Performance Measurement System

Final Workgroup

Master in Data Science 2018

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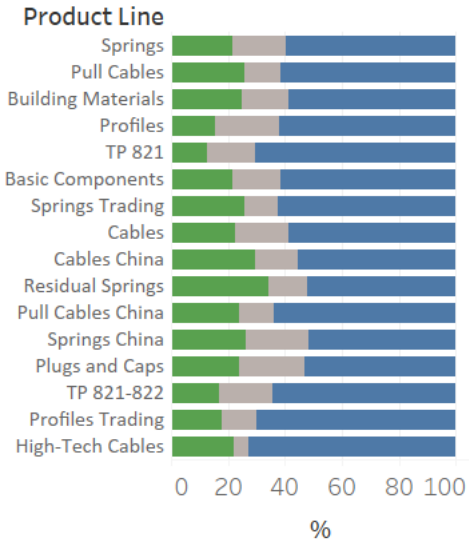
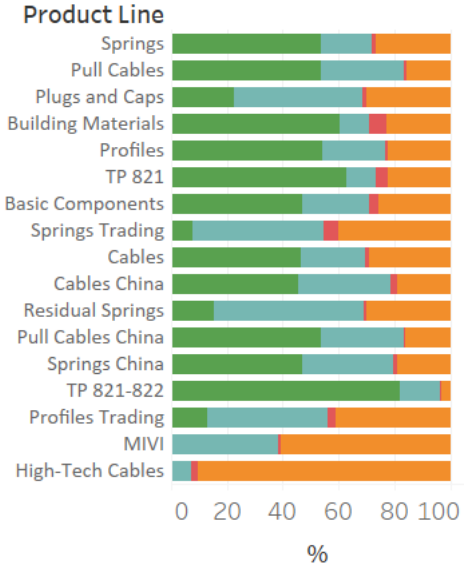
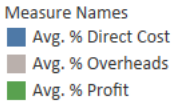
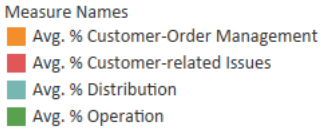
Exploratory Data Analysis









We can see that **Residual Springs** is the most **profitable** product line. There is one unprofitable product (plugs and Caps

We can see that some products has low operation costs. This means probably that that line are mainly related to **trading**

