1.7 Inputs for purchasing materials and consumer goods .......................................................... page 40
6.1.8 Inputs for used materials and consumer goods ... page 40
6.1.9 Inputs for defining suppliers ............................................. page 41
6.2 Outputs .................................................................................. page 42
6.2.1 Outputs active job ................................................................. page 42
6.2.2 Output report ........................................................................ page 43
   6.2.2.1 Screening by job ......................................................... page 44
   6.2.2.2 Screening by customer ................................................ page 48
   6.2.2.3 Screening by operator ................................................ page 48
   6.2.3 Output check materials and consumer goods stock ........................................................ page 48
7. Conclusion .................................................................................. page 49
7.1 Example of a real case ............................................................... page 69
7.2 Savings ...................................................................................... page 75
7.3 Amortization ........................................................................ page 78
8. References and bibliography ...................................................... page 79
1. **ABSTRACT**

The project is based in developing a database with the excel software, using Macros and VBA, in order to achieve an interactive application for automate the management manufacturing process control (input for job, worker name, length hour, task description, platform and crane and other cost). It has been develop inside of a company, denominate Talleres y Montajes Luna S.L.

The application stores the inputs in order to have all the information in a database, so on, the completely job report can be done instantly, screening by job, operator, day, customer.

This quick information is a powerful tool for the management because they can know where has been working each worker every day and every hour; they can know all the cost invested in every customer and even better, they can know exactly how well is going each job, using the **money as a key performance indicator**.

The benefits from this application has been worthy because of implementation in Talleres y Montajes Luna S.L. For stating some benefits we can say; an indirect labour hour saved; fast and instant information; much control of the business from the beginning of the job up to the end; information in digital format (before it was in a paper format); control and follow stock and purchasing material.
2. ACKNOWLEDGEMENTS

I wish to express my sincere thanks to Miguel Jorge Reig Pérez, Professor of Mechanic and Materials Engineering Department and Manuel Llorca Alcón, Professor of IT Systems and Computer Engineering Department, for providing me with all the necessary facilities for the project.

I am also grateful to Manuel Luna Sánchez, Manager from Talleres y Montajes Luna S.L. I am extremely thankful and indebted to him for sharing expertise, and sincere and valuable guidance and encouragement extended to me.

I also thank my mother, Isabel Sánchez and my recent deceased father, Jose Luis Francés for the unceasing encouragement, support and attention. I am also grateful to my wife, Madalina Croicu, who supported me through this venture.

I also place on record, my sense of gratitude to one and all, who directly or indirectly, have lent their hand in this venture.
3. INTRODUCTION OR BACKGROUND

This project has been developed because of the rudimentary method of controlling the business, being a low process and a waste of time. The process for register all the data (operator, hour used by operator, day, job, platform, crane, material, other cost) was done in a paper format.

Every time that the manager wanted to know the information, he asked the supervisor to come and explain the data; so the supervisor had to left what he was doing immediately, being an interruption for the supervisor and affecting manufacturing process. So on, this should be improved.

The information was communicated as an interview way, the manager ask who operators were working in each job; which and how many platforms; which crane; how many cranes works every day and how many hours works the crane; material used; personal protective equipment used (PPE). We can see a waste of time, it is being two people working on the same task, they both were doing the data input when nowadays it is only done by the supervisor.

The solution suggest and implement for improving the flow process is creating a digital database using an excel file.
Defining roles and responsibilities for interacting with the excel sheet application.

Nowadays, the supervisor input all the data into the excel sheet at the end of the day. He does this task as he can do it. He organized his job and there are no interruptions for the supervisor, affecting at the production as before.

The manager can have the outputs when need it, just opening an excel sheet a screening by job. He can know the money invest up to now for material, direct labor hour, platform, crane, other cost as soon as he press the bottom when before he had to look the registration paper just for the job who wanted to know and he had to look and calculate for the labor hour, material, platform, etc and make extra operation in order to know the money invested up to know.

In order to design, implement and control the new system, it has been created another role, know as a “Controller database”. This person is the main responsible for the database. He has design the database solving and improving the problem and the waste. He is the responsible for implementing the database within the organization, he is the responsible for training all people who interact with the database and he is the role for updating all the data need it, like creating and closing finished jobs, maintaining operator, etc.
Another point of improving, it is to control the material and consumption good at the warehouse. Every time a material or consumption good goes in or out of the warehouse is registered at the application. So on, we can know the value of the warehouse very accurate. Since the big data to control all the information required for the warehouse, the company did not control the material and consumption goods at warehouse before the implementation.

Finally, in the future, it is plan to program another application in order to control manufacturing jobs, with a visible KPI and to control purchasing.
4. **STATE OF ART**

   This problem can be solved using software available at the market. In this case, the company has to change and adapt the way of working to the define software (remember that the excel application has been programmed using the actual way of working in order to not change the actual way and to assure the implementation).

   The excel application is programmed with the goal of several field like, cost production, control warehouse, control production, control purchasing, etc. So on, in the hypothetical case, in order to achieve all the required topics the company have to spend money buying specific software for each topic. It is also needed training for each software, with their cost.

   Personally, I think, the point of using a several programs available at the market or just to program an excel sheet application depends on the business size; if it is a small company or if it is multinational company.

   In the case of a big company, I will use a common program, available at the market. In the other hand, when we are in a small company, I will use an excel sheet application.
5. LIST OF PROGRAMME

In order to give you a better understanding of the project, we show you some programme application use it on the excel sheet application.

5.1 REGISTER MATERIALS (Programme used in 6.1.6 point. "Inputs for defining materials and consumer goods")

Sub ALTA_ARTICULOS()
' ALTA_ARTICULOS Macro
Rows("112:112").Select
Selection.Insert Shift:=xlDown, CopyOrigin:=xlFormatFromLeftOrAbove
Range("F7:F9").Select
Selection.Copy
Range("B112").Select
Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
:=False, Transpose:=True
Application.CutCopyMode = False
ActiveWorkbook.Worksheets("ARTICULOS").ListObjects("Tabla1").Sort.SortFields. _
    Clear    ActiveWorkbook.Worksheets("ARTICULOS").ListObjects("Tabla1").Sort.SortFields. _
            Add Key:=Range("Tabla1[#All],[CODIGO]]")", SortOn:=xlSortOnValues, Order _
            :=xlAscending, DataOption:=xlSortNormal
With ActiveWorkbook.Worksheets("ARTICULOS").ListObjects("Tabla1").Sort
    .Header = xlYes
    .MatchCase = False
    .Orientation = xlTopToBottom
    .SortMethod = xlPinYin
    .Apply
End With
Range("F7:F11").Select
Selection.ClearContents
ActiveWindow.SmallScroll ToRight:=3
Range("F7").Select
End Sub

