

QUALITY CONTROL OF PERISHABLE GOODS SALE POINTS



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THE CONTEXT:

A DISTRIBUTION PROCESS OF PERISHABLE GOODS IS CONSIDERED. THE WORK IS REFERRED TO AN ORGANIZATION WITH SALE POINTS. IN A PREVIOUS WORK WE HAVE INTRODUCED THE CONCEPT OF SUFFICIENCY AND COMPLETENESS OF A QUALITY CONTROL SYSTEM, IN GENERAL TERMS.

IN THIS WORK WE GIVE THE CONDITION OF COMPLETENESS OF A SYSTEM RELATED TO A SITUATION SIMILAR TO THAT OF A PERISHABLE GOODS OF A DISTRIBUTION COMPANY

DEFINITIONS:

REAL (TECHNICAL) QUALITY OF A PRODUCT, Q_1 :

$$Q_1 = Q_o / Q_s = \underline{\text{ORDERED QUANTITY/SOLD QUANTITY}}$$

VIRTUAL QUALITY OF A PRODUCT, Q_v :

$$Q_v = Q_1 c_o/c_s = \underline{\text{TOTAL COST / TOTAL PROCEEDS}}$$

(c_o : UNITARY COST OF PRODUCT

c_s : UNITARY PROCEED OF A PRODUCT

$c_o \leq c_s$)

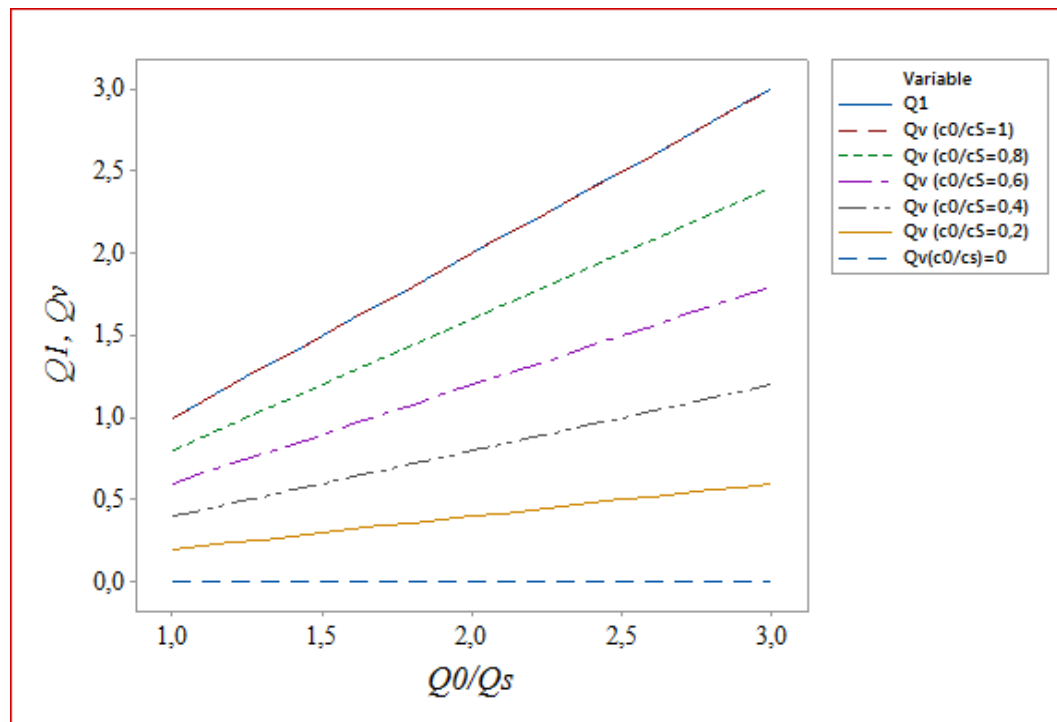
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SKETCH OF $Q_1(Q_o, Q_s)$, $Q_v(Q_1, c_o, c_s)$ VERSUS Q_o/Q_s (NUMERICALLY)