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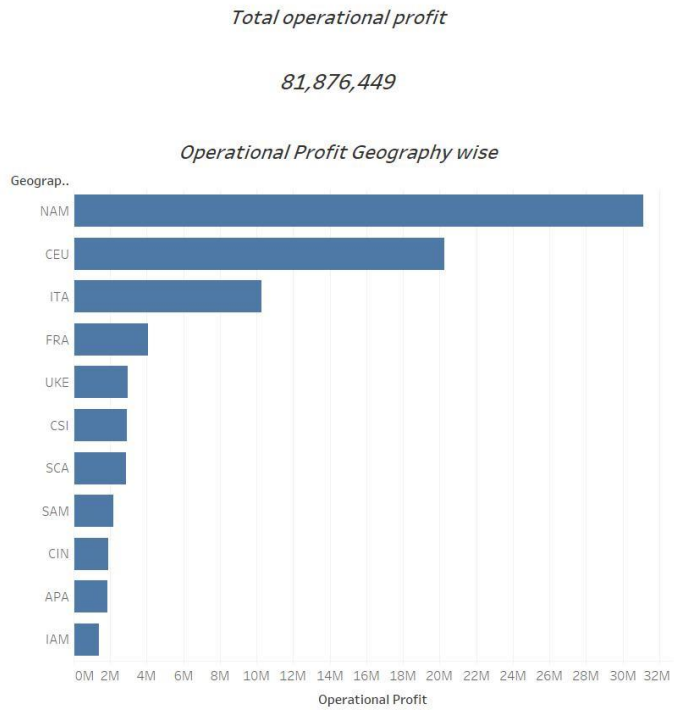
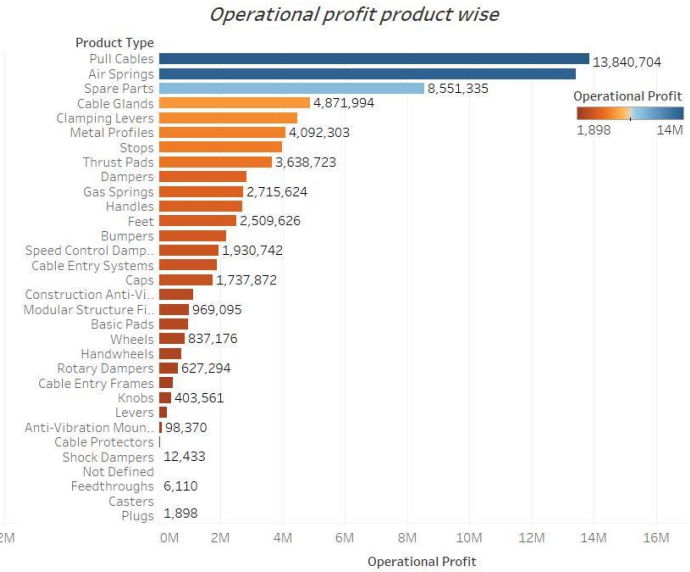
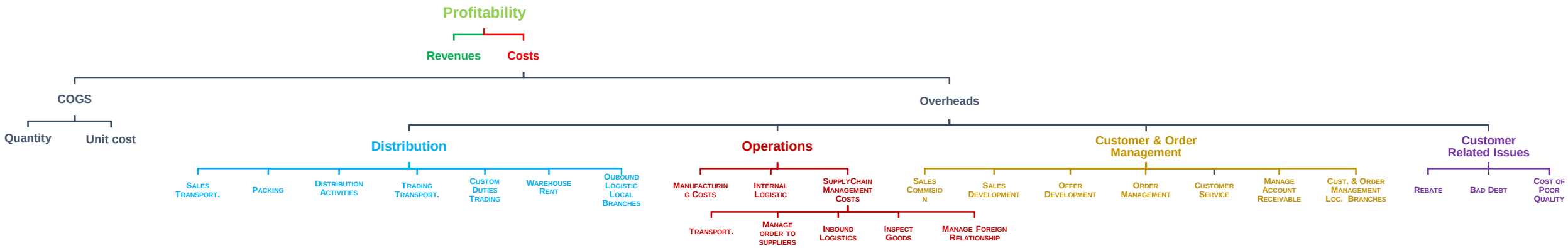


