UNIVERSITÀ DEGLI STUDI DI PADOVA

DEPARTMENT OF MANAGEMENT AND ENGINEERING

LAUREA TRIENNALE IN INGEGNERIA GESTIONALE

An Information System to Support Customer Service in Far East Countries

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ACADEMIC SESSION 2012-2013

To my great-grandmother Nella
and my grandfather Angelo.

Contents

1. Introduction

This thesis project is based on activity of an internship in a company, Megadyne China Ltd., whose headquarter is Megadyne S.p.a. located in Torino, Italy.

The Company was funded by Corrado Tadolini in 1957. At the beginning the core business was rubber belts manufacturing, which by the years has expanded also to polyurethane belts and pulleys.

Megadyne owns productive branches in the USA, China and all over Europe. The European plants are mainly situated in the central part of Europe. In China, there are 3 invested companies. The company has been holding service-commercial company in China (Foshan) since 1999 and its branch in Shanghai in 2001; the first production plant was established in Qingdao in 2005 for the production of polyurethane belts. After some years, in 2008, a further plant for rubber belt manufacturing was acquired in Ningbo. The last commercial branch is situated in Shanghai.

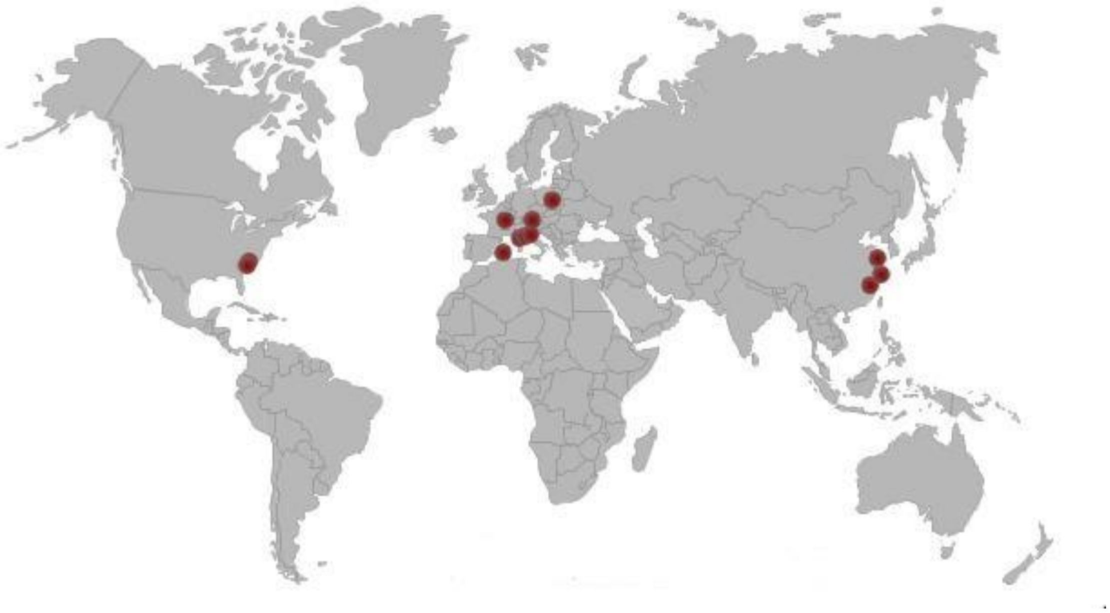


Fig. 1: Megadyne's production plants around the world.

1.1. Supply Chain Network Structure for the Far East Market

The plants of Qingdao and Ningbo produce most of the belts sold to the Asia Pacific Market. Big orders containing standard products, are directly delivered to the customers from Qingdao and Ningbo **(Fig.2)**. The other orders, are usually delivered to the Shanghai or Foshan plants to be completed with packaging and special reworking and then shipped to the customer.

Foshan is the center for the export department and it processes all the quotations and orders placed by the far east customers, while the other Chinese branches have a customer service to deal with the Chinese market.

Orders of belts with special requirements (coating etc), or products which are not produced in the Chinese plants are imported from Italy.

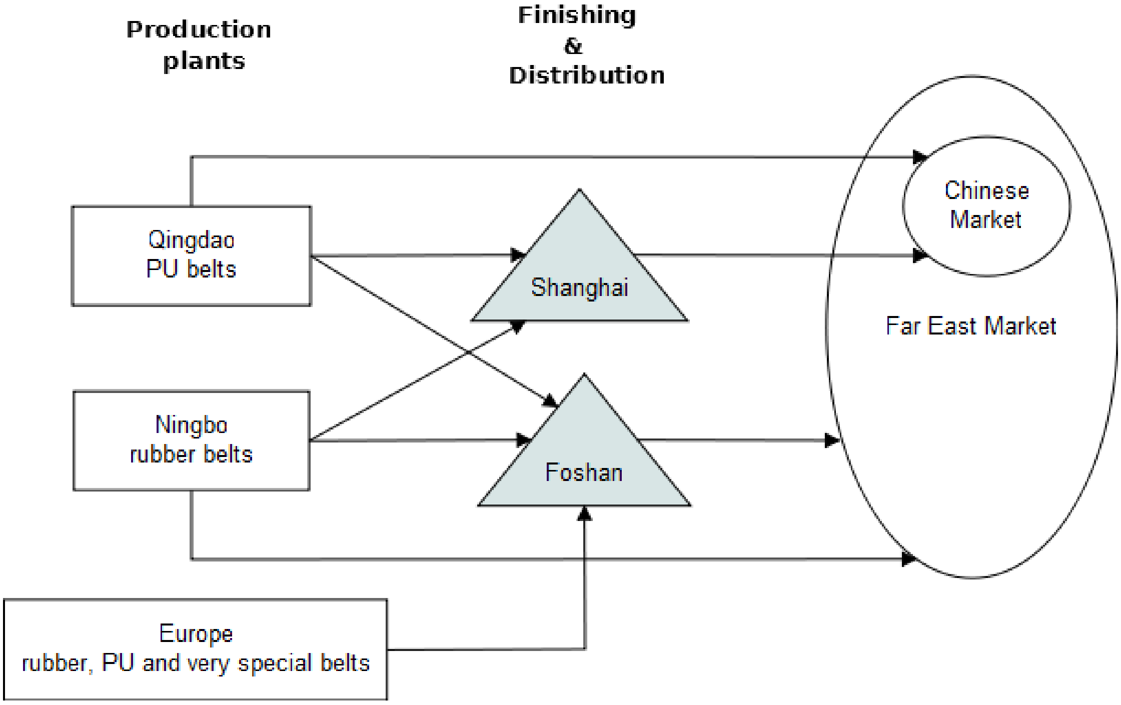


Fig. 2: Supply chain network structure and flows

1.2. Short Introduction to the Product

Belts were invented as an alternative to chains. There are several advantages in the use of belts instead of chains. Belts are made in materials like rubber or PU, therefore they are lighter and cheaper than the chains. In addition, they do not produce any noise while working and do not need any lubrication. On the other hand, the power which chains can bear is higher than those of belts and belts are easier to be broken. It is up to the designer to choose which solution is more suitable for each application.

In order to bear the strains which belts are subjected to during working, belts must be designed with a strong core. In the central part of the belts there are cords which are made of material with high mechanical characteristics, such as steel, Kevlar etc., this part actually transfers the power.

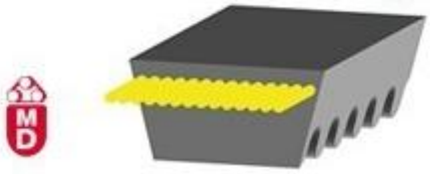


Fig. 3: Basic structure of a belt.

1.2.1. Application Fields

The main fields of application for belts are in power transmission, timing, conveyor and lift systems. An example of power transmission is between engine and wheel in motorbikes. Belts designed with teeth, also called synchronous belts, are capable to guarantee temporization between two pulleys, this allow to have both the systems connected to the two pulleys in the same position at the same time. An example is the synchronization between crankshaft and camshaft in internal combustion engines.
The synchronous belts can be produced with different pitch, dimension and shape depending on the work conditions (speed and power) of the final application. With pitch we identify the shortest distance between the middle point of two teeth (**Fig. 4**). They are commonly identified by a letter or by an alfa-numeric code (**Fig. 4**).

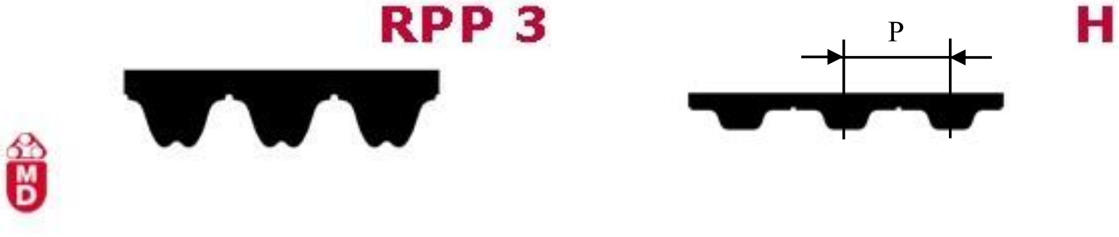


Fig. 4: Examples of shapes and codes for different pitches.

Other important applications fields are conveyor and lift systems. In the first application belts are used to move materials from one place to another, for example to move a product between two processes in a manufacturing system.

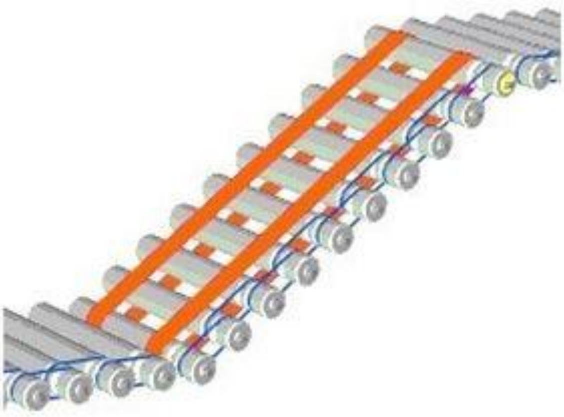


Fig. 5: Conveyor system involving belts for the rollers motion (blue colour) and for lifting (orange color).