5.2 REGISTER JOBS (Programme used in 6.1.2 point. "Inputs for creating a job")
Sub ALTA_TRABAJOS()
' ALTA_TRABAJOS Macro'
    Range("D4:D8").Select
    ActiveWindow.SmallScroll Down:=21
    Rows("46:46").Select
    Selection.Insert Shift:=xlDown, CopyOrigin:=xlFormatFromLeftOrAbove
    ActiveWindow.SmallScroll Down:=-36
    Range("D4:D8").Select
    Selection.Copy
    ActiveWindow.SmallScroll Down:=27
    Range("C46").Select
    Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks:=False,
        Transpose:=True
    ActiveWindow.SmallScroll Down:=21
    Application.CutCopyMode = False
    ActiveWindow.SmallScroll Down:=33
    Range("D9").Select
    Selection.Copy
    ActiveWindow.SmallScroll Down:=30
    Range("I46").Select
    Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks:=False,
        Transpose:=False
    ActiveWindow.SmallScroll Down:=39
    Application.CutCopyMode = False
    ActiveWindow.SmallScroll Down:=39
    ActiveWindow.SmallScroll Down:=6
    Range("D4:D9").Select
    Selection.ClearContents
    ActiveWindow.SmallScroll Down:=39
        SortOn:=xlSortOnValues, Order:=xlAscending, DataOption:=xlSortNormal
    With ActiveWorkbook.Worksheets("ALTAS").AutoFilter.Sort
        .Header = xlYes
        .MatchCase = False
        .Orientation = xlTopToBottom
        .SortMethod = xlPinYin
        .Apply
    End With
    ActiveWindow.SmallScroll Down:=6
    Sheets("PARTE DIARIO").Select
    Range("C51").Select
    Selection.AutoFill Destination:=Range("C51:C94"), Type:=xlFillDefault
Range("C51:C94").Select
Sheets("REPORTE").Select
Range("C54").Select
Selection.AutoFill Destination:=Range("C54:C97"), Type:=xlFillDefault
Range("C54:C97").Select
Sheets("ALTAS").Select
Range("C45").Select
Sheets("ALTAS").Select
Rows("B9:B9").Select
Selection.Delete Shift:=xlUp
Sheets("PARTE DIARIO").Select
ActiveWindow.SmallScroll Down:=24
Range("C51:C94").Select
Selection.Copy
Sheets("COMPRAS").Select
ActiveWindow.SmallScroll Down:=12
Range("D52").Select
Range("D52").Select
Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
:=False, Transpose:=False
ActiveWindow.SmallScroll Down:=9
Sheets("SALIDAS").Select
Range("D51").Select
Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
:=False, Transpose:=False
ActiveWindow.SmallScroll Down:=24
Sheets("ALTAS").Select
ActiveWindow.SmallScroll Down:=48
Range("C41").Select
ActiveWindow.SmallScroll Down:=12
Range("C45").Select
Sheets("PARTE DIARIO").Select
ActiveWindow.SmallScroll Down:=27
Range("C51:C94").Select
Selection.Copy
Sheets("COMPROBAR STOCK").Select
Range("D49").Select
Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
:=False, Transpose:=False
ActiveWindow.SmallScroll Down:=39
Range("D8").Select
Sheets("SALIDAS").Select
ActiveWindow.SmallScroll Down:=72
5.3 CANCEL JOBS (Programme used in 6.1.3 point. "Inputs for closing finished jobs")

Sub BAJA_TRABAJOS()
  ' BAJA_TRABAJOS Macro
  Dim I As String
  I = Range("Q13").Value
  Range("C45").Select
  Do While Not IsEmpty(ActiveCell)
    If ActiveCell = I Then
      Selection.EntireRow.Delete
    Else
      ActiveCell.Offset(1, 0).Select
    End If
  Loop
  Range("Q13").Select
  Selection.ClearContents
  Sheets("PARTE DIARIO").Select

  Range("C51").Select
  Selection.AutoFill Destination:=Range("C51:C94"), Type:=xlFillDefault
  Range("C51:C94").Select
  Sheets("REPORTE").Select
  Range("C54").Select
  Selection.AutoFill Destination:=Range("C54:C97"), Type:=xlFillDefault
  Range("C54:C97").Select
  Sheets("ALTAS").Select
  Range("C45").Select
Sheets("PARTE DIARIO").Select
ActiveWindow.SmallScroll Down:=24
Range("C51:C94").Select
Selection.Copy
Sheets("COMPRAS").Select
ActiveWindow.SmallScroll Down:=12
Range("D52").Select
Range("D52").Select
Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
:=False, Transpose:=False
ActiveWindow.SmallScroll Down:=9
Sheets("SALIDAS").Select
Range("D51").Select
Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
:=False, Transpose:=False
ActiveWindow.SmallScroll Down:=24
Sheets("ALTAS").Select
ActiveWindow.SmallScroll Down:=48
Range("C41").Select
ActiveWindow.SmallScroll Down:=12
Range("C45").Select

Sheets("PARTE DIARIO").Select
ActiveWindow.SmallScroll Down:=27
Range("C51:C94").Select
Selection.Copy
Sheets("COMPROBAR STOCK").Select
Range("D49").Select
Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
:=False, Transpose:=False
ActiveWindow.SmallScroll Down:=39
Range("D8").Select
Sheets("SALIDAS").Select
ActiveWindow.SmallScroll Down:=72
Range("D6").Select
Sheets("COMPRAS").Select
ActiveWindow.SmallScroll Down:=93
Range("D6").Select
Sheets("REPORTE").Select
ActiveWindow.SmallScroll Down:=72
Range("D7").Select
Sheets("PARTE DIARIO").Select
ActiveWindow.SmallScroll Down:=57
Range("D3").Select
Sheets("ALTAS").Select
Range("C45").Select

End Sub

5.4 JOB REPORT. MAIN TOOL (Programme used in 6.2.2 point. “Outputs report”)

Sub FINAL02()

Call primero 'llama al procedimiento de nombre primero
Call segundo 'llama al procedimiento de nombre segundo
Call tercero 'llama al procedimiento de nombre tercero
Call cuarto 'llama al procedimiento de nombre cuarto

End Sub '  
' FINAL02 Macro

Sub primero()
CreateObject("WScript.Shell").popup "Realizando Reporte. Espere, por Favor", 3
Application.ScreenUpdating = False

,  
Sheets("FINAL").Select
Cells.Select
Range("A67").Activate
Selection.ClearContents
Selection.ClearContents
Selection.ClearContents
Selection.ClearContents
Range("D2").Select
ActiveCell.FormulaR1C1 = ""
Cells.Select
Selection.Delete Shift:=xlUp
Range("E3").Select
ActiveCell.FormulaR1C1 = "REPORTE FINAL OBRA"
Range("E3:G3").Select
With Selection
  .HorizontalAlignment = xlCenter
  .VerticalAlignment = xlBottom
  .WrapText = False
  .Orientation = 0
  .AddIndent = False
  .IndentLevel = 0
.ShrinkToFit = False
.ReadingOrder = xlContext
.MergeCells = False

End With

Selection.Merge

Selection.Borders(xlDiagonalDown).LineStyle = xlNone
Selection.Borders(xlDiagonalUp).LineStyle = xlNone

With Selection.Borders(xlEdgeLeft)
    .LineStyle = xlContinuous
    .ColorIndex = 0
    .TintAndShade = 0
    .Weight = xlMedium
End With

With Selection.Borders(xlEdgeTop)
    .LineStyle = xlContinuous
    .ColorIndex = 0
    .TintAndShade = 0
    .Weight = xlMedium
End With

With Selection.Borders(xlEdgeBottom)
    .LineStyle = xlContinuous
    .ColorIndex = 0
    .TintAndShade = 0
    .Weight = xlMedium
End With

With Selection.Borders(xlEdgeRight)
    .LineStyle = xlContinuous
    .ColorIndex = 0
    .TintAndShade = 0
    .Weight = xlMedium
End With

Selection.Borders(xlInsideVertical).LineStyle = xlNone
Selection.Borders(xlInsideHorizontal).LineStyle = xlNone

With Selection.Interior
    .Pattern = xlSolid
    .PatternColorIndex = xlAutomatic
    .ThemeColor = xlThemeColorDark1
    .TintAndShade = -0.249977111117893
    .PatternTintAndShade = 0
End With

Range("E5").Select
ActiveCell.FormulaR1C1 = "DATOS"