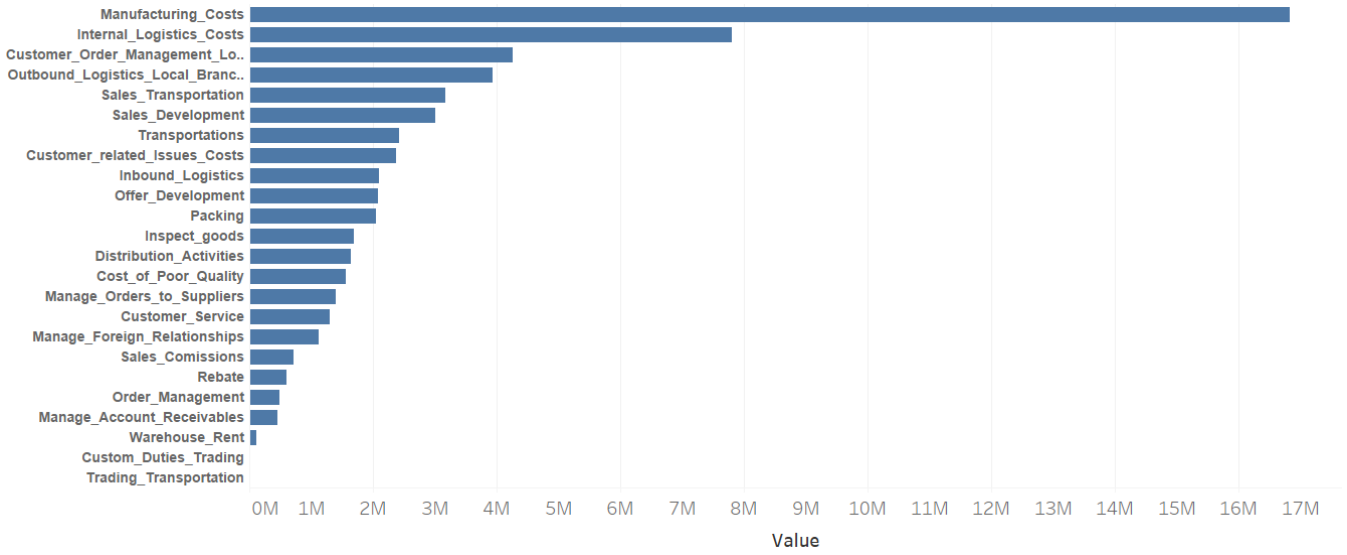


Total operational profit

81,876,449

Business Model (Cost Prospective)





This is the **decomposition** of the cost accounting method of the company.
In the following slides we try to find cost drivers for each activity through **multiple linear regressions**.
Our approach to identify relations between cost drivers and activities is to consider just the activities that have an **impact** on the **total overheads**. In each regression we consider as dependent variable an activity and as regressors all the possible **cost drivers** (N°Parts, Assembly Labor Minutes, Machinery Minutes, Number of Deliveries, Average Delivery Batch Size units) with some **control variables** categorized (Plant, Product Line, Turnover Range and Customer Class)