| $Q_v (c_o/c_s=1)$ | $Q_v (c_o/c_s=0,8)$ | $Q_v (c_o/c_s=0,6)$ | $Q_v (c_o/c_s=0,4)$ | $Q_v (c_o/c_s=0,2)$ |
|-------------------|---------------------|---------------------|---------------------|---------------------|
| 1 | 0,8 | 0,6 | 0,4 | 0,2 |
| 1,1 | 0,88 | 0,66 | 0,44 | 0,22 |
| 1,2 | 0,96 | 0,72 | 0,48 | 0,24 |
| 1,3 | 1,04 | 0,78 | 0,52 | 0,26 |
| 1,4 | 1,12 | 0,84 | 0,56 | 0,28 |
| 1,5 | 1,2 | 0,9 | 0,6 | 0,3 |
| 1,6 | 1,28 | 0,96 | 0,64 | 0,32 |
| 1,7 | 1,36 | 1,02 | 0,68 | 0,34 |
| 1,8 | 1,44 | 1,08 | 0,72 | 0,36 |
| 1,9 | 1,52 | 1,14 | 0,76 | 0,38 |
| 2 | 1,6 | 1,2 | 0,8 | 0,4 |
| 2,1 | 1,68 | 1,26 | 0,84 | 0,42 |
| 2,2 | 1,76 | 1,32 | 0,88 | 0,44 |
| 2,3 | 1,84 | 1,38 | 0,92 | 0,46 |
| 2,4 | 1,92 | 1,44 | 0,96 | 0,48 |
| 2,5 | 2 | 1,5 | 1 | 0,5 |
| 2,6 | 2,08 | 1,56 | 1,04 | 0,52 |
| 2,7 | 2,16 | 1,62 | 1,08 | 0,54 |
| 2,8 | 2,24 | 1,68 | 1,12 | 0,56 |
| 2,9 | 2,32 | 1,74 | 1,16 | 0,58 |
| 3 | 2,4 | 1,8 | 1,2 | 0,6 |

NOTE: VIRTUAL QUALITY , Q_v ,
IS COINCIDING WITH REAL
(TECHNICAL) QUALITY, Q_1 OF
A PRODUCT, FOR $c_o/c_s = 1$

SKETCH OF $Q_1(Q_o, Q_s)$, $Q_v(Q_1, c_o, c_s)$ VERSUS Q_o/Q_s (GRAPHICALLY)



NOTE:

$$1 \leq Q_1 < \infty$$

$$0 \leq Q_v < \infty$$

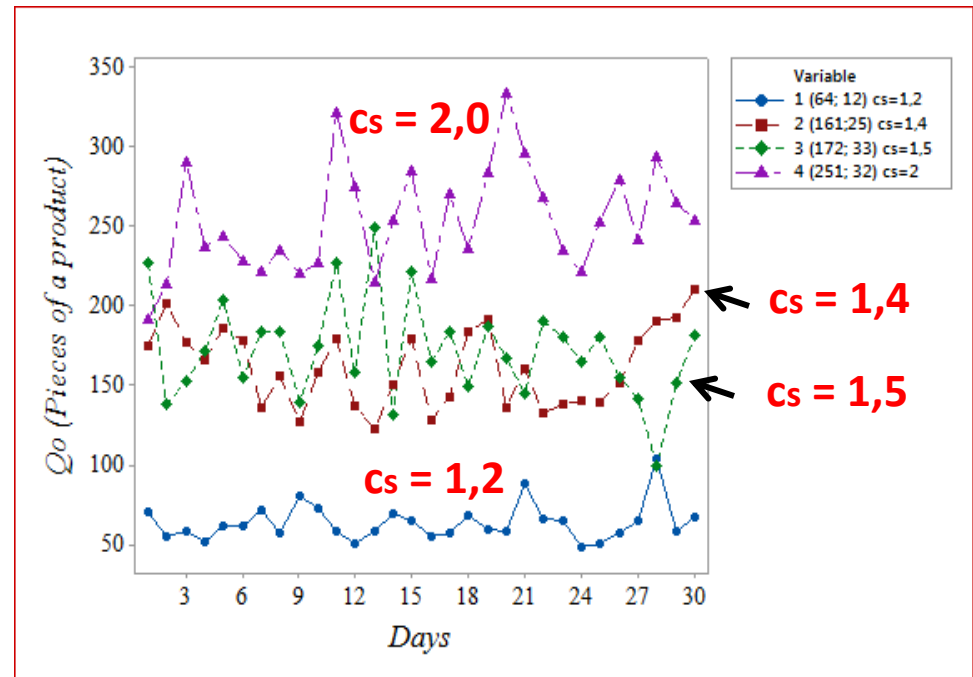
AN EXPERIMENT HAS BEEN CONDUCTED ON 4 SALE POINTS, TO INVESTIGATE THE RELATION, IF ANY, BETWEEN DAILY SALES OF A PRODUCT VERSUS DIFFERENT VALUES OF c_s (c_o HAS BEEN ASSUMED EQUAL TO 1)