Range("E7").Select
ActiveCell.FormulaR1C1 = "CLIENTE"
Range("E8").Select
ActiveCell.FormulaR1C1 = "OBRA"
Range("E9").Select
ActiveCell.FormulaR1C1 = "NºPRESUPUESTO"
Range("E5:F5").Select
With Selection
  .HorizontalAlignment = xlCenter
  .VerticalAlignment = xlBottom
  .WrapText = False
  .Orientation = 0
  .AddIndent = False
  .ShrinkToFit = False
  .ReadingOrder = xlContext
  .MergeCells = False
End With
Selection.Merge
Selection.Borders(xlDiagonalDown).LineStyle = xlNone
Selection.Borders(xlDiagonalUp).LineStyle = xlNone
With Selection.Borders(xlEdgeLeft)
  .LineStyle = xlContinuous
  .ColorIndex = 0
  .TintAndShade = 0
  .Weight = xlMedium
End With
With Selection.Borders(xlEdgeTop)
  .LineStyle = xlContinuous
  .ColorIndex = 0
  .TintAndShade = 0
  .Weight = xlMedium
End With
With Selection.Borders(xlEdgeBottom)
  .LineStyle = xlContinuous
  .ColorIndex = 0
  .TintAndShade = 0
  .Weight = xlMedium
End With
With Selection.Borders(xlEdgeRight)
  .LineStyle = xlContinuous
  .ColorIndex = 0
  .TintAndShade = 0
  .Weight = xlMedium
End With
With Selection.Borders(xlInsideVertical)
  .LineStyle = xlNone
End With
Selection.Borders(xlInsideHorizontal).LineStyle = xlNone
With Selection.Interior
  .Pattern = xlSolid
  .PatternColorIndex = xlAutomatic
  .ThemeColor = xlThemeColorDark1
  .TintAndShade = -0.149998474074526
  .PatternTintAndShade = 0
End With
Range("E7:F9").Select
Selection.Borders(xlDiagonalDown).LineStyle = xlNone
Selection.Borders(xlDiagonalUp).LineStyle = xlNone
With Selection.Borders(xlEdgeLeft)
  .LineStyle = xlContinuous
  .ColorIndex = 0
  .TintAndShade = 0
  .Weight = xlThin
End With
With Selection.Borders(xlEdgeTop)
  .LineStyle = xlContinuous
  .ColorIndex = 0
  .TintAndShade = 0
  .Weight = xlThin
End With
With Selection.Borders(xlEdgeBottom)
  .LineStyle = xlContinuous
  .ColorIndex = 0
  .TintAndShade = 0
  .Weight = xlThin
End With
With Selection.Borders(xlEdgeRight)
  .LineStyle = xlContinuous
  .ColorIndex = 0
  .TintAndShade = 0
  .Weight = xlThin
End With
With Selection.Borders(xlInsideVertical)
  .LineStyle = xlContinuous
  .ColorIndex = 0
  .TintAndShade = 0
  .Weight = xlThin
End With
With Selection.Borders(xlInsideHorizontal)
  .LineStyle = xlContinuous
  .ColorIndex = 0
.TintAndShade = 0
.Weight = xlThin
End With
Columns("E:E").ColumnWidth = 17.71
Columns("F:F").ColumnWidth = 27.14
Range("F8").Select
Sheets("REPORTE").Select
Selection.Copy
Sheets("FINAL").Select
Range("F7").Select
Application.CutCopyMode = False
ActiveCell.FormulaR1C1 = "=VLOOKUP(R[1]C,ALTAS!R[38]C[38]:R[81]C[38],3,FALSE)"
Range("F9").Select
ActiveCell.FormulaR1C1 = "=VLOOKUP(R[-1]C,ALTAS!R[36]C[36]:R[79]C[36],2,FALSE)"
Range("E12").Select
Columns("F:F").ColumnWidth = 34.14
Range("F7:F9").Select
With Selection
    .HorizontalAlignment = xlCenter
    .VerticalAlignment = xlBottom
    .WrapText = False
    .Orientation = 0
    .AddIndent = False
    .IndentLevel = 0
    .ShrinkToFit = False
    .ReadingOrder = xlContext
    .MergeCells = False
End With
With Selection
    .HorizontalAlignment = xlCenter
    .VerticalAlignment = xlBottom
    .WrapText = True
    .Orientation = 0
    .AddIndent = False
    .IndentLevel = 0
    .ShrinkToFit = False
    .ReadingOrder = xlContext
    .MergeCells = False
End With
With Selection
    .HorizontalAlignment = xlCenter
    .VerticalAlignment = xlBottom
    .WrapText = True
    .Orientation = 0
    .AddIndent = False
    .IndentLevel = 0
    .ShrinkToFit = False
    .ReadingOrder = xlContext
    .MergeCells = False
End With
With Selection
    .HorizontalAlignment = xlCenter
    .VerticalAlignment = xlBottom
Range("E11").Select
ActiveCell.FormulaR1C1 = "COSTES"
Range("E11").Select
ActiveCell.FormulaR1C1 = "RESUMEN COSTES"
Range("E11:F11").Select
With Selection
  .HorizontalAlignment = xlCenter
  .VerticalAlignment = xlBottom
  .WrapText = False
  .Orientation = 0
  .AddIndent = False
  .IndentLevel = 0
  .ShrinkToFit = False
  .ReadingOrder = xlContext
  .MergeCells = False
End With
Selection.Merge
Selection.Borders(xlDiagonalDown).LineStyle = xlNone
Selection.Borders(xlDiagonalUp).LineStyle = xlNone
With Selection.Borders(xlEdgeLeft)
  .LineStyle = xlContinuous
  .ColorIndex = 0
  .TintAndShade = 0
  .Weight = xlMedium
End With
With Selection.Borders(xlEdgeTop)
  .LineStyle = xlContinuous
  .ColorIndex = 0
  .TintAndShade = 0
  .Weight = xlMedium
End With
With Selection.Borders(xlEdgeBottom)
  .LineStyle = xlContinuous
  .ColorIndex = 0
  .TintAndShade = 0
.Weight = xlMedium
End With
With Selection.Borders(xlEdgeRight)
  .LineStyle = xlContinuous
  .ColorIndex = 0
  .TintAndShade = 0
  .Weight = xlMedium
End With
Selection.Borders(xlInsideVertical).LineStyle = xlNone
Selection.Borders(xlInsideHorizontal).LineStyle = xlNone
With Selection.Interior
  .Pattern = xlSolid
  .PatternColorIndex = xlAutomatic
  .ThemeColor = xlThemeColorDark1
  .TintAndShade = -0.349986266670736
  .PatternTintAndShade = 0
End With
With Selection.Interior
  .Pattern = xlSolid
  .PatternColorIndex = xlAutomatic
  .ThemeColor = xlThemeColorDark1
  .TintAndShade = -0.249977111117893
  .PatternTintAndShade = 0
End With
Range("E13").Select
ActiveCell.FormulaR1C1 = "MANO OBRA"
Range("E14").Select
ActiveCell.FormulaR1C1 = "GRÚAS"
Range("E15").Select
ActiveCell.FormulaR1C1 = "PLATAFORMAS"
Range("E16").Select
ActiveCell.FormulaR1C1 = "TRANSPORTE"
Range("E17").Select
ActiveCell.FormulaR1C1 = "EXTRAS"
Range("E18").Select
ActiveCell.FormulaR1C1 = "CONSUMIBLES"
Range("E19").Select
ActiveCell.FormulaR1C1 = "MATERIAL"
------------------- AS THE PROGRAMME IS VERY LONG, A PART OF IT IT IS NOT SHOWN
  .TintAndShade = 0
  .Weight = xlMedium
End With
With Selection.Borders(xlEdgeRight)
  .LineStyle = xlContinuous
"PARTES DE TRABAJO DE PERSONAL, GRÚAS, PLATAFORMAS Y EXTRAS"
End With
With Selection.Borders(xlEdgeBottom)
  .LineStyle = xlContinuous
  .ColorIndex = 0
  .TintAndShade = 0
  .Weight = xlMedium
End With
With Selection.Borders(xlEdgeRight)
  .LineStyle = xlContinuous
  .ColorIndex = 0
  .TintAndShade = 0
  .Weight = xlMedium
End With
Selection.Borders(xlInsideVertical).LineStyle = xlNone
Selection.Borders(xlInsideHorizontal).LineStyle = xlNone
Range("AP120:BB120").Select
ActiveCell.FormulaR1C1 = _
  "PARTES DE TRABAJO DE CONSUMIBLES, EPIS Y HERRAMIENTAS"
Range("AP121").Select
Range("F7").Select
Sheets("STOCK").Select
Columns("Q:AC").Select
Range("Q4").Activate
Selection.Delete Shift:=xlToLeft
Range("A4").Select
Sheets("FINAL").Select