Regressions on Cost Drivers.R

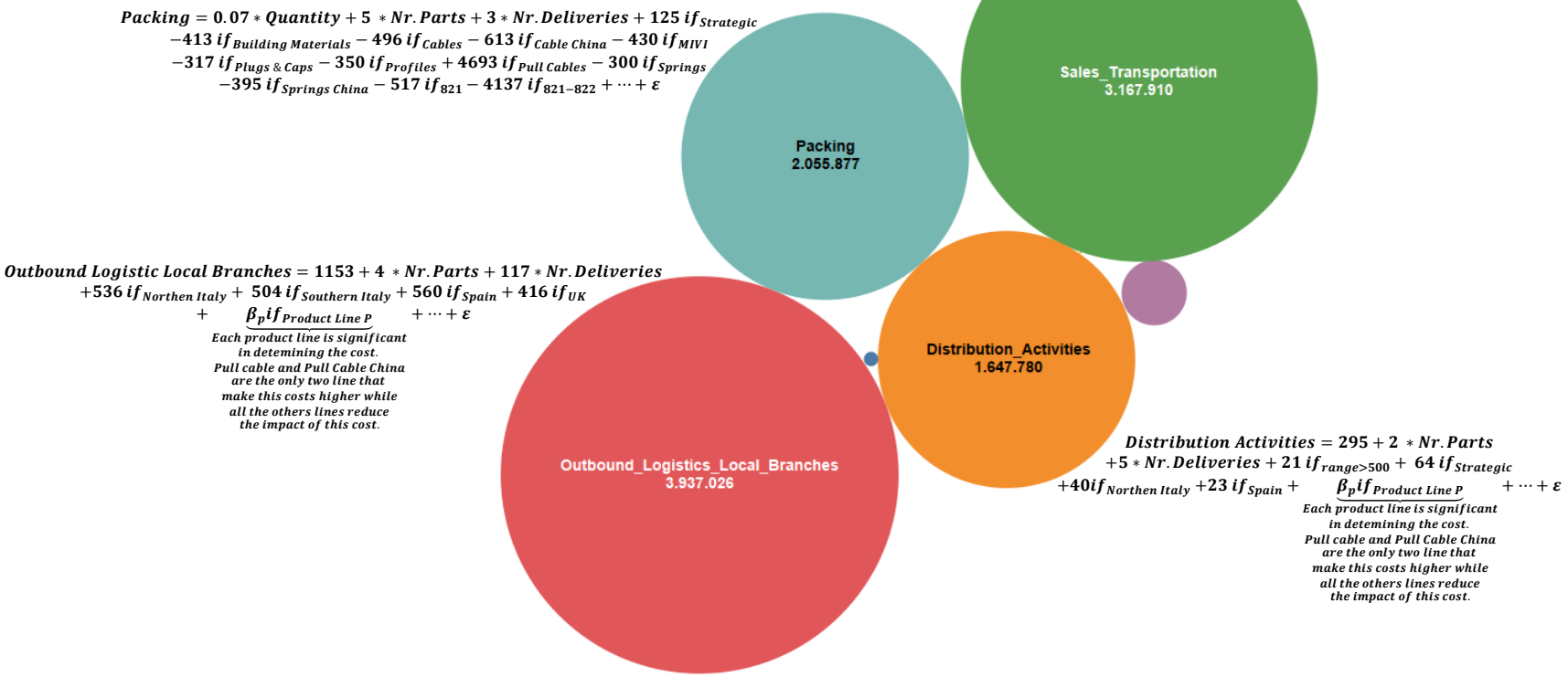
Total Cost of Distribution

$$Sales\ Transportation = 12 * Nr.Parts + 43 * Nr.Deliveries + 1094\ if_{Cable\ China} + 16430\ if_{Pull\ Cable} + 831\ if_{Springs\ trading} + 7907 if_{821-822} + \cdots + \varepsilon$$

$$Packing = 0.07 * Quantity + 5 * Nr.Parts + 3 * Nr.Deliveries + 125\ if_{Strategic} - 413\ if_{Building\ Materials} - 496\ if_{Cables} - 613\ if_{Cable\ China} - 430\ if_{MIVI} - 317\ if_{Plugs\ \&\ Caps} - 350\ if_{Profiles} + 4693\ if_{Pull\ Cables} - 300\ if_{Springs} - 395\ if_{Springs\ China} - 517\ if_{821} - 4137\ if_{821-822} + \cdots + \varepsilon$$

