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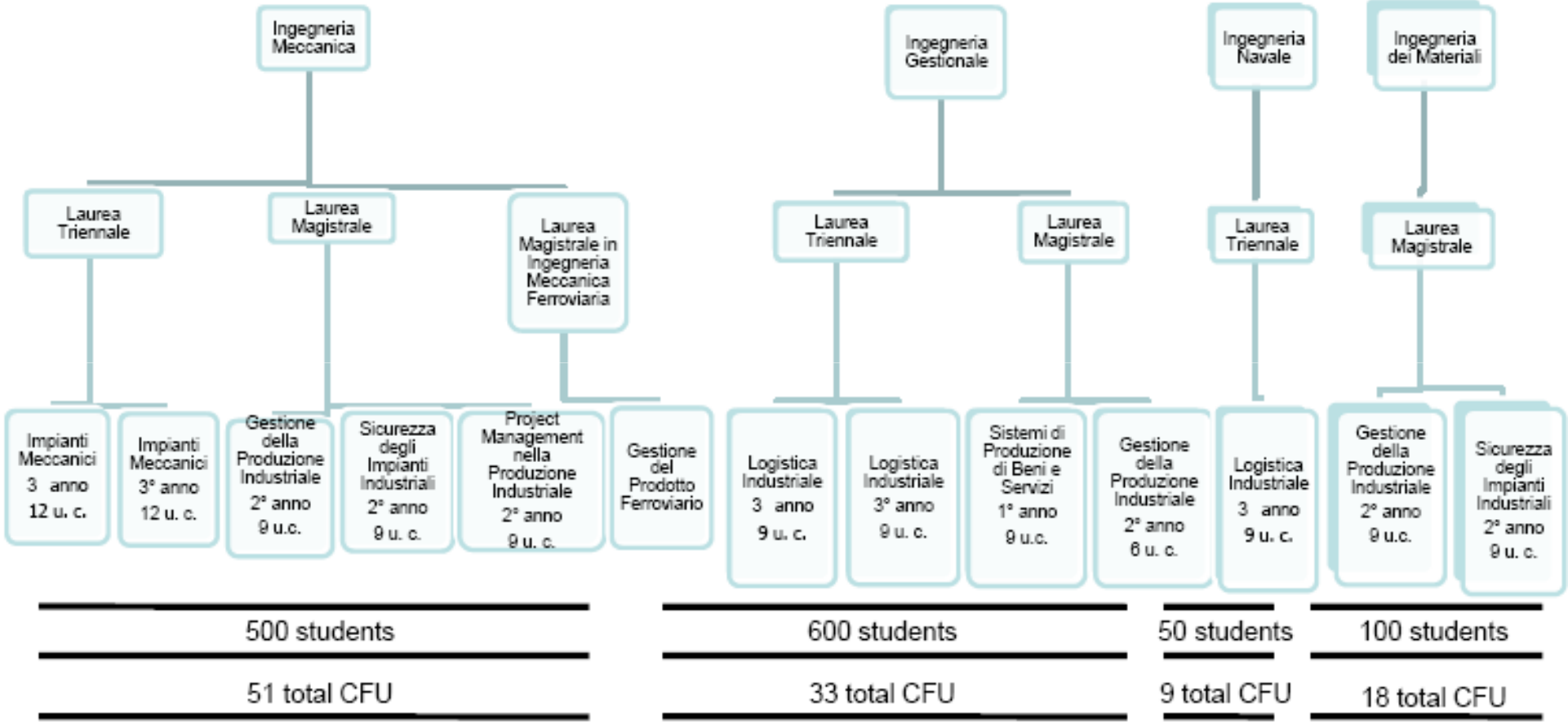
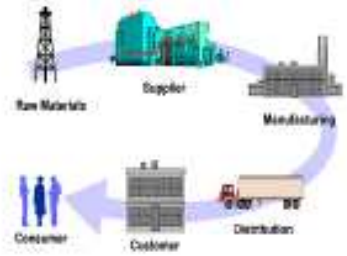
# TEACHING ACTIVITY




Ph. D. School in "Technology and Production Systems – Safety and Risk Management" - Head prof. L. C. Santillo
2 scholarships/year
Master "Planning and Control of the supply network" and "Workplace Safety"

XVI Summer School "Francesco Turco" Impianti Industriali Meccanici
*Abano Terme (Padova, Italy) - 14-16 September 2011*