Range("F7").Select
  ActiveWindow.ScrollColumn = 37
ActiveWindow.ScrollColumn = 34
ActiveWindow.ScrollColumn = 1
ActiveWindow.ScrollRow = 85
ActiveWindow.ScrollRow = 78
ActiveWindow.ScrollRow = 69
ActiveWindow.ScrollRow = 66
ActiveWindow.ScrollRow = 63
ActiveWindow.ScrollRow = 54
ActiveWindow.ScrollRow = 51
ActiveWindow.ScrollRow = 35
ActiveWindow.ScrollRow = 32
ActiveWindow.ScrollRow = 26
ActiveWindow.ScrollRow = 23
ActiveWindow.ScrollRow = 20
ActiveWindow.ScrollRow = 16
ActiveWindow.ScrollRow = 13
ActiveWindow.ScrollRow = 10
ActiveWindow.ScrollRow = 7
ActiveWindow.ScrollRow = 4
ActiveWindow.ScrollRow = 1
ActiveWindow.SmallScroll ToRight:=3

Application.ScreenUpdating = True
End Sub

5.5 OPERATOR REPORT (Programme used in 6.2.2.3 point. “Screening by operator”)  

Sub FILTRO()

' FILTRO Macro

CreateObject("wscript.shell").popup "Aplicando Filtro. Espere, por Favor", 3
Application.ScreenUpdating = False

Range("D7").Select
Application.CutCopyMode = False
Selection.Copy

Range("Z2").Select
ActiveSheet.Paste

Range("D7").Select
Application.CutCopyMode = False
Selection.Copy
Application.CutCopyMode = False
Selection.Copy

Range("Z2").Select
Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
:=False, Transpose:=False
Application.CutCopyMode = False
Range("D8").Select
Selection.Copy
ActiveWindow.ScrollColumn = 2

Range("AX2").Select
Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
:=False, Transpose:=False
Application.CutCopyMode = False
Range("D9").Select
Selection.Copy

Range("AA2").Select
Application.CutCopyMode = False

Range("D10:D11").Select
Selection.Copy

Range("AC2").Select
Application.CutCopyMode = False

Range("D7:D13").Select
Selection.ClearContents
Sheets("PARTE").Range("Tabla3[#All]").AdvancedFilter Action:=xlFilterCopy, _
   CriteriaRange:=Range("Z1:AX2"), CopyToRange:=Range("Z5:AX5"), Unique:=
   False
Range("Z2:AX2").Select
Selection.ClearContents
Range("Z5:AX1035").Select
Selection.Borders(xlDiagonalDown).LineStyle = xlNone
Selection.Borders(xlDiagonalUp).LineStyle = xlNone
With Selection.Borders(xlEdgeLeft)
   .LineStyle = xlContinuous
   .ColorIndex = 0
   .TintAndShade = 0
   .Weight = xlThin
End With
With Selection.Borders(xlEdgeTop)
   .LineStyle = xlContinuous
   .ColorIndex = 0
   .TintAndShade = 0
   .Weight = xlThin
End With
With Selection.Borders(xlEdgeBottom)
   .LineStyle = xlContinuous
   .ColorIndex = 0
.TintAndShade = 0
.Weight = xlThin
End With
With Selection.Borders(xlEdgeRight)
.LineStyle = xlContinuous
.ColorIndex = 0
.TintAndShade = 0
.Weight = xlThin
End With
With Selection.Borders(xlInsideVertical)
.LineStyle = xlContinuous
.ColorIndex = 0
.TintAndShade = 0
.Weight = xlThin
End With
With Selection.Borders(xlInsideHorizontal)
.LineStyle = xlContinuous
.ColorIndex = 0
.TintAndShade = 0
.Weight = xlThin
End With
Range("Z5:AX5").Select
With Selection.Interior
.Pattern = xlSolid
.PatternColorIndex = xlAutomatic
.ThemeColor = xlThemeColorDark1
.TintAndShade = -0.349986266670736
.PatternTintAndShade = 0
End With
Application.ScreenUpdating = True
ActiveWindow.ScrollColumn = 26
End Sub

5.6 REGISTER TASK (Programme used in 6.1.1 point. * Inputs for the task*)

Sub INTRODUCIR_TRABAJO()
,' INTRODUCIR_TRABAJO Macro'
CreateObject("wscript.shell").popup "Introduciendo datos. Espere, por Favor",
3
Application.ScreenUpdating = False
,'
Range("D3:D7").Select
Selection.Copy
Sheets("PARTE").Select
Rows("3:3").Select
Application.CutCopyMode = False
Selection.Insert Shift:=xlDown, CopyOrigin:=xlFormatFromLeftOrAbove
Sheets("PARTE DIARIO").Select
Selection.Copy
Sheets("PARTE").Select
Range("A3").Select
Sheets("PARTE DIARIO").Select
Application.CutCopyMode = False
Range("D9:D19").Select
Selection.Copy
Sheets("PARTE").Select
ActiveWindow.SmallScroll ToRight:=8
Range("N3").Select

Range("A2").Select
Sheets("PARTE DIARIO").Select
Application.CutCopyMode = False
Selection.ClearContents
Range("D3:D4").Select
Selection.ClearContents
Range("D6:D7").Select
Selection.ClearContents
Range("D3").Select
Sheets("PARTE").Select
ActiveWindow.ScrollColumn = 8
ActiveWindow.ScrollColumn = 7
ActiveWindow.ScrollColumn = 6
ActiveWindow.ScrollColumn = 5
ActiveWindow.ScrollColumn = 4
ActiveWindow.ScrollColumn = 3
ActiveWindow.ScrollColumn = 2
ActiveWindow.ScrollColumn = 1
Range("A3").Select
Sheets("PARTE DIARIO").Select
Range("D3").Select
Application.ScreenUpdating = True
5.7 REGISTER SUPPLIERS (Programme used in 6.1.9 point. “Inputs for defining suppliers”)

Sub IR_ALTA_PROVEEDORES()
  ' IR_ALTA_PROVEEDORES Macro
  ActiveWindow.ScrollWorkbookTabs Sheets:=1
  ActiveWindow.ScrollWorkbookTabs Sheets:=1
  ActiveWindow.ScrollWorkbookTabs Sheets:=1
  ActiveWindow.ScrollWorkbookTabs Sheets:=1
  Sheets("COMPRAS").Select
  ActiveWindow.SmallScroll Down:=-111
  ActiveWindow.SmallScroll ToRight:=3
  Range("F52").Select
End Sub