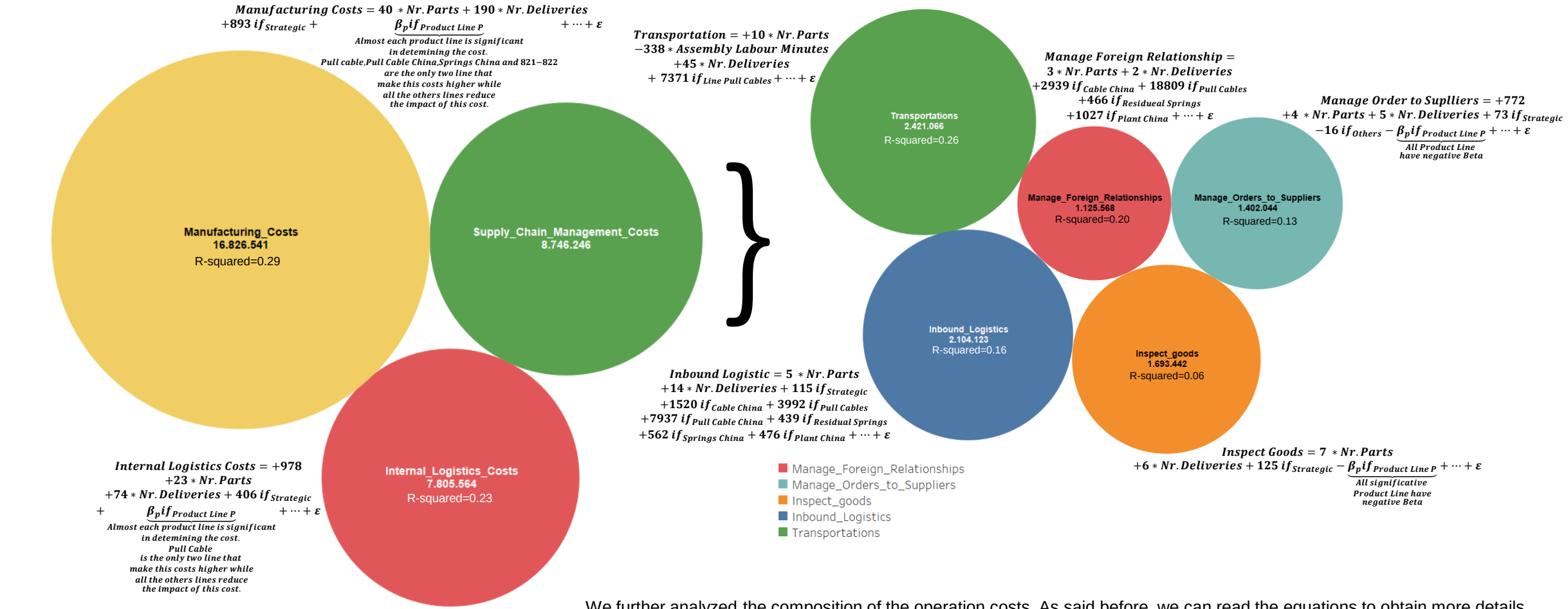
$$Outbound\ Logistic\ Local\ Branches = 1153 + 4 * Nr.Parts + 117 * Nr.Deliveries + 536\ if_{Northen\ Italy} + 504\ if_{Southern\ Italy} + 560\ if_{Spain} + 416\ if_{UK} + \underbrace{\beta_p if_{Product\ Line\ P}}_{\substack{Each\ product\ line\ is\ significant\ in\ detemining\ the\ cost.\ Pull\ cable\ and\ Pull\ Cable\ China\ are\ the\ only\ two\ line\ that\ make\ this\ costs\ higher\ while\ all\ the\ others\ lines\ reduce\ the\ impact\ of\ this\ cost.}} + \cdots + \varepsilon$$

$$Distribution\ Activities = 295 + 2 * Nr.Parts + 5 * Nr.Deliveries + 21\ if_{range>500} + 64\ if_{Strategic} + 40 if_{Northen\ Italy} + 23\ if_{Spain} + \underbrace{\beta_p if_{Product\ Line\ P}}_{\substack{Each\ product\ line\ is\ significant\ in\ detemining\ the\ cost.\ Pull\ cable\ and\ Pull\ Cable\ China\ are\ the\ only\ two\ line\ that\ make\ this\ costs\ higher\ while\ all\ the\ others\ lines\ reduce\ the\ impact\ of\ this\ cost.}} + \cdots + \varepsilon$$



Each circle represents a cost and, with each of them, we reported an equation that highlights the best drivers and their regression's coefficients. The latter show the impact of every regressor over the variability of the related costs. Every regression model is also represented with the R-squared which is an indicator of how much of the variability of the cost is explained by its relation with all the cost drivers included as regressors. In the next slides we are showing as we did the same thing going into details drilling down to activities costs.