The main characteristic of these belts is the high friction coefficient between the belt and products to guarantee their movement. With small or thin products, friction is not enough, and special cleats are fixed on its back side to ensure products movement.

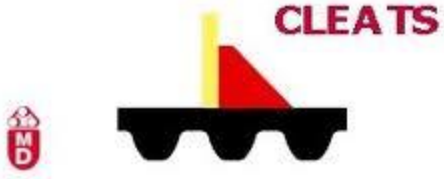


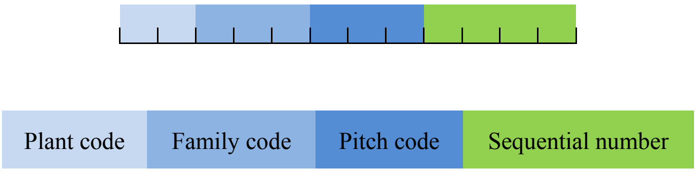
Fig. 6: Example of cleats designed to convey small products.

1.3. Overview of the Information System for Product Handling

All the departments in Megadyne are managed with Microsoft Dynamics NAV, a Navision ERP system [http://www.microsoft.com/it-it/dynamics/erp-small-midsize-business.aspx].
The main problem in belts production in IT System for the management of belt production in the high customization of the product required to suit clients' requirement. Each customer requires to choose the belts characteristics (width, pitch, cord etc.) according to his machinery and application. To univocally identify each product, the information system introduced NAV with an *Item Card*. The Item Card contains all the information about any quoted products. It also allows the system to identify it univocally through a combination of a code and description. The description is a string which contains all the information about the belt, i.e.:

Width – pitch – length cord type + coating material thickness
Ex: ***75 – H – 7073.9 kevlar + red rubber 4.00 mm***

The code is a twelve-digit array generated by the system and has the following structure:



2. Analysis of Current State

The selling procedure starts with customers inquiry, and the quotation proposed as a reply. When the quotation is accepted and the customer places the order, a new procedure starts to manage the order to deliver the goods.

Quotations are made through NAV, when a product is not in the database a new Item Card is created for the new product to be quoted. This is the main critical issue: each customer has different machines and needs for belts, thus belts can be widely customized and each small difference introduced requires the creation of a new Item Card. Therefore, it is easy to figure out that this process generates high costs of human resources and requires a huge quantity of data. Moreover, any costs and space become useless when no order follow the quotation.

To cope with this problem, a new selling policy was introduced in the Chinese market. It consists in having an efficient sales team which deal directly with the customers. A better customer care presents in 90% of quotations become orders. This justifies the costs for the 'quotations process'.

Nevertheless, the previous policy, which is successful for the Chinese market, is not suitable for the rest of the far east market and just a small percentage of quotations become orders. Thus, the export department uses MS Excel for the quotations and the price is calculated by hand each time by searching through the pricelist and adding eventual special processing costs. Only after the order confirmation is placed the order is inserted and processed with NAV.

The two-step procedure avoid waste of space in the main server but required time for making quotations and doesn't allow quick analysis or data mining as data are collected in electronic sheets. The biggest drawback of this procedure is that it requires a huge amount of work for monthly reports. This causes the loss of useful information for the management, such as percentage of successful quotations and market's trend. Therefore, predictions are difficult and decisions are not supported by enough information.

2.1. IDEF0 for quotations making process

The following IDEF0 represents the customer service as a black box, which has input, output, controls and support tools.

The input is the inquiry received from the customers, while the output is the offer which is issued as a reply to the inquiry.

During the process of quotation making the customer service can use support tools such as pricelists and MS Excel to create the quotations.

To offer only products which can be produced, feasibility tables can be used by the employees of the customer service to control the feasibility of the belts.

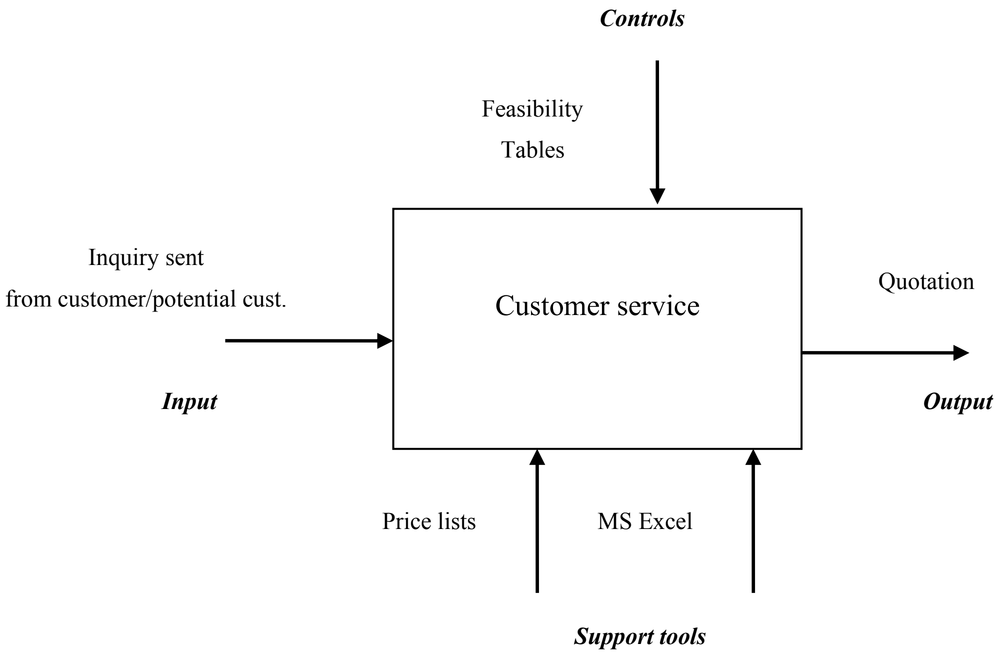


Fig. 7: IDEF0 for customer service processes

2.2. Flow of Activities

The activities of the customer service for the export department are all started by inquiries. Once the customer service gets the inquiry the first step is to evaluate whether the required product is technically feasible, then it is also important to check if the process of the other orders respect the required delivery time to satisfy the customer.

When a product is feasible in terms of lead time and technical features, it is important to understand whether the product is a standard belt or a special belt.

If the inquiry is about a standard belt, the price is the standard price from pricelist.

In the latter case there are two possibilities. When the required belt is uncommon, for example not available in the catalogue, the inquiry is forwarded to Italy. Otherwise it can be processed internally or by an external supplier. The belts can be reworked by the Megadyne Foshan's job-shops, external supplier, or from Megadyne Italy job-shops. After this process is finished, the price of the belt is defined and an offer is sent to the customer.

If the customer accepts the offer, an order confirmation and a pro-forma invoice is sent to him/her. For an internal policy, the order is processed only after the customer's payment. After the payment, the order is inserted in the NAV System. Next page shows a flow chart of the whole process.