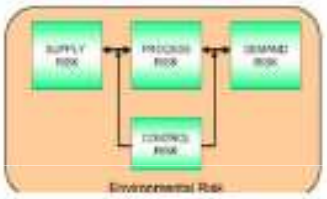
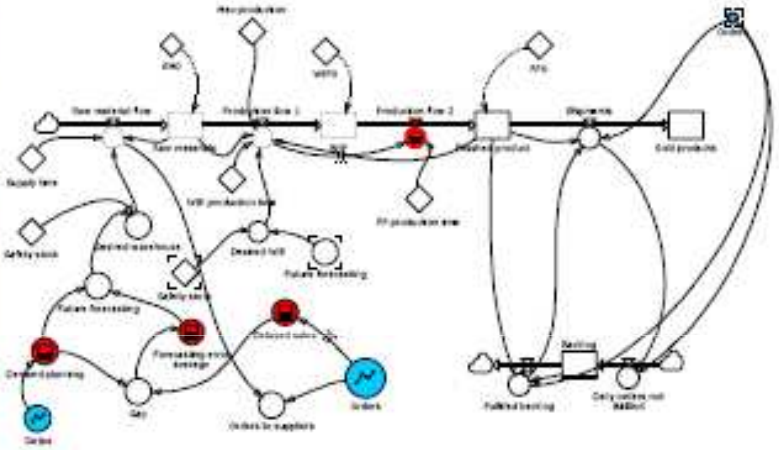
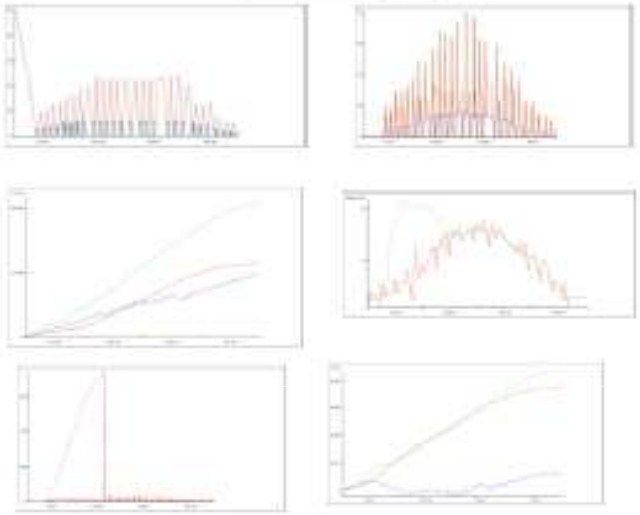




Figure 1 - Concept of resilience


System Dynamics Model



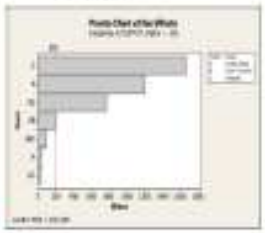
Data Analysis

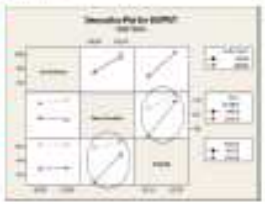


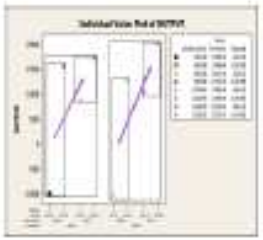
DOE

| VARIABLES | - | + |
|---|---|---|
| Stock level | 690,88 | 1258,85 |
| Number of suppliers | 2316,76 | 1198,49 |
| Velocity | 2142,90 | -652,22 |

| Stock Level | Number Of suppliers | Velocity | OUTPUT |
|---|---|---|---|
| + | + | + | 1711,14 |
| + | - | + | 1567,92 |
| + | + | - | 873,83 |
| - | + | + | 2014,45 |
| - | - | + | 1283,36 |
| - | - | - | -1030,32 |
| + | - | - | -999,93 |
| - | + | - | 1049,64 |







$$R = \beta_1 \times X_1 + \beta_2 \times X_2 + \beta_3 \times X_1 \times X_2$$

$$\hat{R} = \beta_1 x'_1 + \beta_2 x'_2 + \beta_3 x'_1 x'_2 + \beta_4 x'^2_1 x'_2 + \beta_5 x'_1 x'^2_2 + \beta_6 x'^2_1 x'^2_2$$

STOCK LEVEL

SUPPLIERS

VELOCITY

The purpose of this analysis is to find which is the lever that allows a greater improvement in resilience function.