5.8 GO TO REGISTER OPERATORS (Programme used in order to go directly to the information)

Sub IR_ALTA_TRABAJOS()
  ' IR_ALTA_TRABAJOS Macro'
  Sheets("ALTAS").Select
  Range("D4").Select
End Sub

5.9 GO TO MENU (Programme used in order to go directly to the information)

Sub IR_MENU()
  ' IR_MENU Macro'
  Sheets("MENU").Select
  Range("B3").Select
End Sub

5.10 GO TO ACTIVE OPERATORS (Programme used in order to go directly to the information)

Sub IR_TRABAJADORES()
  ' IR_TRABAJADORES Macro'
  Sheets("PARTE DIARIO").Select
  ActiveWindow.SmallScroll Down:=6
  ActiveWindow.SmallScroll ToRight:=1
  Range("C174").Select
5.11 SAVE AS (Programme used in 6.1.3 point. “Inputs for closing finished jobs”)

Sub GUARDAR_COMO()
' GUARDAR_COMO Macro
Sheets("FINAL").Select
  Workbooks.Add
  Windows("BASE DE DATOS.xlsm").Activate
  Cells.Select
  Selection.Copy
  Windows("Libro1").Activate
  Cells.Select
  Cells.Select
  Range("F13").Select
  ActiveWindow.SmallScroll Down:=-51
  Range("B3").Select
  Windows("BASE DE DATOS.xlsm").Activate
  Range("A1").Select
  Application.CutCopyMode = False
  ActiveCell.FormulaR1C1 = ""
  Range("A2").Select
  Windows("Libro1").Activate
  Range("A2").Select

  Application.Dialogs(xlDialogSaveAs).Show
  ActiveWorkbook.Close
  Sheets("ALTAS").Select
  Range("Q13").Select'

End Sub

5.12 REGISTER PURCHASING MATERIAL (Programme used in 6.1.7 point. “Inputs for purchasing materials and consumer goods”)
Sheets("STOCK").Select
Rows("4:4").Select
Selection.Insert Shift:=xlDown, CopyOrigin:=xlFormatFromLeftOrAbove
Sheets("COMPRAS").Select
Range("D6:D15").Select
Selection.Copy
Sheets("STOCK").Select
Range("B4").Select
Range("C5").Select
Sheets("COMPRAS").Select
Range("D6").Select
Application.CutCopyMode = False
Range("D6:D8").Select
Selection.ClearContents
Range("D10:D15").Select
Selection.ClearContents
Range("C3:D4").Select
ActiveCell.FormulaR1C1 = "COMPRAS DE MATERIAL"
Sheets("STOCK").Select
Range("A4").Select
ActiveCell.FormulaR1C1 = "ENTRADAS"
Range("C6").Select
Sheets("COMPRAS").Select
Range("D6").Select
Range("D6").Select
End Sub
6. METHODOLOGY

The way of developing the database was done for the first time, having a meeting with the involve people. The person and roles who were at the meeting was the manager, the supervisor and the controller database; the manager define what he need using his actual way of registration the inputs, so on the controller said how could be done and program.

In order to not modify the actual way of registration very much and to do not get people confused and to guarantee the implementation the designer tried to adapt the actual system into the digital way for being the flow process very similar.

Once the needs were defined, the designer started to program the inputs and the outputs.

Most of the tools used have been learn by Self-taught way. What the designer has done is Watching videos in youtube, reading on internet, reading examples.

6.1 INPUTS
6.1.1 Inputs for the task.

Those inputs are done by the supervisor and it is his responsibility to keep updates it. This is related for the
task what the operators has been doing during their job shift.

The inputs are the fields shown in chart 1.

**Chart 1. Inputs**

**Field job:** there is a list where it can be selected the job.

**Field Operator name:** there is a list where it can be select the operator name.
**Field Data:** It has to be registered the date where the operator has worked.

**Field Start hour:** It is the time when the operator starts working.

**Field Finish hour:** It is the time when the operator end working at this job.

**Field Hour:** This is a field which is calculating automatically. It is the hour worked between the end working operator and the starts.

**Field manufacturing or assembly:** This field is a list for selecting which task is done by the operator and it is related to the manufacturing or assembly process.

**Field type job:** This field is a list for what type of the job the operator is working, choosing from pipe, boiler works, fences, engineering, etc.
Field job description: This is an open field where the supervisor can write down what the operator has done.

Field comments: This is an open field where the supervisor can write down any comments which he thinks are relevant, important or just to mention whatever.

Field Administration: This is a list field where it can be selected from 2 choice, Administration or budget. Budget is for something which has been valued at the budget process and administration is for when the job is ongoing and the customer asks for anything extra what has been not defined at the budget process. This field is very important because calculate extra cost for the customer and for the business is a very powerful tool that give at the report a quick data cost in order to invoice.
Field platform: It is a list field where it can be selected what kind of platform has been used for the task. All the platform cost has been defined previously.

<table>
<thead>
<tr>
<th></th>
<th>Tipo</th>
<th>MODELO</th>
<th>DIA LABORAL</th>
<th>SÉMI O.TA</th>
<th>DIA LABORAL</th>
<th>SÉMI O.TA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Articulada, PEO</td>
<td>PA212</td>
<td>PA212</td>
<td>93,00 €</td>
<td>93,00 €</td>
<td>93,00 €</td>
<td>93,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA212</td>
<td>PA212</td>
<td>95,00 €</td>
<td>95,00 €</td>
<td>95,00 €</td>
<td>95,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA214</td>
<td>PA214</td>
<td>104,00 €</td>
<td>104,00 €</td>
<td>104,00 €</td>
<td>104,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA226</td>
<td>PA226</td>
<td>185,00 €</td>
<td>185,00 €</td>
<td>185,00 €</td>
<td>185,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA212</td>
<td>PA212</td>
<td>120,00 €</td>
<td>120,00 €</td>
<td>120,00 €</td>
<td>120,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA214</td>
<td>PA214</td>
<td>115,00 €</td>
<td>115,00 €</td>
<td>115,00 €</td>
<td>115,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA216</td>
<td>PA216</td>
<td>220,00 €</td>
<td>220,00 €</td>
<td>220,00 €</td>
<td>220,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA218</td>
<td>PA218</td>
<td>310,00 €</td>
<td>310,00 €</td>
<td>310,00 €</td>
<td>310,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA220</td>
<td>PA220</td>
<td>610,00 €</td>
<td>610,00 €</td>
<td>610,00 €</td>
<td>610,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA222</td>
<td>PA222</td>
<td>640,00 €</td>
<td>640,00 €</td>
<td>640,00 €</td>
<td>640,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA224</td>
<td>PA224</td>
<td>670,00 €</td>
<td>670,00 €</td>
<td>670,00 €</td>
<td>670,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA226</td>
<td>PA226</td>
<td>700,00 €</td>
<td>700,00 €</td>
<td>700,00 €</td>
<td>700,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA228</td>
<td>PA228</td>
<td>730,00 €</td>
<td>730,00 €</td>
<td>730,00 €</td>
<td>730,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA230</td>
<td>PA230</td>
<td>760,00 €</td>
<td>760,00 €</td>
<td>760,00 €</td>
<td>760,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA232</td>
<td>PA232</td>
<td>790,00 €</td>
<td>790,00 €</td>
<td>790,00 €</td>
<td>790,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA234</td>
<td>PA234</td>
<td>820,00 €</td>
<td>820,00 €</td>
<td>820,00 €</td>
<td>820,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA236</td>
<td>PA236</td>
<td>850,00 €</td>
<td>850,00 €</td>
<td>850,00 €</td>
<td>850,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA238</td>
<td>PA238</td>
<td>880,00 €</td>
<td>880,00 €</td>
<td>880,00 €</td>
<td>880,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA240</td>
<td>PA240</td>
<td>910,00 €</td>
<td>910,00 €</td>
<td>910,00 €</td>
<td>910,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA242</td>
<td>PA242</td>
<td>940,00 €</td>
<td>940,00 €</td>
<td>940,00 €</td>
<td>940,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA244</td>
<td>PA244</td>
<td>970,00 €</td>
<td>970,00 €</td>
<td>970,00 €</td>
<td>970,00 €</td>
</tr>
<tr>
<td>Articulada, PEO</td>
<td>PA246</td>
<td>PA246</td>
<td>1000,00 €</td>
<td>1000,00 €</td>
<td>1000,00 €</td>
<td>1000,00 €</td>
</tr>
</tbody>
</table>

Field crane: It is a list field where it can be selected what type of crane has been working on the task. All the crane cost has been defined previously.