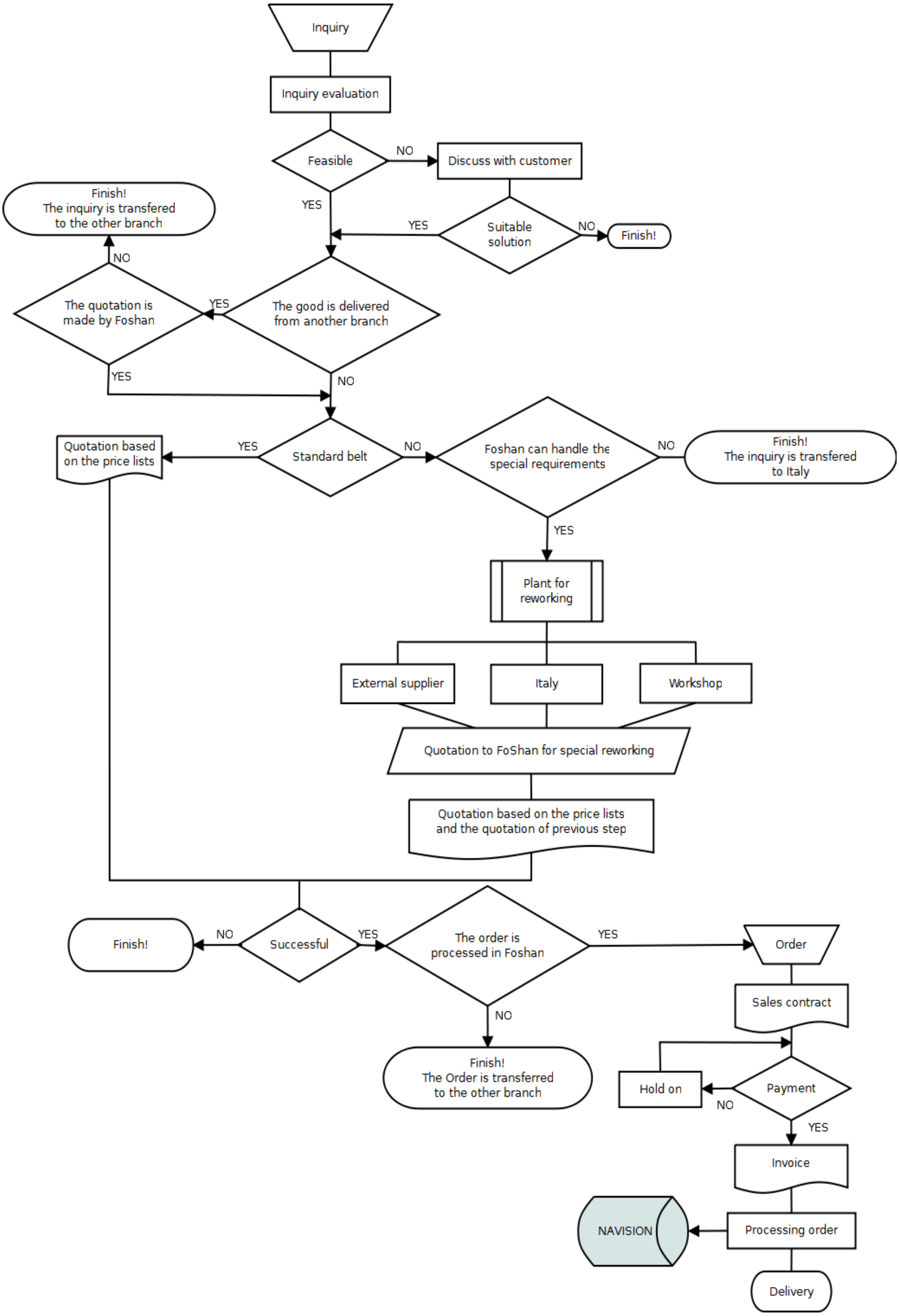

Inquiry
Inquiry evaluation
Feasible
NO
Discuss with customer
YES
Suitable solution
YES
NO
Finish!
Finish! The inquiry is transfered to the other branch
NO
The quotation is made by Foshan
YES
The good is delivered from another branch
YES
NO
Quotation based on the price lists
YES
Standard belt
NO
Foshan can handle the special requirements
NO
Finish! The inquiry is transfered to Italy
YES
Plant for reworking
External supplier
Italy
Workshop
Quotation to FoShan for special reworking
Quotation based on the price lists and the quotation of previous step
Finish!
NO
Successful
YES
The order is processed in Foshan
YES
Order
NO
Finish! The Order is transferred to the other branch
Sales contract
Hold on
Payment
NO
YES
Invoice
NAVISION
Processing order
Delivery

Chart 1: Flows involved in the customer service department

2.2.1. Activities on Successful Quotation

The following table summarises: (1) the activities after the offer is accepted, (2) the document details at each step, and (3) the way to collect them.

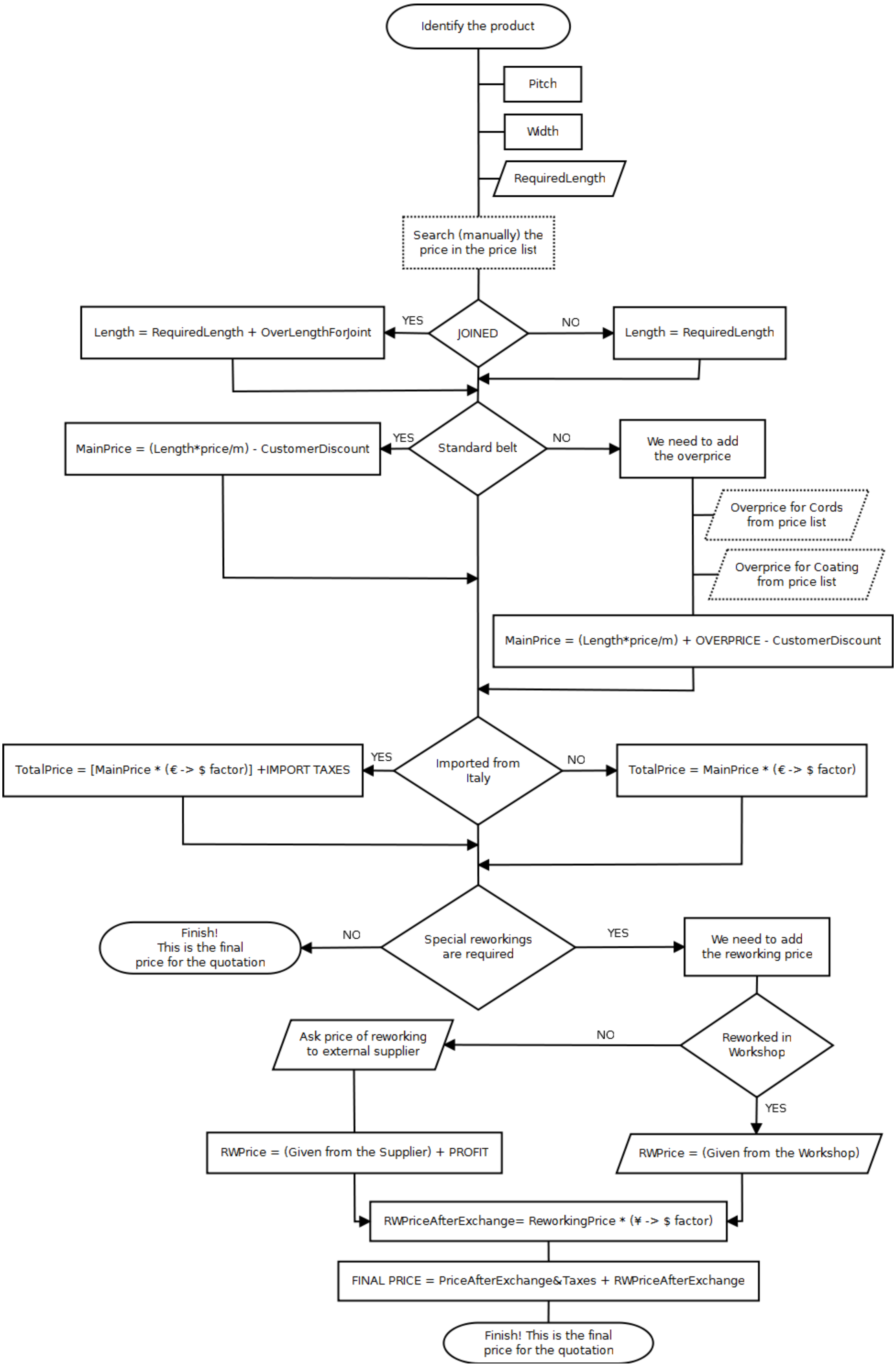
Activity	**Documents**	**Rec./sent through**	**Software**	**Processing mode**	**Collecting mode**
Inquiry receiving		1) e-mail 2) Skype 3) msn			1) Fox mail 2) nothing 3) nothing
Inquiry evaluation				Check Feasibility Tables	
Quotation	Offer	e-mail	MS Excel	Manually calculated	Excel file
Order receiving	Purchasing order	1) FAX 2) e-mail			
Order confirmation	Sales Contract Pro-forma invoice	1) FAX 2) e-mail	MS Excel	Manually typed	- Collector - Copy in the computer
Invoice	Invoice	e-mail	MS Excel NAV	Manually typed	- Collector - NAV
Order processing			NAV	Input the order in NAV	
Delivery	Invoice Packing list Sales contract Custom declare paper				Delivered with the good

Table 1: Description of the activities of customer service

2.3. Price Calculation Procedures for Main Families of PU Belts

In this project the focus will be on the PU belts, as they are more customizable then the rubber belts, and because they make up 95% of the products processed by the export department. The procedure to calculate the price depends on several factors, as shown in the next pages. All prices are calculated by matching belts characteristics, with the pricelists.

- MEGALINEAR



Identify the product
Pitch
Width
RequiredLength
Search (manually) the price in the price list
JOINED
YES
NO
Length = RequiredLength + OverLengthForJoint
Length = RequiredLength
Standard belt
YES
NO
MainPrice = (Length*price/m) - CustomerDiscount
We need to add the overprice
Overprice for Cords from price list
Overprice for Coating from price list
MainPrice = (Length*price/m) + OVERPRICE - CustomerDiscount
Imported from Italy
YES
NO
TotalPrice = [MainPrice * (€ -> $ factor)] +IMPORT TAXES
TotalPrice = MainPrice * (€ -> $ factor)
Special reworkings are required
NO
YES
Finish! This is the final price for the quotation
We need to add the reworking price
Reworked in Workshop
NO
YES
Ask price of reworking to external supplier
RWPrice = (Given from the Supplier) + PROFIT
RWPrice = (Given from the Workshop)
RWPriceAfterExchange= ReworkingPrice * (¥ -> $ factor)
FINAL PRICE = PriceAfterExchange&Taxes + RWPriceAfterExchange
Finish! This is the final price for the quotation

Chart 2: Activities for price calculation as regards Megalinear.