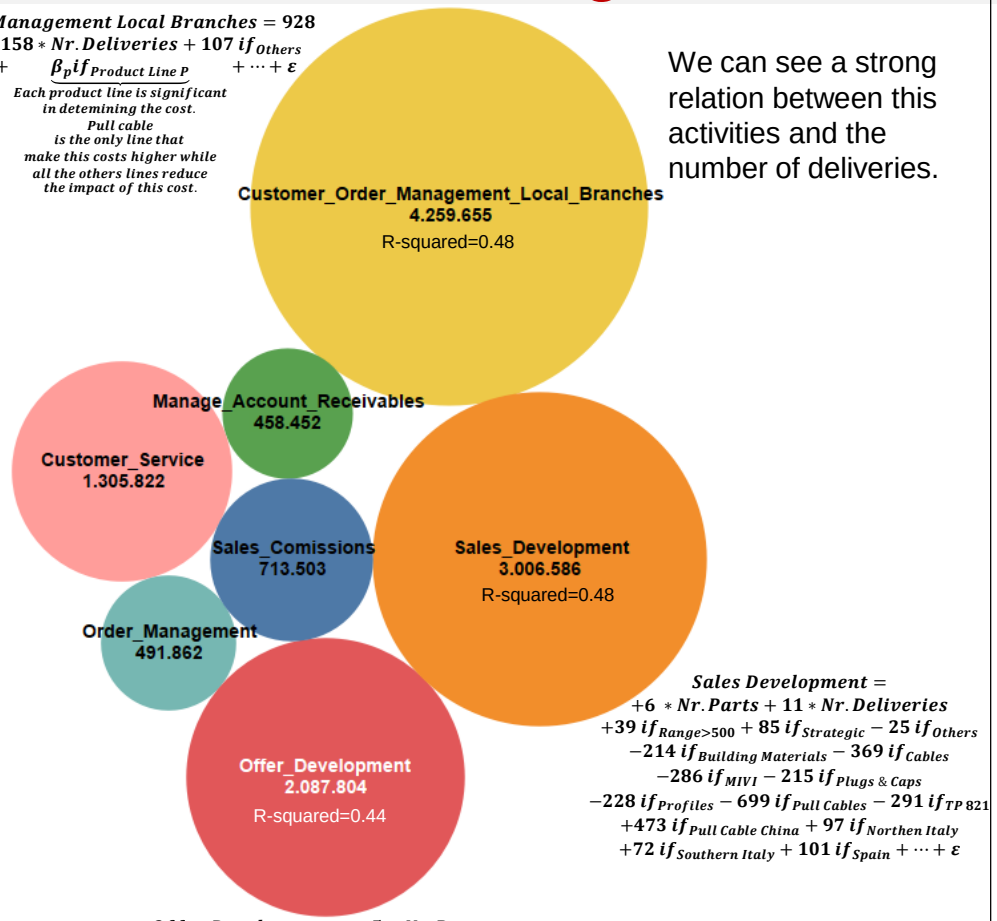
Operations



We further analyzed the composition of the operation costs. As said before, we can read the equations to obtain more details on how cost drivers contribute in explaining the variability of each activity cost. This set is composed by the best regression models that we could have found and unfortunately none of the R-squared in here is higher than 29%. We're putting a table at the end of the presentation to help with the comparison and final assumption.

Customer & Order Management

$$Customer\ Order\ Management\ Local\ Branches = 928 + 4 * Nr.Parts + 158 * Nr.Deliveries + 107\ if_{Others} + 367\ if_{Plant\ USA} + \underbrace{\beta_p if_{Product\ Line\ P}}_{\substack{\text{Each product line is significant in detemining the cost.}\\ \text{Pull cable is the only line that make this costs higher while all the others lines reduce the impact of this cost.}}} + \cdots + \varepsilon$$