1 (64; 12) $c_s=1,2$ 2 (161;25) $c_s=1,4$ 3 (172; 33) $c_s=1,5$ 4 (251; 32) $c_s=2,0$

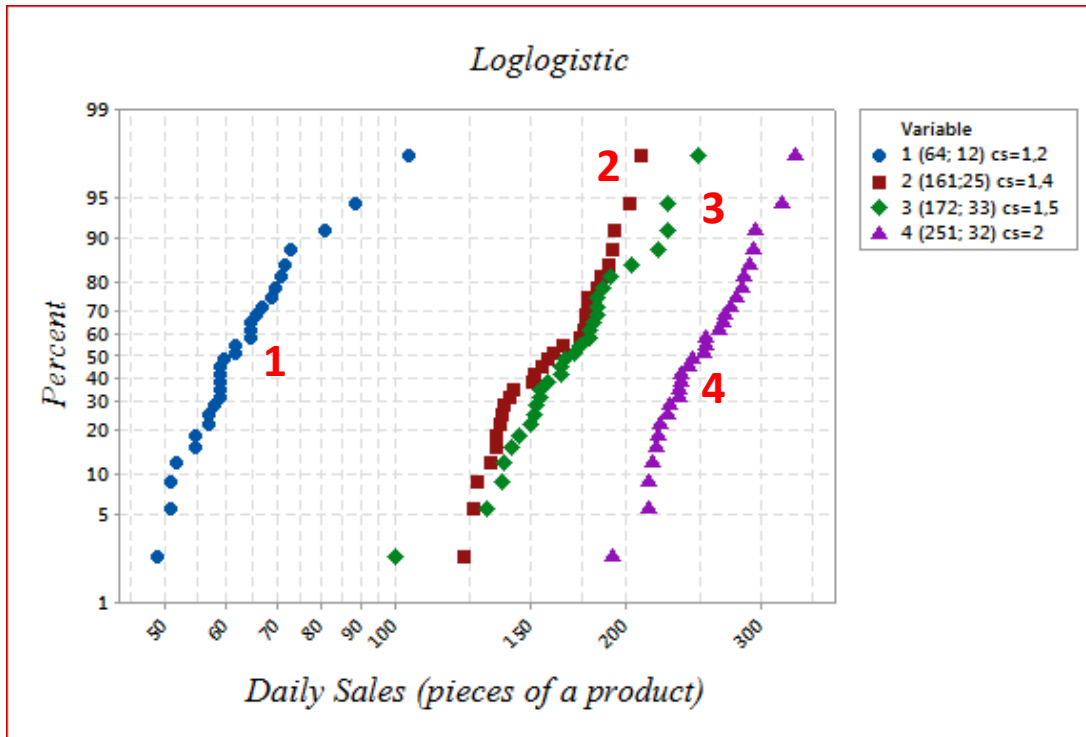
| | | | |
|-----|-----|-----|-----|
| 71 | 175 | 227 | 192 |
| 55 | 202 | 138 | 214 |
| 59 | 177 | 153 | 290 |
| 52 | 166 | 172 | 237 |
| 62 | 186 | 204 | 244 |
| 62 | 178 | 155 | 228 |
| 72 | 136 | 184 | 222 |
| 57 | 156 | 184 | 235 |
| 81 | 127 | 139 | 220 |
| 73 | 158 | 175 | 227 |
| 59 | 179 | 227 | 321 |
| 51 | 137 | 158 | 275 |
| 59 | 123 | 249 | 215 |
| 70 | 151 | 132 | 254 |
| 65 | 179 | 221 | 285 |
| 55 | 128 | 165 | 217 |
| 58 | 143 | 184 | 270 |
| 69 | 184 | 150 | 236 |
| 60 | 192 | 187 | 284 |
| 59 | 136 | 167 | 333 |
| 89 | 161 | 145 | 296 |
| 66 | 133 | 191 | 268 |
| 65 | 138 | 180 | 235 |
| 49 | 141 | 165 | 221 |
| 51 | 139 | 180 | 253 |
| 57 | 152 | 155 | 279 |
| 65 | 178 | 142 | 242 |
| 104 | 190 | 100 | 294 |
| 59 | 193 | 152 | 265 |
| 67 | 210 | 182 | 254 |