- MEGAPOWER

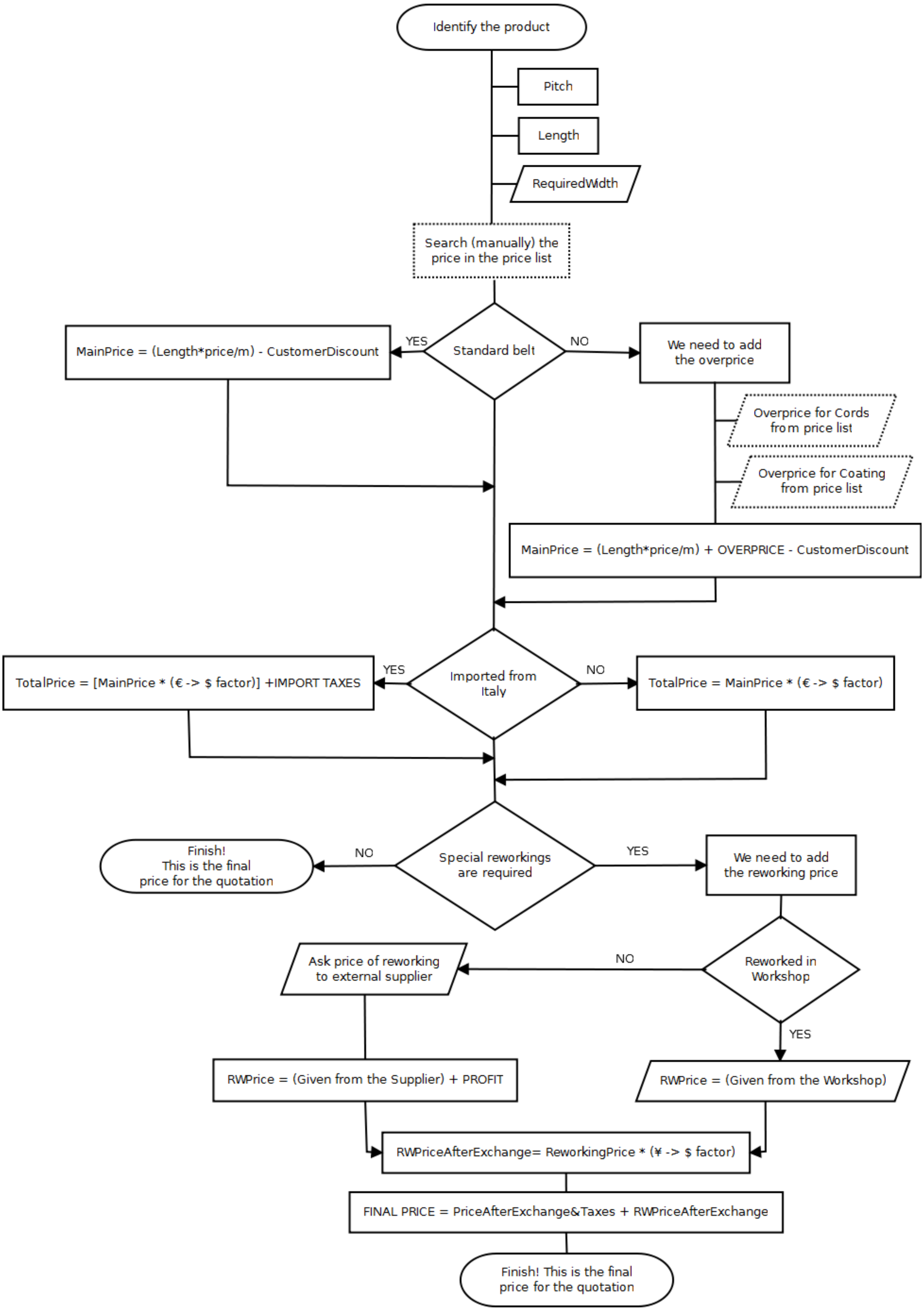

Identify the product
Pitch
Length
RequiredWidth
Search (manually) the price in the price list
Standard belt
YES
NO
MainPrice = (Length*price/m) - CustomerDiscount
We need to add the overprice
Overprice for Cords from price list
Overprice for Coating from price list
MainPrice = (Length*price/m) + OVERPRICE - CustomerDiscount
Imported from Italy
YES
NO
TotalPrice = [MainPrice * (€ -> $ factor)] +IMPORT TAXES
TotalPrice = MainPrice * (€ -> $ factor)
Special reworkings are required
NO
YES
Finish! This is the final price for the quotation
We need to add the reworking price
Reworked in Workshop
NO
YES
Ask price of reworking to external supplier
RWPrice = (Given from the Supplier) + PROFIT
RWPrice = (Given from the Workshop)
RWPriceAfterExchange= ReworkingPrice * (¥ -> $ factor)
FINAL PRICE = PriceAfterExchange&Taxes + RWPriceAfterExchange
Finish! This is the final price for the quotation

Chart 3: Activities for price calculation as regards Megapower.

- **MEGAFLEX**

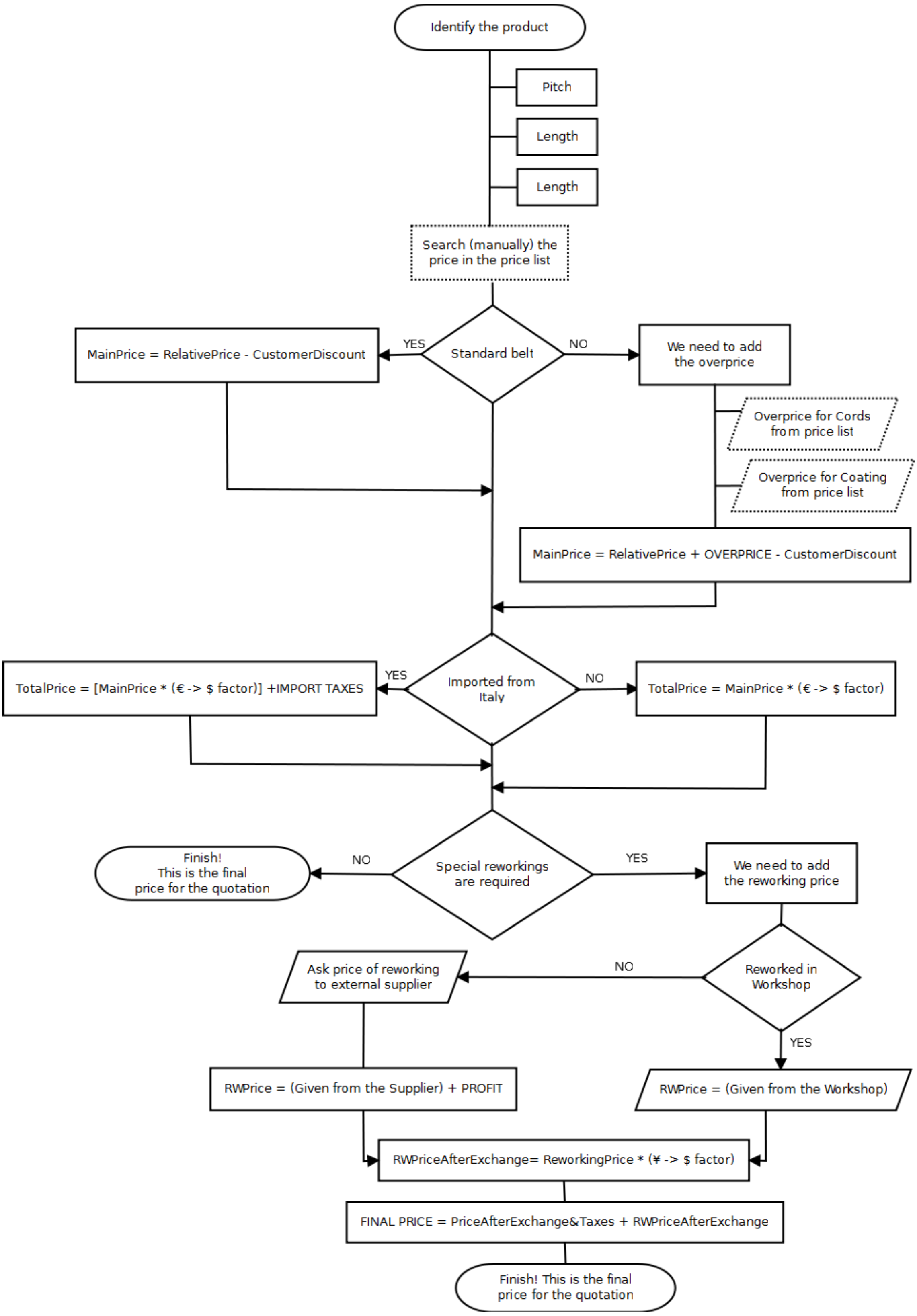

Identify the product
Pitch
Length
Length
Search (manually) the price in the price list
Standard belt
YES
NO
MainPrice = RelativePrice - CustomerDiscount
We need to add the overprice
Overprice for Cords from price list
Overprice for Coating from price list
MainPrice = RelativePrice + OVERPRICE - CustomerDiscount
Imported from Italy
YES
NO
TotalPrice = [MainPrice * (€ -> $ factor)] +IMPORT TAXES
TotalPrice = MainPrice * (€ -> $ factor)
Special reworkings are required
NO
YES
Finish! This is the final price for the quotation
We need to add the reworking price
Reworked in Workshop
NO
YES
Ask price of reworking to external supplier
RWPrice = (Given from the Supplier) + PROFIT
RWPrice = (Given from the Workshop)
RWPriceAfterExchange= ReworkingPrice * (¥ -> $ factor)
FINAL PRICE = PriceAfterExchange&Taxes + RWPriceAfterExchange
Finish! This is the final price for the quotation

Chart 4: Activities for price calculation as regards Megaflex.

2.4. Good Flows

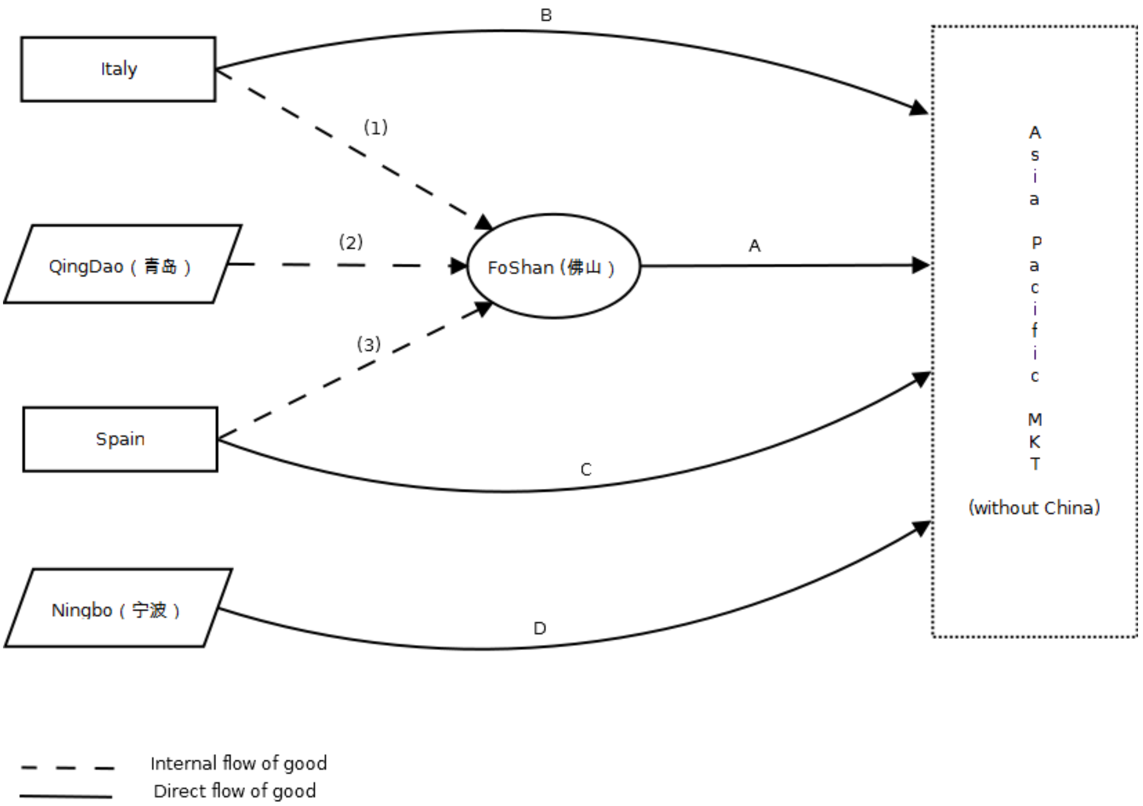


Chart 5: Good flows from plants to the Asia Pacific Market.