Field hour crane: It is how many hours the crane has worked.

Field Extra description: This is an open field to describe any extra cost.

Field extra cost (€): This field is to indicate the extra cost describe in the before field.

6.1.2 Inputs for creating a job.
Once the budget job has been accepted by the customer for being done, it is needed to create the job in the system and define several items like, number budget, customer, contact, accepted budget date, globally description job. After defining all points, it has to be pressed “Alta button” in order to register the data automatically in the system.

<table>
<thead>
<tr>
<th>OBRA</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Nº PRESUPUESTO</td>
<td></td>
</tr>
<tr>
<td>CLIENTE</td>
<td></td>
</tr>
<tr>
<td>CONTACTO</td>
<td></td>
</tr>
<tr>
<td>FECHA ALTA</td>
<td></td>
</tr>
<tr>
<td>DESCRIPCIÓN TRABAJO</td>
<td></td>
</tr>
</tbody>
</table>

6.1.3 Inputs for closing finished job.

When the job is completely finished, the job report has to be saved in the selected folder for having the information available in order to check the data as needed (for future similar projects or to review the project done).

The way of saving the data is after creating the final job report pressing “GUARDAR” button. Just pressing the button is open an interaction window in order to saved the data in the wanted file.

Once the data is properly saved the following step is closing the job in the system. So on, it is selecting the job
wanted to be closed from the list and pressing the “BAJA” button.

6.1.4 Inputs for creating new operators and updating within the actual organization.

The system needs to be updated with the actual people within the organization. So on, this tools is used for defining the category, the status on the company, the price every hour for each type (normal hour cost, extra hour cost, night hour cost, holiday hour cost).

6.1.5 Inputs for platforms and crane.
In order to calculate automatically the cost for the platform and cranes needs to be defined all the data required. At this point can be defined the entire platform types with their cost in function of the days used.

6.1.6 Inputs for defining materials and consumer goods.

All materials and consumer goods which are at the warehouse should be introduced at the application. They are defined by file, code and description.
6.1.7 Inputs for purchasing materials and consumer goods.

Every time a purchasing is done, it should be registered indicating the following items:

- **Purchasing date:** Data when the material has been bought.
- **Code:** The identification material.
- **Quantity bought:** Number of item bought.
- **Cost:** To indicate how much has the item cost.
- **Comments:** This field is for writing any comments.
- **Supplier:** To indicate which one is the supplier.
6.1.8 Inputs for used materials and consumer goods.

In order to register when a material or consumption goods are used, it is programmed the following fields:

**Job:** To select from the list the job where the material is used.

**Administration:** To indicate if the material is for administration o from budget.

**Date:** To indicate the data.

**Code:** to write the code.

**Description:** field to not modify. Once the code has been introduced, this file is shown automatically.

**Quantity:** To indicate how many items has been used.

**Cost:** This field is automatically. Once introduced the code and the quantity, it is shown the total cost.

**Name:** to indicate what operator is using the material or consumption good.

**Comments:** to write down any comment wanted.
6.1.9 Inputs for defining suppliers.

All suppliers should be introduced at the application. The way is just writing down the supplier name on the list.

After program all this topics comments before, it was programmed a menu in order to go directly and fast to the required inputs. In the chart below is shown the menu as it is.
6.2 OUTPUTS

6.2.1 Output active jobs

The excel sheet shows the active jobs which are running, defined by quotation number, customer, contact, start date, end date, job description.

There is available a tool if the user needs to screen by customer in order to know the jobs running for each client.

6.2.2 Output Report

This is the most important tool of the project. Below is shown, the menu for creating the job report, to know where has been working each operator and what the operator has done, the crane and platforms used, the material and consumption good used, the
extras used. We can know very accurate the money invested up to know.

Mention that in the future it can be programmed other fields in order to screen by other topics like data, hour time started, hour time ended and so on.

6.2.2.1 Screening by job

Pressing the job field is shown all the active jobs. Underneath you can see a view of how it can be selected the job in order to create the final report.
Once selected the job wanted and pressing “Generar reporte final de obra” button, it is created the final job report automatically.

As it is shown, at the final report can be found:

**General data:** Customer, name of the job, number of budget, description job.

**Outcomes cost (budget and administration):** It is shown how much money it is invested in labour hour, crane, platforms, extras, consumption goods and at the end, it is shown all the cost together.

Note that there are some field to indicate the value of the quotation, the way of paying and the interest bank. Once introduced the profitability and the money earn is shown automatically.

**Extras:** It is shown all the extras introduced at inputs.

**Comments:** It is shown all the comments introduced at inputs.

**Platforms:** It is shown all the platforms introduced at inputs.

**Cranes:** It is shown the entire crane introduced at inputs.

**Chart:** This is the main information, where the entire data job is registered. If required can be sorting by field.
### GRÚAS TRABAJOS POR ADMINISTRACIÓN

<table>
<thead>
<tr>
<th>HORAS TRAB. (H)</th>
<th>COSTE HOR. TRAB. (€)</th>
<th>COSTE MÍNIMO (€)</th>
<th>COSTE REAL (€)</th>
<th>COSTE DESPLAM. (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>322,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>344,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>380,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>480,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>500,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>400,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>240,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>320,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>440,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>500,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>900,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>1,200,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>1,440,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>1,840,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>2,400,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>3,600,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>4,VALOR!</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SUMA**

0,00 €

**COSTE TOTAL**

0,00 €

---

### GRÚAS TRABAJOS POR ADMINISTRACIÓN

<table>
<thead>
<tr>
<th>HORAS TRAB. (H)</th>
<th>COSTE HOR. TRAB. (€)</th>
<th>COSTE MÍNIMO (€)</th>
<th>COSTE REAL (€)</th>
<th>COSTE DESPLAM. (€)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>322,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>344,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>380,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>480,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>500,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>400,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>240,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>320,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>440,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>500,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>900,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>1,200,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>1,440,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>1,840,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>2,400,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>3,600,00</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0-1-00 0:00</td>
<td>0,00</td>
<td>4,VALOR!</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**SUMA**

0,00 €

**COSTE TOTAL**

0,00 €

---

<table>
<thead>
<tr>
<th>OBRA</th>
<th>NOMBRE TRABAJADOR</th>
<th>FECHA</th>
<th>HORA INICIO</th>
</tr>
</thead>
<tbody>
<tr>
<td>SERGIO PRUEBA</td>
<td>ALEJANDRO</td>
<td>6/5/2014</td>
<td>6:00</td>
</tr>
</tbody>
</table>
6.2.2.2 Screening by customer

This tool has been programmed in order to know what jobs and task has been done for each customer.
Note: This tool is ongoing. At the moment is not available.