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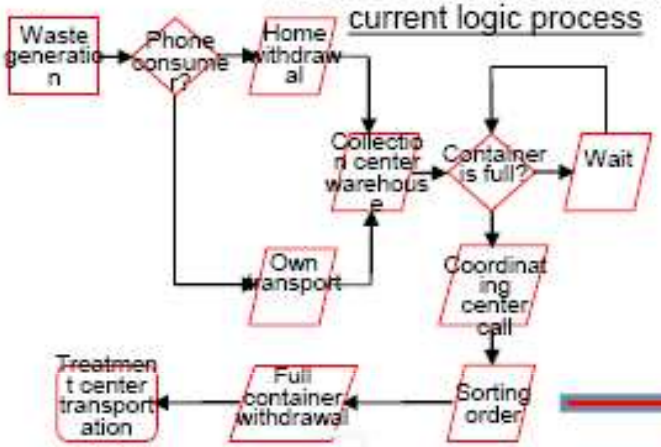
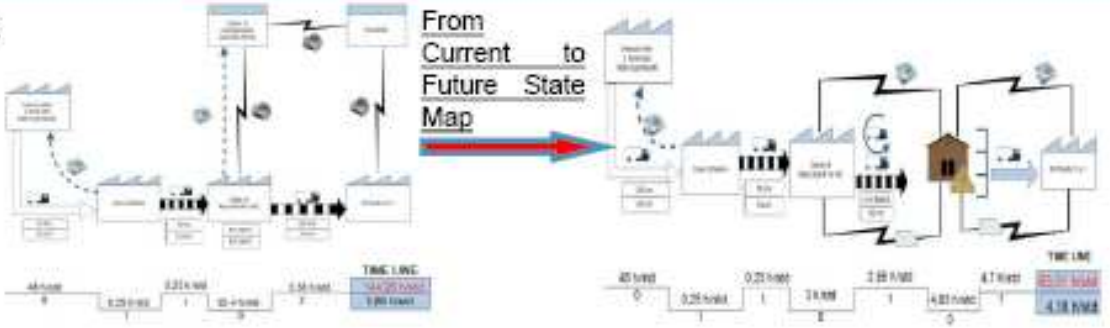
# MODELLING SUPPLY CHAIN

## *Hybrid Logic simulation applied to Reverse Logistics Network*

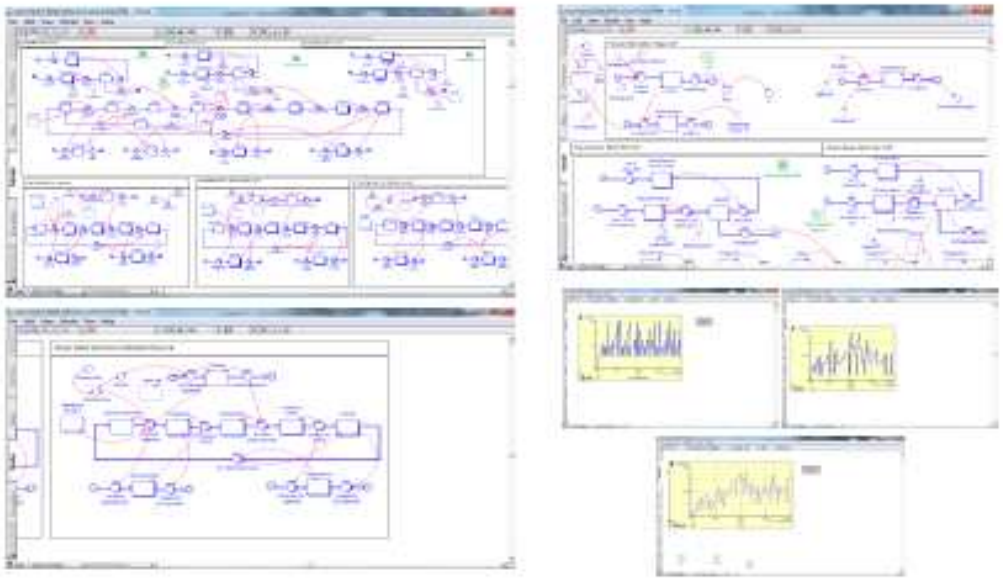
### WEEE Collecting and Treating current logic process



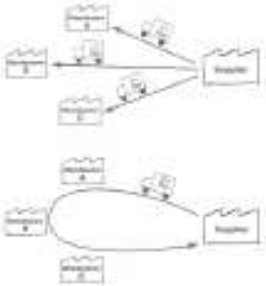

PUSH LOGIC

### System Dynamics Model



SUPERMARKET

Small warehouse, with the aim of creating a continuous flow of material



MILK RUN

Method which speed the material flow between different locations, thanks to the transit one or more vehicles that match material deliveries and withdrawals