2.4.1. Details of Good Flows and Orders Execution

- Goods produced in Italy are directly delivered to the customer (B). Even when the quotation is from the Customer Service of Foshan, the order is processed by the Italian branch.
- Goods produced in Spain are also directly delivered to the customer (C). The quotation can be made by the Customer Service of FoShan but the order is processed by the Spanish branch.
- Goods produced at Ningbo are directly delivered to the customer (D). The customer is transferred to the Customer Service of Ningbo.
- When the goods are previously stocked in Foshan and then are delivered to the customer, as they are or after reworking (1A, 3A). Both quotation and order are processed in Foshan.

2.5. Price Lists and Price Calculation Procedures

The price calculation is based on two pricelists. The first one in Euros (€) while the second is in Yuan (¥). The € price list contains the prices of both PU and Rubber belts, while the ¥ price list is limited to the Rubber.

The choice of the price list depends on the flow followed by good **Chart 5**:

- € price list for A, B flows;
- ¥ price list for A, C.

3. Proposed Solution and Action Plan

The proposed solution was to design a Database Management System with MS Access, to be used to process quotations and orders and to store data for future analysis. The choice of Access was motivated by its availability in MS Office therefore not requiring any further investments. This implementation would automatize the processes of the customer service for the export department, so far mostly done manually. Objectives of change are (1) decrease the process time for handling quotations and orders (2) create a standard process to reduce mistakes. A further goal is to store previous data.

The previous DMS structure required many change to be introduced before starting the development of new applications.

One issue was about the pricelist of the MEGAFLEX family, which contained a huge quantity of items with a specific combination of width and length. But, as said before, belts are highly customizable so it is impossible to create a pricelist which includes all the products that can be ordered by customers.

The next step was to find, for each different pitch, a mathematical formula aimed at obtain the price as a function of the length and width. This change reduces the quantity of data stored in the server, and make possible for users to calculate the price automatically (just inserting length and width) with a reduction of time. Moreover, as the prices change continuously depending on several reasons (market trend, promotions etc.) with the formula it is enough just to change one coefficient, while it was a real long job to update the previous long pricelist.

The previous issue is also true for the coating applied on the back of some special belts. It is frequent that a customer requires a special coating on the back of the belts used, for example, in conveyor systems. The back coating can be made in rubber or silicon, in order to increase the grip. In this case as well, there is a pricelist which sets the prices for ranges of belt, dividing them by ranges of length per each different width. The solution is to define a price per square meter in order to eliminate the pricelist with ranges used so far, and to improve a simple pricelist with a price for each available material. Once the pricelist for single material is defined the formula is simply be the following:

where p is the price, l and w are respectively the length and the width in meters of the belt and c the cost of the coating material per square meter.

The following table summarises the details of the proposed actions.

Action	Goals	Advantages	How to do
Introduce MS Access application software	- Move from manual quotation to software-based - Save time, avoid mistakes, store data history	1) Automatic calculation of the final price for the quotation 2) Collect all the quotation in a database 3) Creation of new Item Code only when the quotation becomes an order	1) Analysis of the procedures currently manually handled by the users 2) Design the database and the User Interface 4) Connect Access to NAV 5) Beta-test period
Redefine the logic of the price list for MEGAFLEX	Line up the price list with the criteria of MEGALINEAR open-end	1) Reduction of the time for price definition 2) Reduction of data quantity 3) Easy change of price on increase	Define a price per linear meter for each pitch and width
Redefine the logic of the price list for back coatings (ex TENAX)	Have a simple table containing the prices for square centimetre for each thickness	1) Reduction in the time calculation of the price 2) Reduction of the quantity of the data 3) Easy change of price on increase	Define the prices for square centimetre for each thickness

Table 2: Main steps for the action plan

4. Structure of MS Access Application Software

As stressed in the previous paragraphs, the DMS should allow users an easier management of quotations and orders and provide analysis tools to the managers.

To achieve these objectives, the database must store all information about customers and their offers and orders and all the types of belts, their characteristics, and the possible combinations of belts' components.

The DMS was designed to be suitable for the price calculation procedure, another weakness of the system. To achieve this objective, the core idea is that this application should not require any Item Card to manage the quotations, and quotations are obtained by allowing users to freely "design" the belts. The users can compose the products which they need through a user friendly interface, by using data from the pricelists stored in the servers.

4.1. Main Tables and Relations

The DMS tables contain all the information about the customers and the related offers and orders. The following relations among the tables allow the system to make some comparisons between data, guarantee the integrity and accuracy information, allow users to create and edit the reports, and, above all, avoid data redundancy.

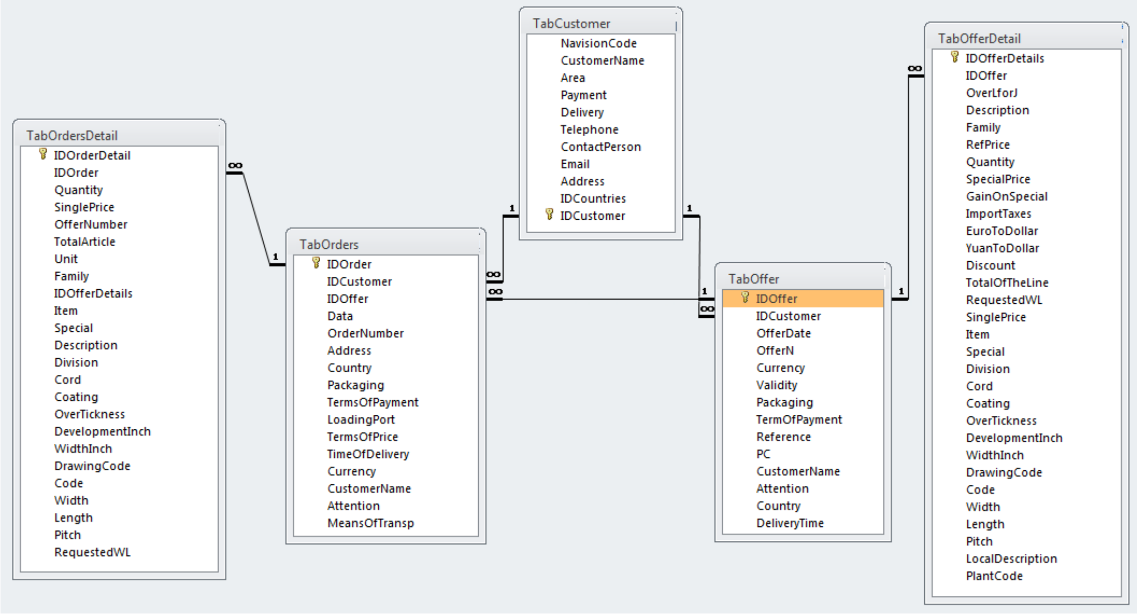


Fig. 8: Entities-relations chart

As mentioned above, one of the main objective is to reply to customer request and accept all the possible product combinations.

This required to define all the possible combinations the products can have, especially considering the technical and manufacturing limitations.

Some families of product, in fact, cannot be produced with certain pitches and some cords are not suitable for some pitches. Thus, it is necessary to create some relations among each other. These relations help users avoiding mistakes during the creation of orders and offers.