6.2.2.3 Screening by Operator

This tool can be used to know the information where, when and what the operator selected have been doing.

6.2.3 Output Check materials and consumption good stock

Sometimes it is needed to know how many items there are at the warehouse.
The way of doing this it is just writing down the code and the quantities available is shown.
7. CONCLUSION

As I am working in a Talleres y Montajes Luna S.L. and we have seen a big opportunity of improvement, we decided to design and implement this application in order to control the manufacturing cost. Talleres y Montajes Luna S.L. is an SME company (small and medium enterprise) based in Alicante, Osa Mayor Street and number 4.

Below it is shown a photo where the factory is located.
The normal size of this business is around 25 workers all the year and reaching the double size when the load job increase to the maximum.

Nowadays, the final invoice at the end of the year is about 1.5 million of Euros. Considering that the economy in Spain the last few years is quite bad, we can say we are working and offering the service. However, before this difficult time, the business invoice around 5-6 million of €.

Below, it is shown two pictures from the street.
At the following picture you can see a photo and make a general idea of this business.
Talleres y Montajes Luna S.L. is a business working for the mechanical sector. The kinds of jobs what the Talleres y Montajes Luna can do are different; working in mechanical structural, mechanical pipes, boiler jobs and industrial maintenance.

Following, you can see photos from jobs which Talleres and Montajes Luna has done.

MECHANICAL STRUCTURAL JOBS

Horno Johson
Parking
Service stairs for a silo
MECHANICAL PIPES
BOILER JOB

Metal tankard
Cyclone blending tank
Hopper and bidirectional hopper

Sliding floodgate with pneumatic command
INDUSTRIAL MAINTENANCE

Change hummer grinding
Fix mechanical conveyor for a oven
Talleres y Montajes Luna S.L. has an industrial unit with 500 m2, being the place for manufacturing, using the following machines:

Hydraulic sheet shear

Bending machine
Folder machine

Milling machine
Lathe machine

Driller machine
Saw machine

Stamp
Welding machines (MAG, TIG, Arc welding process)

Oxygen Flame cutting machine(oxicorte)
Plasma cutting machine
Crane-truck

Overhead travelling crane
EXAMPLE OF A REAL CASE

A customer ask for 100 steel container in 3 different types. In order to control the manufacturing cost; people, materials, good consumer goods is include all the information on the excel sheet application.

The manufacturing organization is done as follow:

Day 1. 3 people. All shift
Day 2. 4 people. All shift
Day 3. 1 person. All shift
Day 4. 3 people. 1 person half shift, other people all shift
Day 5. 4 people. 2 people 6 hours, other people all shift
Day 6. 1 person. All shift
Day 7. 5 person. All shift

The material and consumer goods are 3 steel sheet, size 6000 x 2000 x 4 mm and 1 box of electrode.

Step 1. We open the application.
Step 2. Go to alta obras. This task is only done the first day.

![alta obras table]

Step 3. Go to Parte Diario. Everyday, at the end of the shift, the data is registered at the excel application.

Day 1

![Parte Diario table]
### Day 2

<table>
<thead>
<tr>
<th>OBRA</th>
<th>100 steal container</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOMBRE TRABAJADOR</td>
<td>ALBERTO MARTÍNEZ</td>
</tr>
<tr>
<td>FECHA</td>
<td>11/09/2015</td>
</tr>
<tr>
<td>HORA INICIO</td>
<td>8:00</td>
</tr>
<tr>
<td>HORA FIN</td>
<td>14:30</td>
</tr>
<tr>
<td>HORAS</td>
<td>6:30</td>
</tr>
<tr>
<td>FABRICACIÓN O MONTAJE</td>
<td>FABRICACIÓN</td>
</tr>
<tr>
<td>CAMPO TRABAJO</td>
<td>CALDERERÍA</td>
</tr>
<tr>
<td>DESCRIPCIÓN TRABAJO</td>
<td>Cutting sheet type 1 using the</td>
</tr>
<tr>
<td>COMENTARIOS</td>
<td></td>
</tr>
<tr>
<td>ADMINISTRACIÓN</td>
<td></td>
</tr>
<tr>
<td>PLATAFORMAS</td>
<td></td>
</tr>
<tr>
<td>GRÚAS</td>
<td></td>
</tr>
<tr>
<td>TIEMPO TRABAJADO GRÚA (HORAS)</td>
<td>8:00</td>
</tr>
<tr>
<td>DESCRIPCIÓN EXTRAS</td>
<td>1 box of electrode</td>
</tr>
<tr>
<td>COSTE EXTRAS (€)</td>
<td>65,44</td>
</tr>
</tbody>
</table>

### Day 3

<table>
<thead>
<tr>
<th>OBRA</th>
<th>100 steal container</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOMBRE TRABAJADOR</td>
<td>RAMON PASTOR</td>
</tr>
<tr>
<td>FECHA</td>
<td>12/09/2014</td>
</tr>
<tr>
<td>HORA INICIO</td>
<td>6:00</td>
</tr>
<tr>
<td>HORA FIN</td>
<td>14:30</td>
</tr>
<tr>
<td>HORAS</td>
<td>8:00</td>
</tr>
<tr>
<td>FABRICACIÓN O MONTAJE</td>
<td>FABRICACIÓN</td>
</tr>
<tr>
<td>CAMPO TRABAJO</td>
<td>CALDERERÍA</td>
</tr>
<tr>
<td>DESCRIPCIÓN TRABAJO</td>
<td>Welding type 1</td>
</tr>
<tr>
<td>COMENTARIOS</td>
<td></td>
</tr>
<tr>
<td>ADMINISTRACIÓN</td>
<td></td>
</tr>
<tr>
<td>PLATAFORMAS</td>
<td></td>
</tr>
<tr>
<td>GRÚAS</td>
<td></td>
</tr>
<tr>
<td>TIEMPO TRABAJADO GRÚA (HORAS)</td>
<td></td>
</tr>
<tr>
<td>DESCRIPCIÓN EXTRAS</td>
<td></td>
</tr>
<tr>
<td>COSTE EXTRAS (€)</td>
<td></td>
</tr>
</tbody>
</table>
### Day 4

<table>
<thead>
<tr>
<th>OBRA</th>
<th>100 steal container</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NOMBRE TRABAJADOR</td>
<td>ANTONIO VARGAS</td>
<td>ALBERTO MARTINEZ</td>
</tr>
<tr>
<td>FECHA</td>
<td>15/06/2015</td>
<td>6:00</td>
</tr>
<tr>
<td>HORAS</td>
<td>4:00</td>
<td>6:00</td>
</tr>
<tr>
<td>FABRICACIÓN O MONTAJE</td>
<td>FABRICACIÓN</td>
<td>FABRICACIÓN</td>
</tr>
<tr>
<td>CAMPO TRABAJO</td>
<td>CALDERERÍA</td>
<td>CALDERERÍA</td>
</tr>
<tr>
<td>DESCRIPCIÓN TRABAJO</td>
<td>Welding type 1,</td>
<td>cutting type 2 swing hydraulic, cutting type 2 swing</td>
</tr>
<tr>
<td>COMENTARIOS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADMINISTRACIÓN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLATAFORMAS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRÚAS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIEMPO TRABAJADO GRÚA (HORAS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DESCRIPCIÓN EXTRAS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COSTE EXTRAS (€)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Day 5