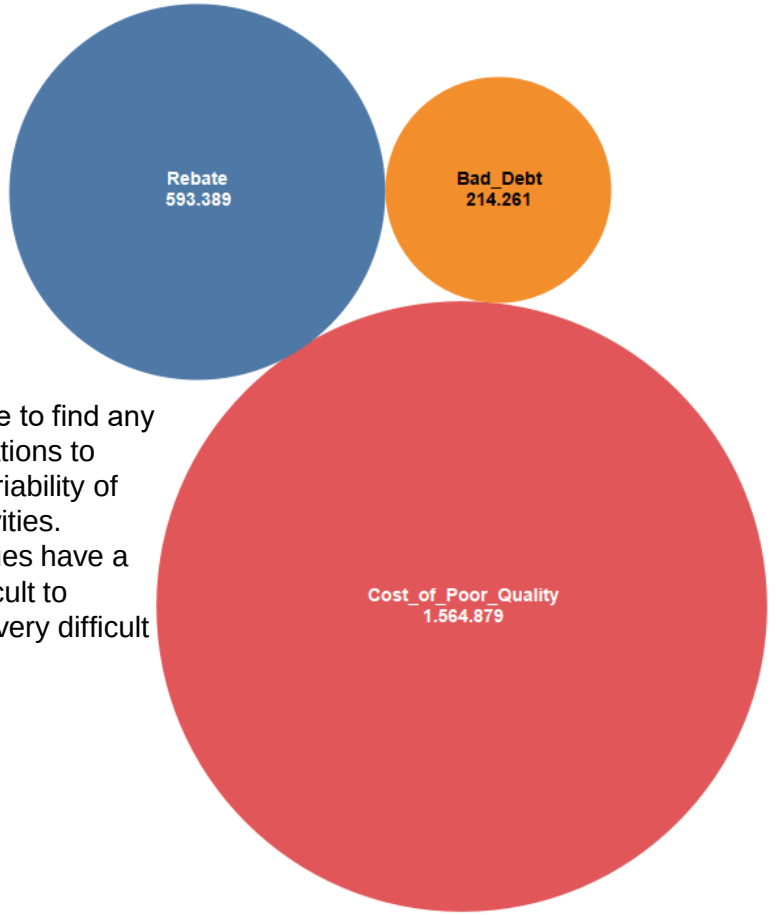
We can see a strong relation between this activities and the number of deliveries.

$$Sales\ Development = +6 * Nr.Parts + 11 * Nr.Deliveries + 39\ if_{Range>500} + 85\ if_{Strategic} - 25\ if_{Others} - 214\ if_{Building\ Materials} - 369\ if_{Cables} - 286\ if_{MIVI} - 215\ if_{Plugs\ \&\ Caps} - 228\ if_{Profiles} - 699\ if_{Pull\ Cables} - 291\ if_{TP\ 821} + 473\ if_{Pull\ Cable\ China} + 97\ if_{Northen\ Italy} + 72\ if_{Southern\ Italy} + 101\ if_{Spain} + \cdots + \varepsilon$$

$$Offer\ Development = +5 * Nr.Parts + 3 * Nr.Deliveries - 210\ if_{Building\ Materials} - 378\ if_{Cables} - 496\ if_{MIVI} - 233\ if_{Plugs\ \&\ Caps} - 304\ if_{Profiles} + 2315\ if_{Pull\ Cables} - 198\ if_{Residual\ Springs} - 243\ if_{Springs} - 257\ if_{Springs\ China} + 812\ if_{TP\ 821-822} + \cdots + \varepsilon$$

- Sales_Comissions
- Sales_Development
- Offer_Development
- Order_Management
- Customer_Service
- Manage_Account_Receivables
- Customer_Order_Management_Local_Branches

Customer Related Issues



We wasn't able to find any significant relations to explain the variability of this three activities. Customer Issues have a variability difficult to explain being very difficult to predict

- Rebate
- Bad_Debt
- Cost_of_Poor_Quality

Cost Configurator

1. Want to understand what would be the cost of a new customer?
2. https://mohammedtopiwalla.shinyapps.io/PMS_Analysis/ - Go here to find it out
3. This is how you could operate it