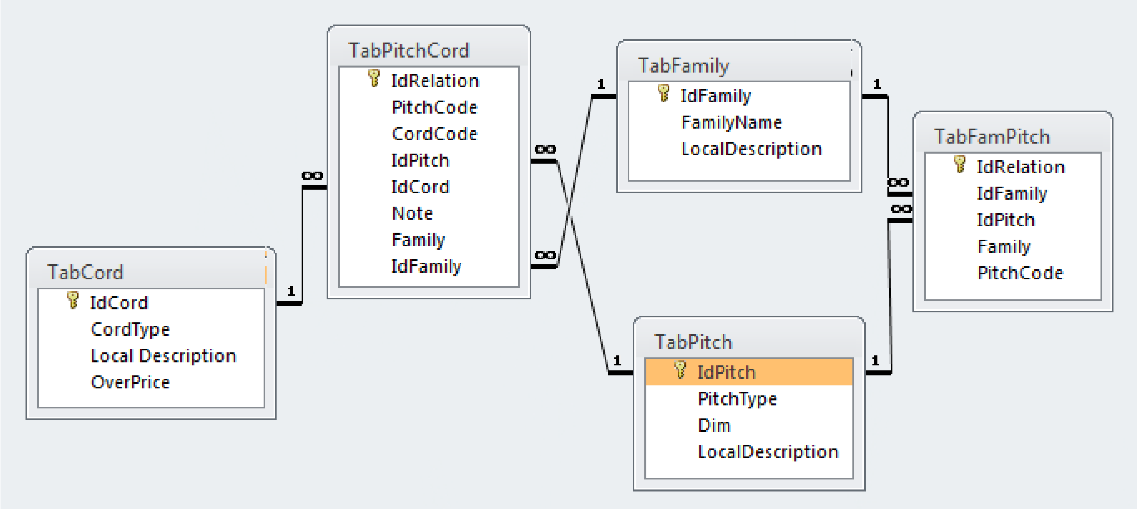


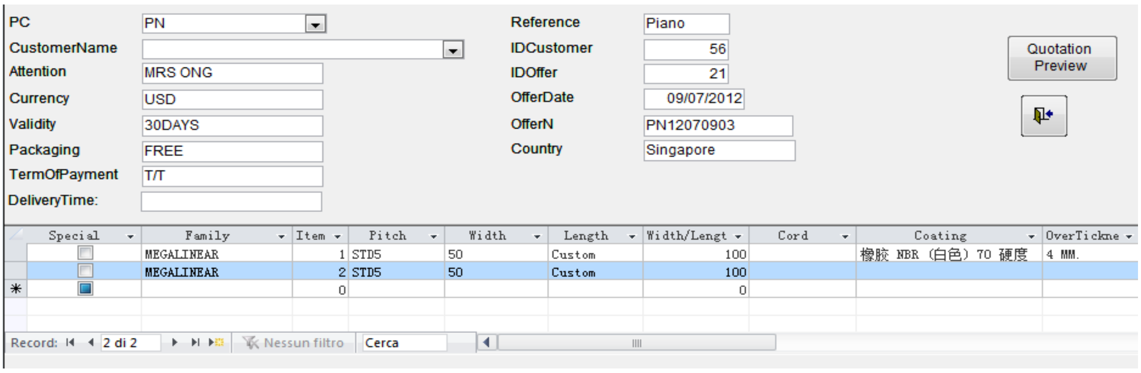
Fig. 9: Entities-relations chart

4.2. User Interface

The main objective of the user interface is to provide the users with (1) a simple way of filling the tables and (2) a tool which automatically access the price lists to autonomously calculate the quotations. With this interface it is possible to create the offer choosing the customers and filling it with the desired products. Most of the fields can be filled with a "combo-box". Moreover, thanks to VB programming language it is possible to help the user with price calculations and to prevent human errors.

4.2.1. Offers Interface

Interface for offers allows the users to fill in the table with information about quotations and their details.



PC	PN	Reference	Piano
CustomerName		IDCustomer	56
Attention	MRS ONG	IDOffer	21
Currency	USD	OfferDate	09/07/2012
Validity	30DAYS	OfferN	PN12070903
Packaging	FREE	Country	Singapore
TermOfPayment	T/T		
DeliveryTime:			

Special	Family	Item	Pitch	Width	Length	Width/Lengt	Cord	Coating	OverTickne
□	MEGALINEAR	1	STD5	50	Custom	100		橡胶 NBR (白色) 70 硬度	4 MM.
□	MEGALINEAR	2	STD5	50	Custom	100			
■		0				0			

Fig. 10: Screenshot of an example of offer interface

The main mask contains the general information regarding the offer, such as customer, date, number, etc. While the sub-mask function is to fill the table containing the details, such as products, prices, discounts etc. Most of the fields of the main mask are filled automatically and a univocal offer number is created with the following code:

```
Private Sub CustomerName_AfterUpdate()

Me.IDCustomer = Me.CustomerName.Column(1)
Me.Country = Me.CustomerName.Column(2)
If Me.OfferN <> 0 Then Exit Sub
If Me.PC <> "" Then
     Dim PersonalCode As String, NewCod As String, OldCod As String,
CodPiu As Byte, Giorno As Date
     Me.OfferDate = Date
     PersonalCode = Me.PersonalCode
     CodPiu = DCount("OfferN", "TabOffer", "OfferDate=#" & Date & "#")
     OldCod = Right("0" & CodPiu, 2)
     NewCod = PersonalCode & Format(Date, "yymmdd") & OldCod
     Me.OfferN = NewCod
Else
     MsgBox ("Please choose the reference code.")
End If

End Sub
```

All the fields in the records for details are combo-boxes with a relation between each other in order to filter the possible choices step by step. As an example, the following are respectively the SQL and VBA codes related to the combo-box for choosing the pitch type. Based on a query, it shows only the pitch types available for the chosen family of belts.

```
SELECT TabPitch.LocalDescription, TabPitch.IdPitch, TabPitch.Dim,
TabPitch.PitchType, TabFamPitch.Family, *
FROM TabPitch INNER JOIN TabFamPitch ON TabPitch.IdPitch =
TabFamPitch.IdPitch
WHERE (((TabFamPitch.Family)=FamilyParameter()));
```

The parameter `FamilyParameter()`, which is given as input data to the query, is filled by the following public function:

```
Public FamParam As String

Public Function FamilyParameter() As String
    FamilyParameter = FamParam
End Function
```

To reduce users' mistake, several lines of code have been written. These functions run while the user fill the field and if the check is not successful the user cannot move on proceeding quotation until the mistake is corrected. Examples of check functions are about the chosen width (1) or the number of teeth (2). In fact, what can happen is that a user inserts a width which is not possible to be produced for that kind of belt. A further error can be about the number of teeth in a belt. In fact, a user can insert a length for a belt which is not multiple of the pitch, while the number of teeth in one belt must be an integer.

```
(1)
[...]
If Width > Me.Length.Column(4) Then
    MsgBox ("The width cannot be more then " & Me.Length.Column(4) & "
mm")
    Me.RequestedWL = ""
    Exit Sub
End If
(2)
[...]
If Me.Family = "Megalinear" Or Me.Family = "Joined" Or Me.Family =
"ISORAN LL" Then
    Dim IsMultiple As Double

    Lunghezza = Me.RequestedWL
    IsMultiple = Lunghezza * 1000 / (Me.Pitch.Column(2))
    If Int(IsMultiple) <> IsMultiple Then
    MsgBox ("The length must be a multiple of " & (Me.Pitch.Column(2)_
/1000))
    Me.RequestedWL = ""
    Me.RequestedWL.SetFocus
    Exit Sub
End If
```

Finally the calculation of the final price is automatically computed taking in account all the options chosen by the user, such as discounts percentage, special reworking etc..

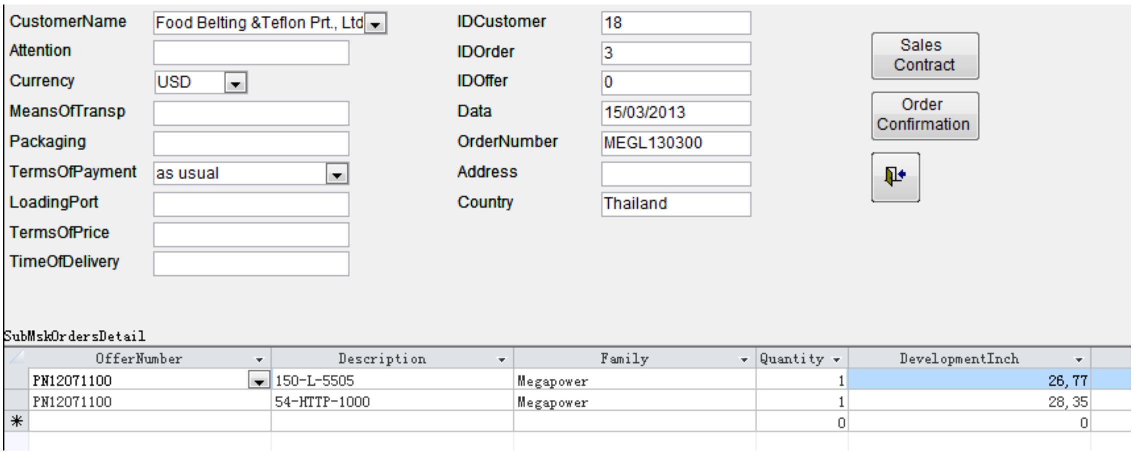
```
Private Sub SinglePrice_GotFocus()

Dim RefPrice As Single, RqstL As Single, Spcl As Single, Gain As Single, Discount As Single, CoatOverPrice As Single
If Me.Family = "Joined" Then
    RqstL = Me.RequestedWL + Me.OverLforJ
    ElseIf Me.Family <> "megaflex" Then
    RqstL = Me.RequestedWL
End If
If Me.RefPrice <> 0 Then
    RefPrice = Me.RefPrice
End If
Spcl = Me.SpecialPrice
Gain = Me.GainOnSpecial
Discount = Me.Discount
If Me.Coating.Column(3) <> "" And Spcl = 0 Then
    CoatOverPrice = Me.Coating.Column(3)
End If
If Me.Family = "megaflex" Then
    Me.SinglePrice = Round((RefPrice * (1 - Discount) * (1 +
    CordOverPrice) * (1 + CoatOverPrice) * (1 + Me.ImportTaxes)) *
    Me.EuroToDollar + (Spcl * (1 + Gain)) * Me.YuanToDollar, 2)
ElseIf Me.Family = "megalinear" Or Me.Family = "Joined" Or Me.Family =
"ISORAN LL" Then
    Me.SinglePrice = Round((RefPrice * RqstL / 1000 * (1 - Discount) *
    (1 + CordOverPrice) * (1 + CoatOverPrice) * (1 + Me.ImportTaxes))
    * Me.EuroToDollar + (Spcl * (1 + Gain)) * Me.YuanToDollar, 2)
Else
    Me.SinglePrice = Round((RefPrice * RqstL * (1 - Discount) * (1 +
    CordOverPrice) * (1 + CoatOverPrice) * (1 + Me.ImportTaxes)) *
    Me.EuroToDollar + (Spcl * (1 + Gain)) * Me.YuanToDollar, 2)
End If
End Sub
```

If we look at the upper right corner of the offer interface (**Fig.10**) we find a button labeled *"Quotation preview"*. It is an active button which allows users to open the current quotation in a form ready to be printed and delivered to the customer in paper or PDF formats.

4.2.2. Orders Interface

Interface for orders is quite similar to the previous one. The following screenshot is an example.



CustomerName	Food Belting &Teflon Prt., Ltd	IDCustomer	18
Attention		IDOrder	3
Currency	USD	IDOffer	0
MeansOfTransp		Data	15/03/2013
Packaging		OrderNumber	MEGL130300
TermsOfPayment	as usual	Address	
LoadingPort		Country	Thailand
TermsOfPrice			
TimeOfDelivery			

SubMskOrdersDetail

	OfferNumber	Description	Family	Quantity	DevelopmentInch
	PN12071100	150-L-5505	Megapower	1	26, 77
	PN12071100	54-HTTP-1000	Megapower	1	28, 35
✱				0	0

Fig. 11: Screenshot of an example of order interface

The main feature of this interface is that it allows the users to make an order choosing the records from an offer which has been previously made. After choosing the offer number from the first combo-box ("OfferNumber" **Fig.11**), in the field labeled *"description"* will appear only the records related to the specific quotation, in this way just the articles of that quotation will be shown. That is possible thanks to the relations between tables (paragraph 4.1) and to some SQL and VBA code. Basically, when the field *"offer number"* gets focus some VBA code starts to run and creates the parameters for the query in SQL which will show to the user all the quotation numbers of offers made in the past to the current customer.