<table>
<thead>
<tr>
<th>OBRA</th>
<th>100 steal container</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>NOMBRE TRABAJADOR</td>
<td>ALBERTO MARTINEZ</td>
<td>ALEJANDRO RAMOS</td>
</tr>
<tr>
<td>FECHA</td>
<td>15/06/2015</td>
<td>6:00</td>
</tr>
<tr>
<td>HORAS</td>
<td>12:30</td>
<td>12:30</td>
</tr>
<tr>
<td>FABRICACIÓN O MONTAJE</td>
<td>FABRICACIÓN</td>
<td>FABRICACIÓN</td>
</tr>
<tr>
<td>CAMPO TRABAJO</td>
<td>CALDERERÍA</td>
<td>CALDERERÍA</td>
</tr>
<tr>
<td>DESCRIPCIÓN TRABAJO</td>
<td>Cutting type 2,</td>
<td>Bending type 2, Welding type 2, Welding type 2</td>
</tr>
<tr>
<td>COMENTARIOS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>ADMINISTRACIÓN</td>
<td></td>
<td></td>
</tr>
<tr>
<td>PLATAFORMAS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>GRÚAS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>TIEMPO TRABAJADO GRÚA (HORAS)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>DESCRIPCIÓN EXTRAS</td>
<td></td>
<td></td>
</tr>
<tr>
<td>COSTE EXTRAS (€)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## Day 6

<table>
<thead>
<tr>
<th>OBRA</th>
<th>100 steel container</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOMBRE TRABAJADOR</td>
<td>RAMÓN PASTOR</td>
</tr>
<tr>
<td>FECHA</td>
<td>17/06/2014</td>
</tr>
<tr>
<td>HORA INICIO</td>
<td>8:00</td>
</tr>
<tr>
<td>HORA FIN</td>
<td>14:30</td>
</tr>
<tr>
<td>HORAS</td>
<td>8:00</td>
</tr>
<tr>
<td>FABRICACIÓN O MONTAJE</td>
<td>FABRICACIÓN</td>
</tr>
<tr>
<td>CAMPO TRABAJO</td>
<td>CALDERERÍA</td>
</tr>
<tr>
<td>DESCRIPCIÓN TRABAJO</td>
<td>Welding type 2</td>
</tr>
<tr>
<td>COMENTARIOS</td>
<td></td>
</tr>
<tr>
<td>ADMINISTRACIÓN</td>
<td></td>
</tr>
<tr>
<td>PLATAFORMAS</td>
<td></td>
</tr>
<tr>
<td>GRÚAS</td>
<td></td>
</tr>
<tr>
<td>TIEMPO TRABAJADO GRÚA (HORAS)</td>
<td></td>
</tr>
<tr>
<td>DESCRIPCIÓN EXTRAS</td>
<td></td>
</tr>
<tr>
<td>COSTE EXTRAS (€)</td>
<td></td>
</tr>
</tbody>
</table>

## Day 7

<table>
<thead>
<tr>
<th>OBRA</th>
<th>100 steel container</th>
</tr>
</thead>
<tbody>
<tr>
<td>NOMBRE TRABAJADOR</td>
<td>ALBERTO MARTÍNEZ, RAMÓN PASTOR, ANTONIO VARGAS, JUAN VALDES, SERGIO RAMÍREZ</td>
</tr>
<tr>
<td>FECHA</td>
<td>18/06/2015</td>
</tr>
<tr>
<td>HORA INICIO</td>
<td>8:00, 8:00, 8:00, 8:00, 8:00</td>
</tr>
<tr>
<td>HORA FIN</td>
<td>14:30, 14:30, 14:30, 14:30, 14:30</td>
</tr>
<tr>
<td>HORAS</td>
<td>8:00, 8:00, 8:00, 8:00, 8:00</td>
</tr>
<tr>
<td>FABRICACIÓN O MONTAJE</td>
<td>Fabricación, Fabricación, Fabricación, Fabricación, Fabricación</td>
</tr>
<tr>
<td>CAMPO TRABAJO</td>
<td>Calderería, Calderería, Calderería, Calderería, Calderería</td>
</tr>
<tr>
<td>DESCRIPCIÓN TRABAJO</td>
<td>Cutting type 2 and welding type 3, Cutting type 3 and welding type 2, Welding type 3, Welding type 3</td>
</tr>
<tr>
<td>COMENTARIOS</td>
<td></td>
</tr>
<tr>
<td>ADMINISTRACIÓN</td>
<td></td>
</tr>
<tr>
<td>PLATAFORMAS</td>
<td></td>
</tr>
<tr>
<td>GRÚAS</td>
<td></td>
</tr>
<tr>
<td>TIEMPO TRABAJADO GRÚA (HORAS)</td>
<td></td>
</tr>
<tr>
<td>DESCRIPCIÓN EXTRAS</td>
<td>3 steel plate 6000<em>2000</em>4 size</td>
</tr>
<tr>
<td>COSTE EXTRAS (€)</td>
<td>800,40</td>
</tr>
</tbody>
</table>
Step 4. Go to reporte

Selecting the job wanted and pressing “Generar reporte final de obra” the main report is automatically create, **being the most value of the excel application.**

![Reporte Final de Obra](image)
7.2 SAVINGS

The implementation in Talleres y Montajes Luna S.L. has been successfully done. All roles are doing their task and the system is working.
The benefits accomplish are many and some of those can be valued and another cannot be valued. For stating some benefits we can say:

- **An indirect labour hour saved:** Every day, 2 people were doing the same task, the Manager ask the information to the supervisor.

  30 minutes/day \( \times \) 5 days/week \( \times \) 52 weeks/year = 7.800 minutes = 130 hours

  130 hours \( \times \) 25 €/hour = **3,250€**

- **Manufacturing process flow improved:** Nowadays, the supervisor does the inputs as he can. There are no interruptions, affecting manufacturing.

  30 minutes/day \( \times \) 5 days/week \( \times \) 52 weeks/year = 7.800 minutes = 130 hours

  130 hours \( \times \) 16 €/hour = **2,080€**

- **Fast and instant information:** just pressing a button you can know all the money invested in every job running. It is a big improvement for the manager, to have all this data every time needed. Before implementing this excel application sheet, he had to calculate manually.
60 minutes/job closed x 2 jobs closed/week x 52 weeks/year = 6,240 minutes = 104 hours

104 hours x 25 €/hour = 2,600 €

• **Much control of the business from the beginning of the job up to the end:** as we can know the money invested up to know very easy we can follow all the jobs running and make some actions as needed.

30 minutes/job check x 5 jobs check/week x 52 weeks/year = 7,800 minutes = 130 hours

130 hours x 25 €/hour = 3,250 €

• **Information in digital format** (before it was in a paper format): all the data it is on the same file. Before the implementation, it takes long time to look for the papers wanted.

10 minutes/job check x 3 jobs check/week x 52 weeks/year = 1,560 minutes = 26 hours

26 hours x 25 €/hour = 650 €
• Control and follow stock and purchasing material for consumption goods at warehouse: it was not control before.

**Total saving cost: 11,830€/year**

It is expected to go further with the excel sheet application. We would like to control manufacturing process in live with a KPI and to control purchasing flow process, we would like to control all raw material (beams, steel sheets, etc) and we would like to have a Personal protective equipment (PPE) used report by operator.

### 7.3 Amortization

**Total Savings:** 11,830€/year

**Cost implementation:** 8 hours/day × 20 days = 160 hours
160 hours × 20 €/hour = 3,200€

3,200 € / 11,830 € = 0.27
Amortization → 0.27 × 52 Weeks = 14.56 weeks × 1 month / 4 week = **3.6 month**
8. REFERENCES AND BIBLIOGRAPHY

- Excel, macros y VBA; Jelen, Bill

- VBA Excel 2007, programar en Excel: Macros y lenguaje VBA; Amelot, Michèle and Som, Guillermo

- Youtube

- Internet