THE OBTAINED RESULTS



ALL DATA CAN BE MODELED BY MEANS OF A LOGLOGISTIC DISTRIBUTION

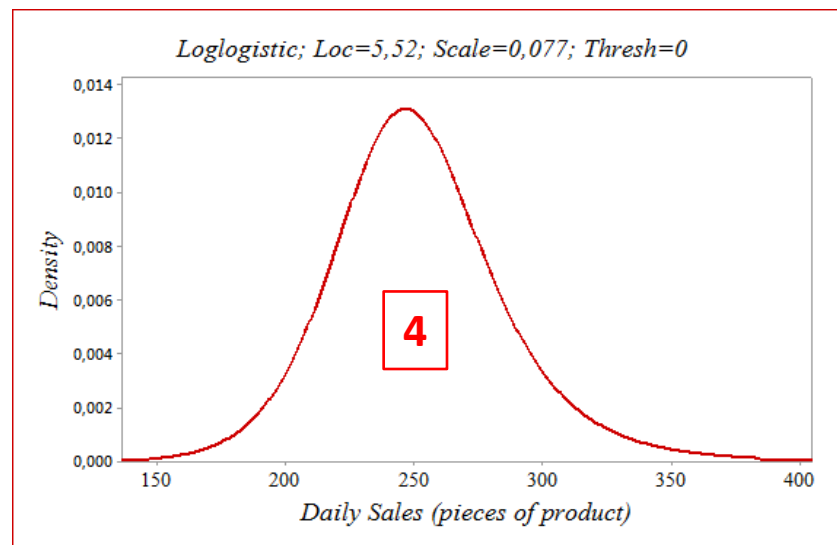
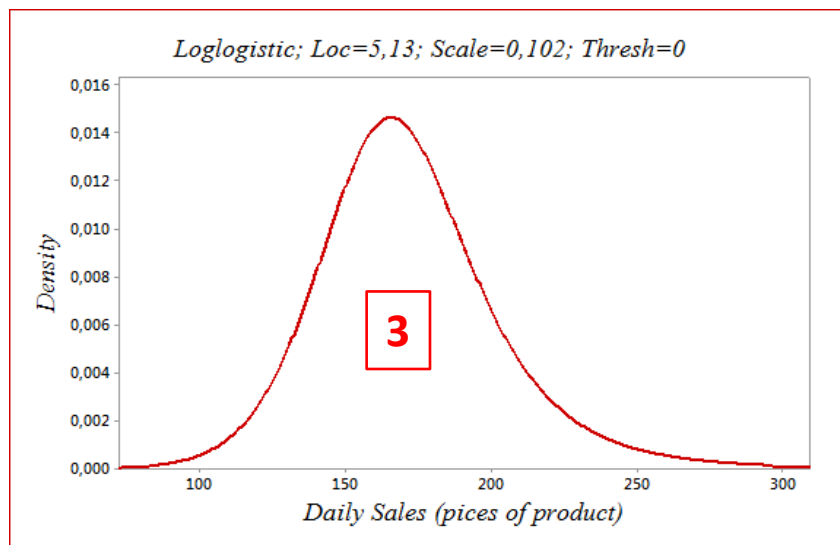
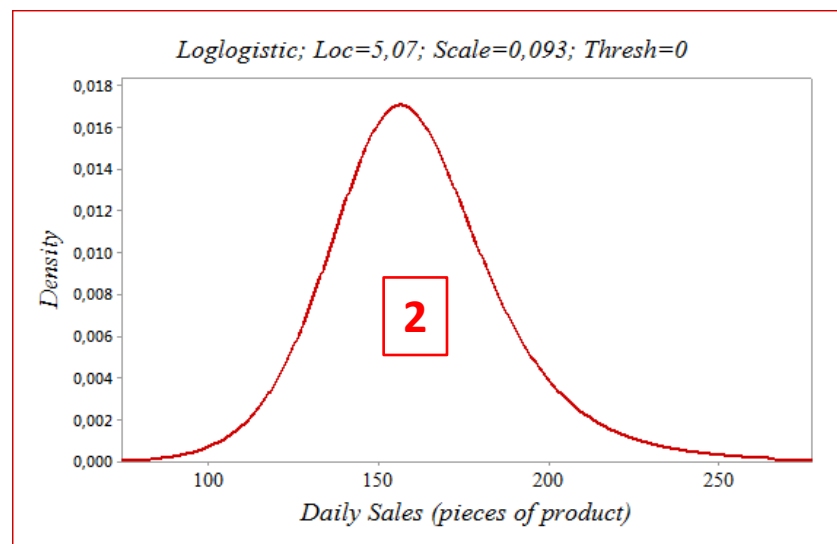
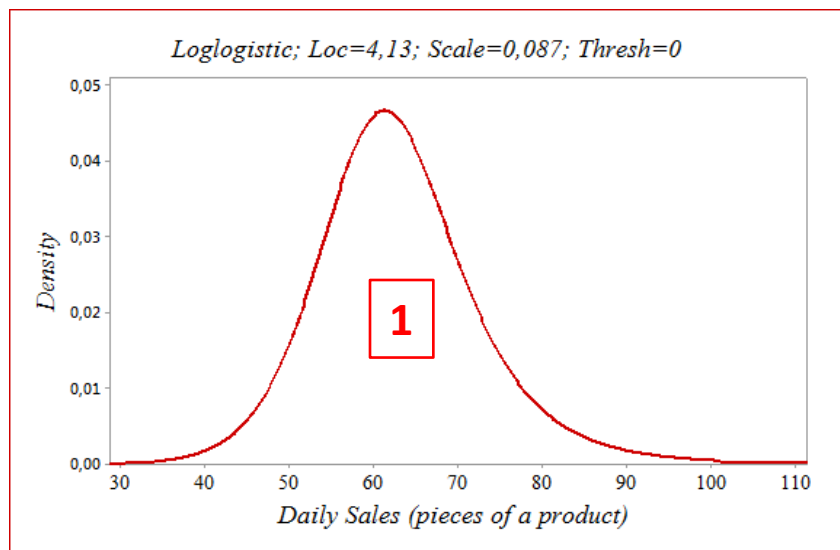