In order to filter the data in the sub mask according to the data in the main mask there is a public function which takes the *"IDcustomer"* as input parameter.

```
Private Sub CustomerName_AfterUpdate()

Me.Address = CustomerName.Column(2)
Me.Country = CustomerName.Column(3)
Me.IDCustomer = CustomerName.Column(1)
CustParam = Me.CustomerName.Column(1)

[...]
```

This parameter, then , will be used as input parameter by the SQL code in order to filter the offer number (4).

```
SELECT TabOffer.OfferN, TabOfferDetail.IDOffer, TabOffer.IDCustomer
FROM TabOffer INNER JOIN TabOfferDetail ON TabOffer.IDOffer =
TabOfferDetail.IDOffer
GROUP BY TabOffer.OfferN, TabOfferDetail.IDOffer, TabOffer.IDCustomer
HAVING (((TabOffer.IDCustomer)=ChosenCustomer()))
ORDER BY TabOffer.OfferN;
```

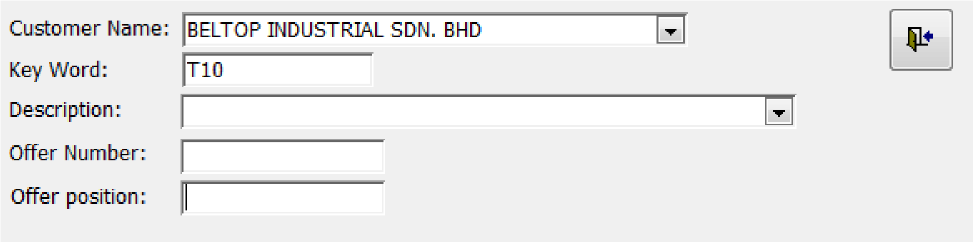
Moreover, as the table of the quotations collects all the information about products, prices, etc. it is possible to automatically fill all the other fields after choosing the article by the *"Description"*.

```
Private Sub Description_AfterUpdate()
    Me.SinglePrice = Round(Me.Description.Column(5), 2)
    Me.Quantity = Me.Description.Column(3)
    Me.TotalArticle = Round(Me.Description.Column(4), 2)
    Me.Family = Me.Description.Column(2)
    Me.Special = Me.Description.Column(6)
    Me.Division = Me.Description.Column(7)
    Me.Cord = Me.Description.Column(8)
    Me.Coating = Me.Description.Column(9)
    Me.OverTickness = Me.Description.Column(10)
    Me.DevelopmentInch = Round(Me.Description.Column(11), 2)
    Me.WidthInch = Round(Me.Description.Column(12), 2)
    Me.DrawingCode = Me.Description.Column(13)
End Sub
```

Finally in this interface, as well as for the offers interface, there are two button which allows to create the *sales contract* and *order confirmation* to be sent to the customer (**Fig.11)**.

4.2.3. Searching Interface

A further useful characteristic of a DMS is to allow users to edit data previously inserted. This can be very important for a user to search a quotation made in the past in order to print a further copy, edit the content or just to make some checks. For this reason a special interface has been designed to allow users to find quickly the position of the offer in the database and open it.



Customer Name: BELTOP INDUSTRIAL SDN. BHD

Key Word: T10

Description:

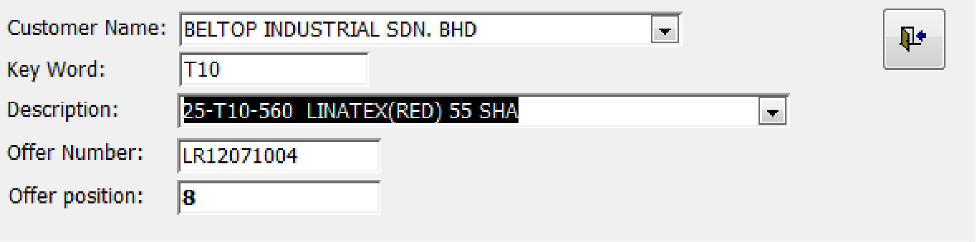
Offer Number:

Offer position:

Fig. 12: Form for offer searching

The searching method is based on two parameters. The user has to choose the customer from the list labeled *"Customer Name"* and to insert a short string in the field *"Key Word"*, this short string should be a group of characters contained in the description of the product. For an input as in the following **Fig.13**, a function will search all the offers made to BELTOP INDUSTRIAL SDN. BHD, and in the list *"Description"* will show only the descriptions which contain a belt with pitch T10. If the user does not have any key word for the searching, the field *"Key Word"* can be left blank and the list *"Description"* will contain all descriptions of the offers made to the chosen customer.

After choosing the description of the product the offer number and position in the database will be automatically displayed.



Customer Name: BELTOP INDUSTRIAL SDN. BHD

Key Word: T10

Description: 25-T10-560 LINATEX(RED) 55 SHA

Offer Number: LR12071004

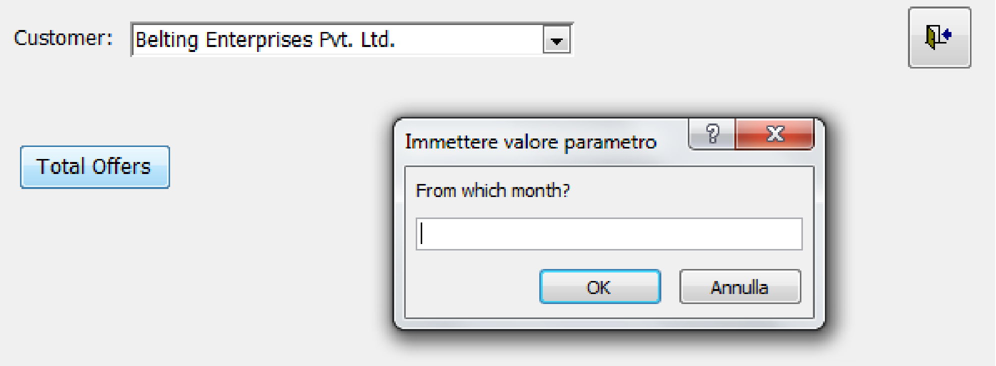
Offer position: 8

Fig. 13: *Example form for offer searching*

After the user gets the position of the offer, it is enough to type it in the lower part of the offers form to directly open that quotations.

4.2.4. Reports interface

The main goal of a database is to collect data to do analyze them and take decisions. A special interface allow managers to get more detailed information of a specific customer over a period of time.

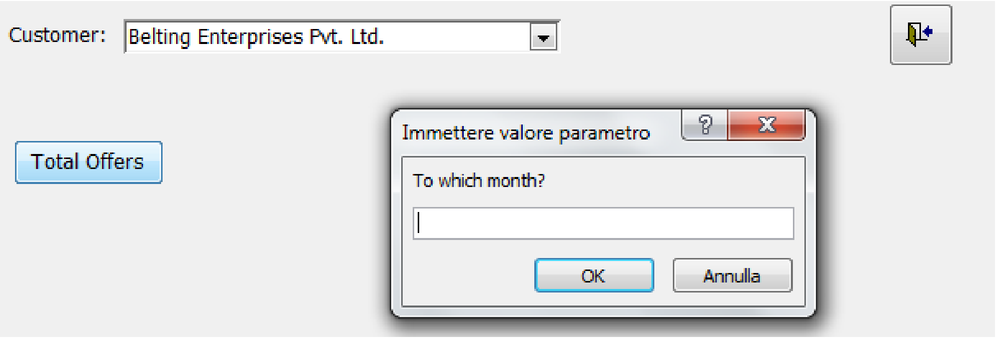


Customer: Belting Enterprises Pvt. Ltd.

Immettere valore parametro

From which month?

Fig. 14: Form for report with the input window

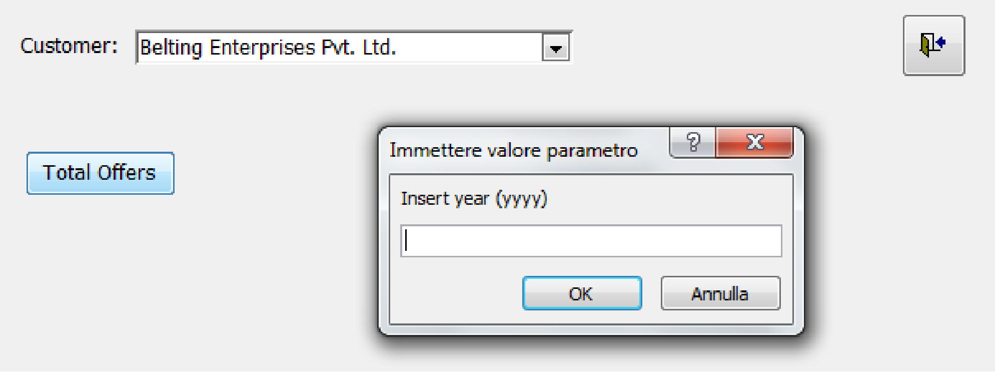


Customer: Belting Enterprises Pvt. Ltd.

Immettere valore parametro

To which month?

Fig. 15: Form for report with the input window



Customer: Belting Enterprises Pvt. Ltd.

Immettere valore parametro

Insert year (yyyy)

Fig. 16: Form for report with the input window

The output of this command is a table which contains all the important information about the customer, such as number of offers, number of orders and so on. Then, it is possible to export that table in MS Excel format to make all the analysis. By leaving blank the field *"Customer"* the query displays all the quotations made within the chosen period.