Documento di Microsoft Word

4. You could use this data to operate it

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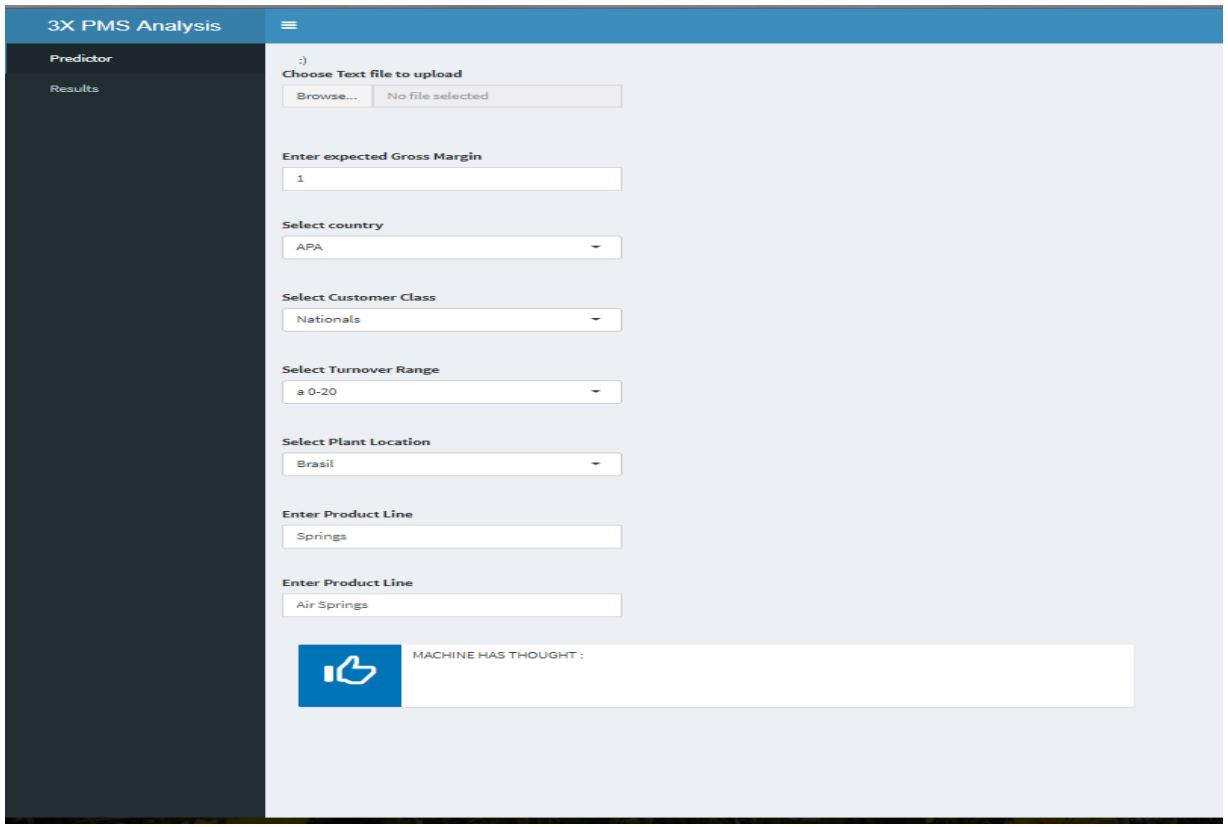
5. There is scope for improvement in the app

   (From the perspective of different cost drivers)



Conclusions

Packing	Outbound Logistic and Local Branches	Distribution Activities	Sales Transportations	Manufacturing Costs	Internal Logistic Costs	Transport.
0,07*Quantity 5*N°Parts 3*N°Deliveries	4*N°Parts 117*N°Deliveries	2*N°Parts 5*N°Deliveries	12*N°Parts 43*N°Deliveries	40*N°Parts 190*N°Deliveries	23*N°Parts 74*N°Deliveries	10*N°Parts 45*N°Deliveries -338*Assembly labour minutes

Manage Foreign Relationship	Manage Order to Suppliers	Inspects Goods	Inbound Logistics	Customer Order Management Local Branches	Offer Development	Sales Development
3*N°Parts 2*N°Deliveries	4*N°Parts 5*N°Deliveries	7*N°Parts 6*N°Deliveries	5*N°Parts 14*N°Deliveries	4*N°Parts 158*N°Deliveries	3*N°Parts 5*N°Deliveries	6*N°Parts 11*N°Deliveries