CHARACTERISTICS OF DISTRIBUTIONS

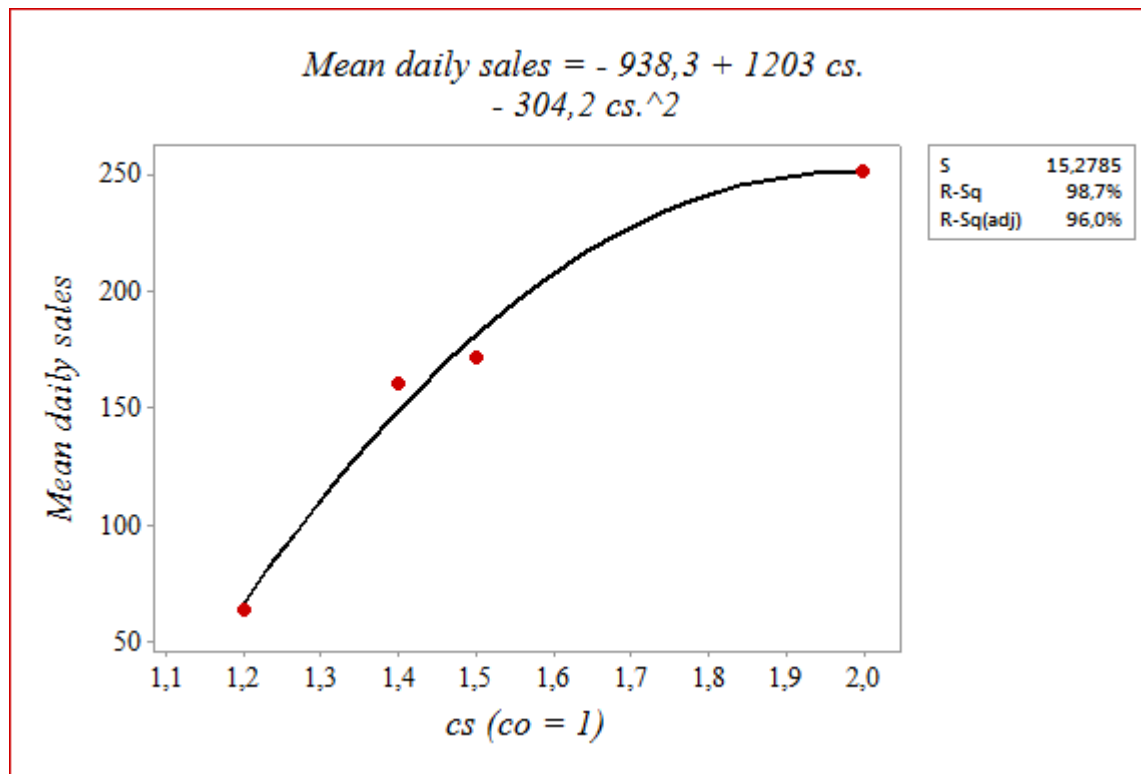
| Sale point | Location | Scale | Average | Sigma |
|------------|----------|-------|---------|-------|
| 1 | 4,13 | 0,087 | 64 | 12 |
| 2 | 5,07 | 0,093 | 161 | 25 |
| 3 | 5,13 | 0,102 | 172 | 32 |
| 4 | 5,52 | 0,077 | 251 | 34 |