4.2.5. Update Dashboard

It is common that the company inserts a new product in the catalogue, or that a new material is adopted for coating, and it is also common to have new customers etc.. Thus, an efficient database requires update procedures for all the tables. The following screenshot is a dashboard to open various interfaces. Through these forms, the user can update the related tables; an example is given by the interface in **Fig.18.**

.

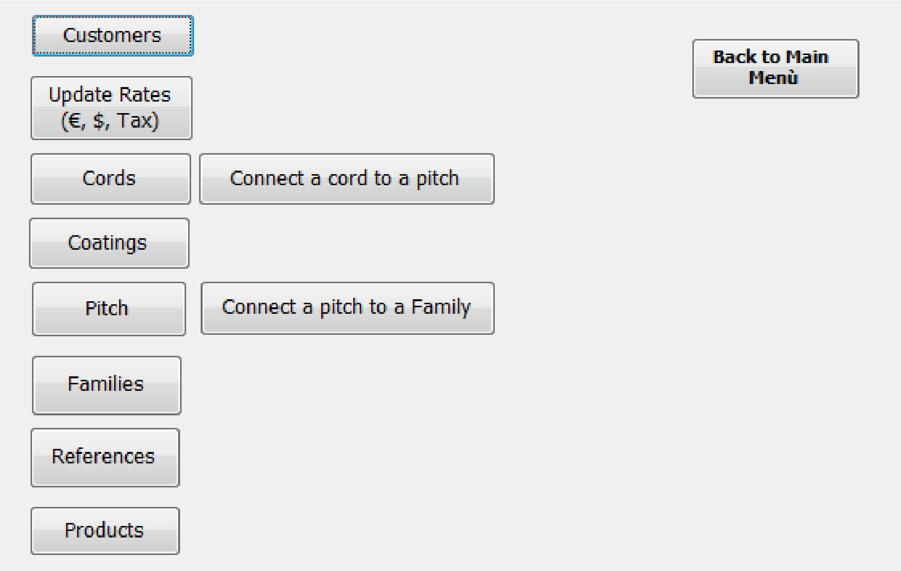
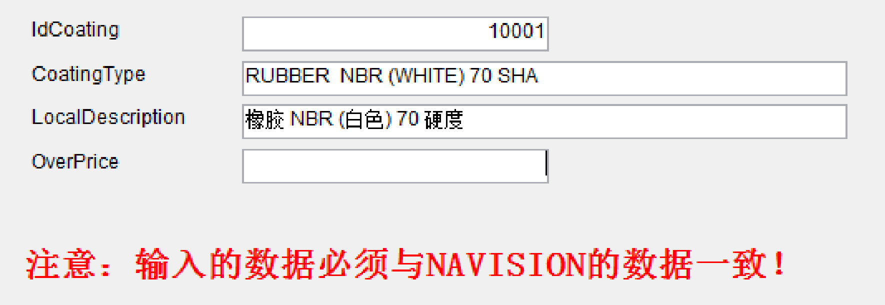


Fig. 17: Buttons dashboard to open various interfaces.



IdCoating	10001
CoatingType	RUBBER NBR (WHITE) 70 SHA
LocalDescription	橡胶 NBR (白色) 70 硬度
OverPrice	

注意：输入的数据必须与NAVISION的数据一致！

Fig. 18: Interface example for adding a new coating type.

(The notice in Chinese is an alert for the users to remaind them that the data inserted in this form must match the ones in Navision.)

4.3. Orders Flow from the DMS to NAV

Once the quotation has been accepted by the customer, as shown before, it is very easy to create the order with the DMS. The order must be processed with NAV, to manage all the related operations about administration, warehouse and production. The solution found to save time and avoid users from inserting twice the data (in the DMS and in NAV) is to export data as SQL tables from the DMS to NAV.

The fundamental aspect to make this operation possible is that the information which identify products and customers must have the same format and contents in both systems. To guarantee this, some guidelines have been adopted: before updating the DMS with new products or customers or any other information, the data must be created in NAV by the IT manager and then inserted in the DMS with the exactly the same description, code etc.

Another important aspect to be taken into account is the creation of new products. As mentioned in the previous paragraphs, a product is univocally identified by a code and a description. Furthermore, the main goal of the DMS is to avoid waste of time and memory caused by creating new products in NAV which will be not sold. To solve this aspect the description created by the DMS while the user makes a new quotation has exactly the same structure required by the NAV system. The item code is created as well according with NAV requirements, but only the first 8 digits of the total 12 are filled, the last 4 (the random part) is created by NAV while importing the SQL table.

This two bits of information, description and the 8 digits of the code, are enough to identify univocally a product in NAV. While importing the SQL table, NAV runs some code to check if a product already exist in the server, if not, it takes all the information from the DMS and adds the 4 missing digits to the item code creating the new product, then it inserts the order in the System.

4.4. Database Division and Data Sharing

The option of multiuser-access to data is one of the most important feature that a database must have. It means that different clients should be able to access and edit data in the server concurrently, and there must be only one collector for the data inserted by all the users. This requires to split the DMS into two parts, tables and user interface. The tables have been stored in the main server and a user interface has been installed on each computer of the export department and also on the laptops. It is in fact possible also for laptops to connect to the server through the Wi-Fi network. A further important advantage of this structure is that in case there is a need to change some features of the interface, insert new functions or new code, it is possible, once the new interface is ready, to update the software without any setup time and without moving or changing the tables.

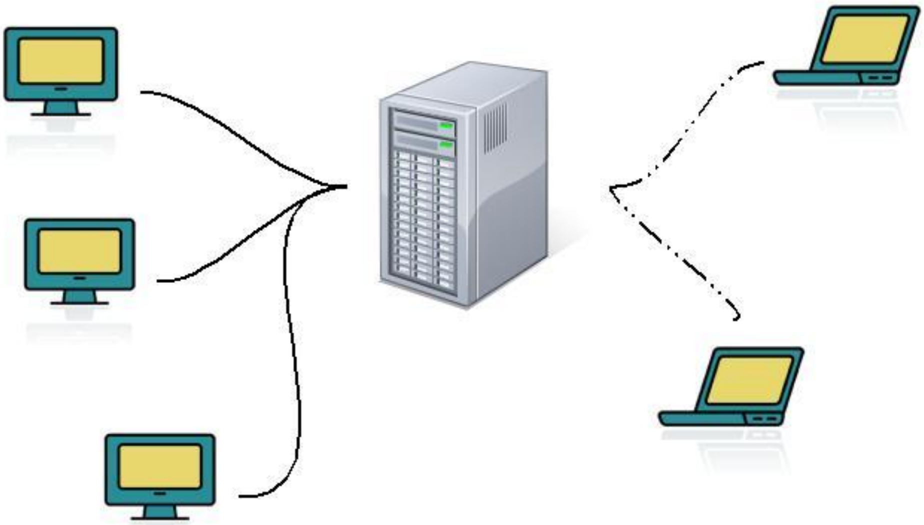


Fig. 19: Network structure of frontend and backend endpoints

5. Situation after Changes

After the DMS was finished, a one-month beta-test period has been done in order to find out any weak points, mistakes, or further required functionalities. During this period the users took notes about all the improvements to be done and later they were discussed and applied when possible.

Once the beta-test period came to end and the DMS was approved, each component of the export department had his interface and the tables were stored in the server and ensured with a password, in this way other department cannot access data.

Furthermore, just the sales manager was provided with an interface which allows them to get sales reports in a moment, and he can access the server with his laptop through the internet.

The main advantage is that, as we can see from the following table, now the quotations and the order confirmations are stored in the database, creating a data history which is very useful to make analysis and comparisons.

Activity	Documents	Received/sent through	Software	Modality of processing	Modality of collecting
Inquiry receiving		1) e-mail 2) Skype 3) msn			1) Fox mail 2) nothing 3) nothing
Inquiry evaluation				Check Feasibility Tables	
Quotation	Offer	e-mail	MS Access	Automatically calculated	**Database**
Order receiving	Purchasing order	1) FAX 2) e-mail			
Order confirmation	Sales Contract Pro-forma invoice	1) FAX 2) e-mail	MS Access	Automatically made and printed	**- Database** - Collector
Invoice	Invoice	e-mail	NAV	Automatically made and printed	- NAV - Collector
Payment receiving			MS Excel	Record the details	
Order processing			NAV	Input the order in NAV	
Delivery	Invoice Packing list Sales contract Custom declare paper				Delivered with the good

Table 3: Description of the activities of customer service after changes

The DMS, moreover, allowed to have a standard method for all the department and mistakes decreased almost to 0%. This is also due to the controls put in the combo-boxes which not allow users to make quotation for unfeasible products. The automatic formula for price calculation is a useful tool, as well, to decrease mistakes.

The process time reduced as well thanks to the fields automatically filled by the code and because all the calculations are made by the computer and not manually.

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Acknowledgment

At the beginning, I would like to record my gratitude to Dr. Dorella Montanari who gave me the chance of taking this internship, and above all for the extraordinary experiences and the knowledge she passed me about the internal dynamics of companies and about the Chinese culture and history. She triggered and nourished my intellectual maturity that I will benefit from, for a long time to come.

I gratefully acknowledge Ing. Valerio Diglio for his advice and supervision during the analysis period. His guide and wide competences in companies management, along with his technical support, were the keys for the success of this project. Furthermore, he gave me strong basis about project management which became part of my background enriching me a lot.

I am very grateful also to my uncle, Ing. Gianpaolo Aganetti, for his priceless contribution during the development of the application system. His crucial suggestions and high competences on programming and database structure were fundamental for saving time during the development and for the high level of the structure and functions which had been implemented.

A big thank is for my university tutor, Prof. Monica Reggiani, the passion and the high preparation she puts in her job and the humility she has with other people were for me an important life's lesson.

My parents, without them I could be nowhere! They deserve a special thank for believing in me and supporting always my decisions, even from far away. My father, Tiziano, at first is the person who thought me that only through effort and honesty I can realize my dreams and achieve my goals. My Mother, Simonetta, is the one who sincerely raised me with her caring and love.

By living, I am daily experiencing that all of them thoughts were true.

My brother Marco, thanks for expressing your admiration and enthusiasm on my decisions, you push me to be better and better every day.