$$Average = e^{location} \Gamma(1 + scale) \Gamma(1 - scale)$$

$$Variance = e^{2location} (\Gamma(1 + 2scale)(\Gamma(1 - 2scale) - \Gamma^2(1 + scale) \Gamma^2(1 - scale))$$



ABOVE DISTRIBUTIONS SHOW THAT A STRUCTURE GOVRNING SALES PHENOMENON IS IN PLACE. THEN, IT LOOKS REASONABLE TO STATE A RELATION BETWEEN THE DISTRIBUTION AVERAGES AND cs . THE RELATION IS SHOWN BELOW.



| Mean Daily Sales | cs |
|------------------|-----|
| 64 | 1,2 |
| 161 | 1,4 |
| 172 | 1,5 |
| 251 | 2 |

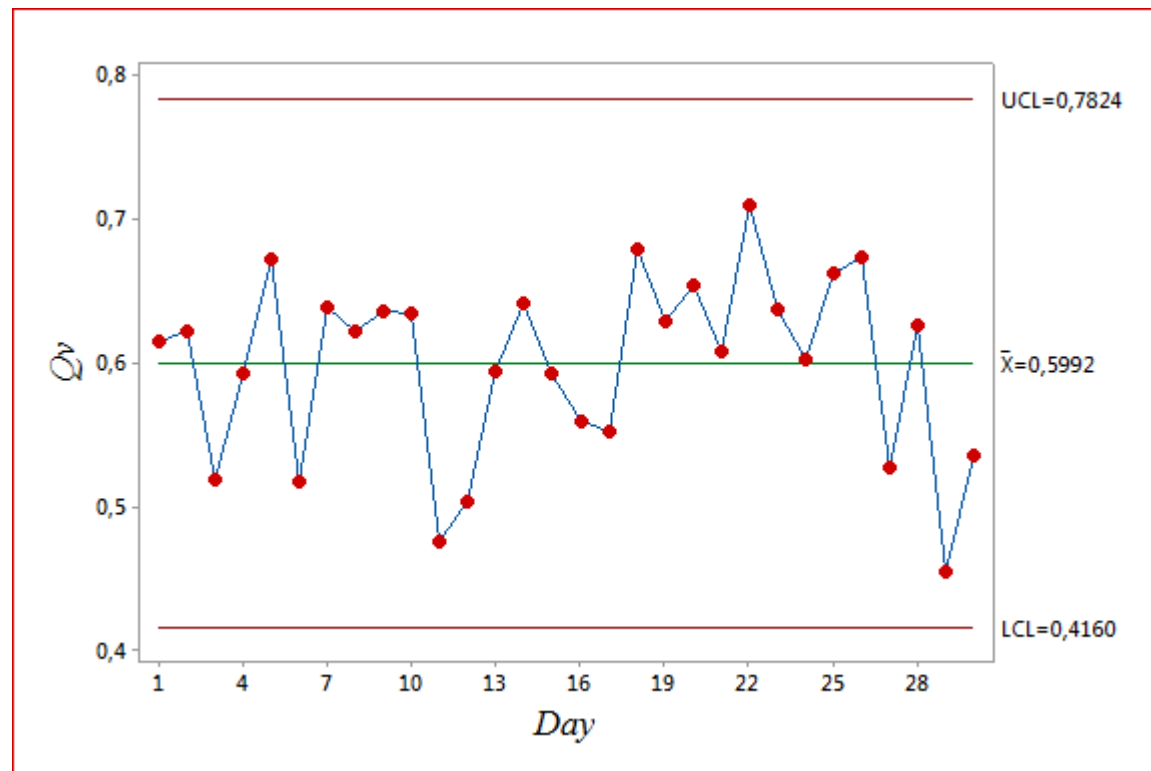
WE HAVE ESTABLISHED AN IMPORTANT POINT:
THE SOLD QUANTITY CAN BE CONTROLLED
BY THE SALE PRICE. WE WILL USE THIS KNOW
HOW TO IMPLEMENT A CORRECTIVE ACTION
OF THE SALE PROCESS, WHEN NECESSARY. LET
SEE HOW

THE CONTROL PARAMETR OF THE SALE PROCESS IS THE VIRTUAL QUALITY OF THE MOST IMPORTANT PRODUCTS, AS SHOWN BELOW. WHAT WE WILL DO, IF THE PARAMETER EXCEED THE UPPER LIMIT?

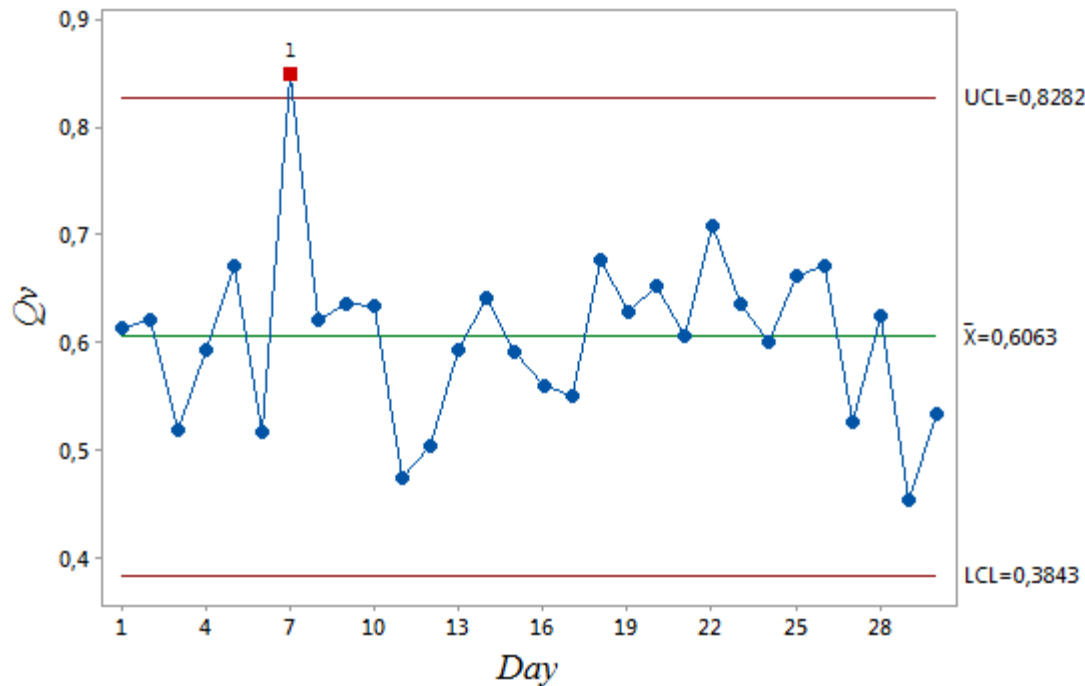
Qualità virtuale in un punto

vendita

0,61467123
0,621439225
0,519460005
0,59302176
0,671310518
0,517924747
0,638447704
0,621395724
0,635631054
0,634083203
0,476022587
0,504279147
0,593067182
0,641416814
0,592047285
0,559684184
0,552060403
0,677699943
0,628276628
0,652723227
0,607536641
0,709350775
0,636076172
0,602161712
0,661607983
0,672286829
0,527191703
0,625220401
0,455059831
0,535074151



A POSSIBLE STRATEGY FOR CORRECTING PROCESS SHIFTS



THE STRATEGY IS:
WHEN WE WILL
OBSERVE A POINT
LIKE THE POINT 1,
TAKING INTO
ACCOUNT THAT:

$$Q_v = \frac{Q_0}{Q_s} \cdot \frac{c_0}{c_s}$$

WE SHOULD CHANGE
THE c_s VALUE. IT IS
SUFFICIENT TO WRITE:

$$Q_s c_s = Q_0 c_0 / 0,6$$

IN THIS WAY WE OBTAIN AN EQUATION THAT PROVIDES US WITH THE VALUE TO ASSIGN TO c_s , ABLE TO GIVE $Q_v = 0,60$. TAKING INTO CONSIDERATION THE EXPERIMENTALLY STATED EQUATION:

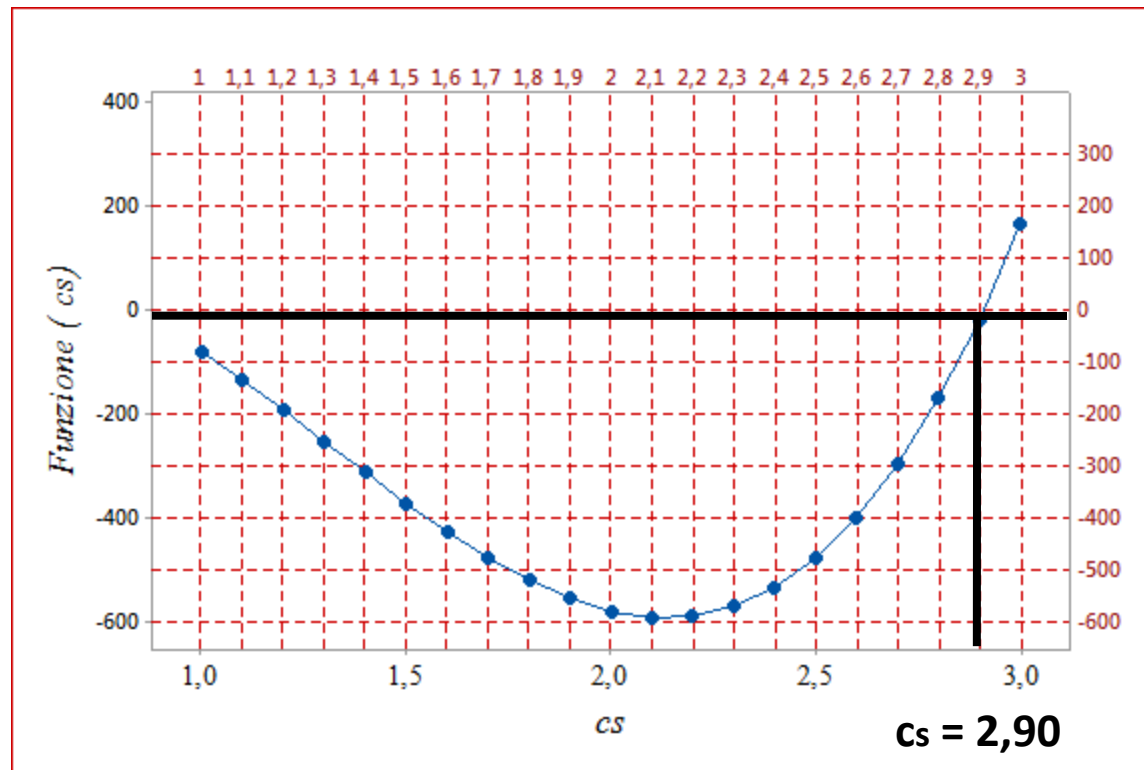
$$Q_s = -938 + 1203c_s - 304c_s^2$$

PUTTING $Q_o = 100$; $c_o = 1$, WE OBTAIN THE EQUATION:

$$304c_s^3 - 1203c_s^2 + 983c_s - 166 = 0$$

WHOSE SOLUTION PROVIDES US WITH SOLUTION OF PROBLEM. THE SOLUTION, FOUND NUMERICALLY, FOR THE STUDY CASE, IS SHOWN IN THE NEXT SLIDE

PUTTING $cs = 2,90$, THE PROCESS SHOULD BE PUT WITHIN ITS NATURAL LIMIT, AGAIN.



CONCLUSIONS

IN THIS WORK A CORRECTIVE ACTION PLAN HAS BEEN DEVISED, TO CORRECT A SERVICE PROCESS, WHEN A SIGNIFICANT DRIFT HAS BEEN OBSERVED. THE PLAN RELYES ON THE POSITIVE EFFECT OF A PRICE VARIATION ON THE SOLD QUANTITY OF A PRODUCT, DETERMINED EXPERIMENTALLY AND MODELED ACCURATELY. THE KEY PARAMETER USED TO THIS PURPOSE IS THE VIRTUAL QUALITY, DEFINED ABOVE.