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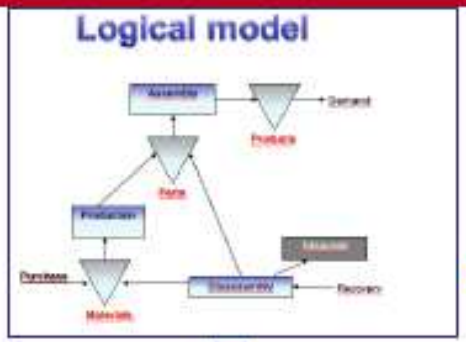
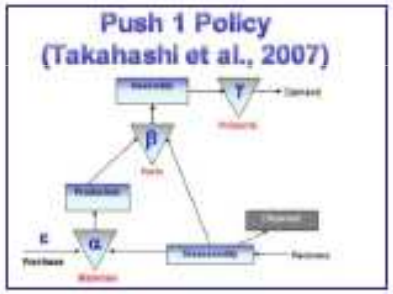
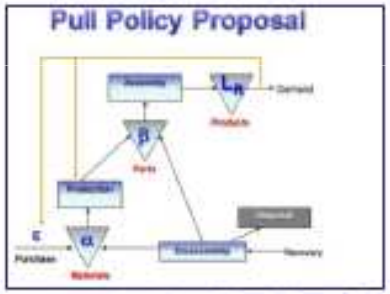
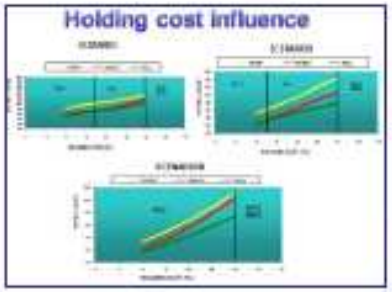
# MODELLING SUPPLY CHAIN
## Closed Loop Supply Chain (CLSC)

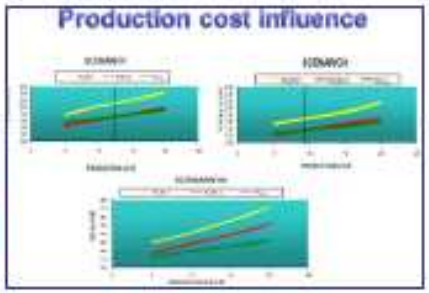



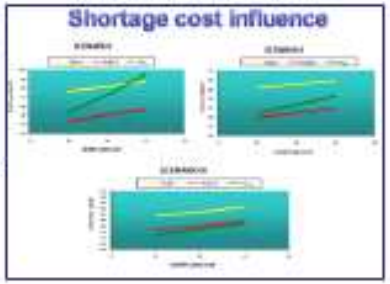






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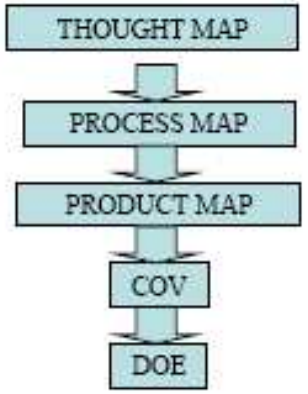
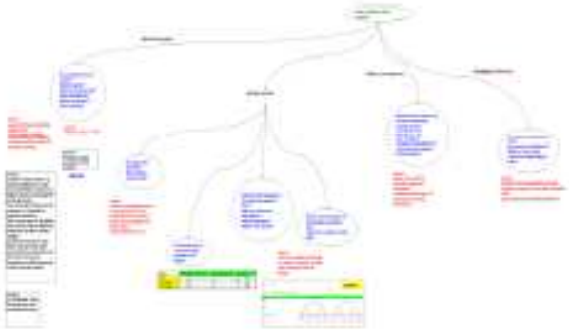
# MATHEMICAL MODELLING AND NUMERICAL SIMULATION OF PRODUCTION PROCESSES

## *Pallet Routing Simulation and Optimization*

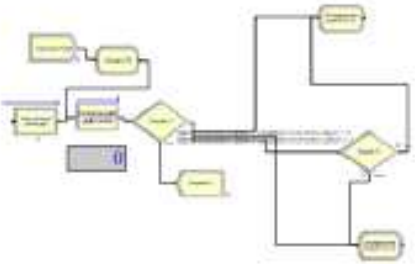
### Pallet Routing

- Strenght is in knowledge;
- Critical Thinking;
- The questions above. Activities and responses follow: "the same questions lead to the same answers";
- Data such as vehicle of knowledge;
- Y=f(X) + NOISE: The solution is in the noise. Study the noise!

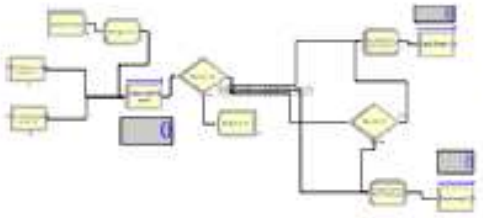


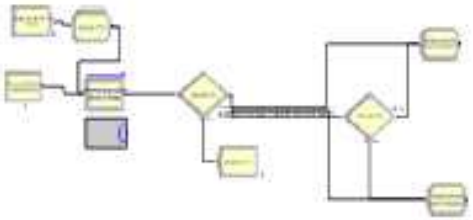



### Descrete Event Model



### Data Analisys (routing)





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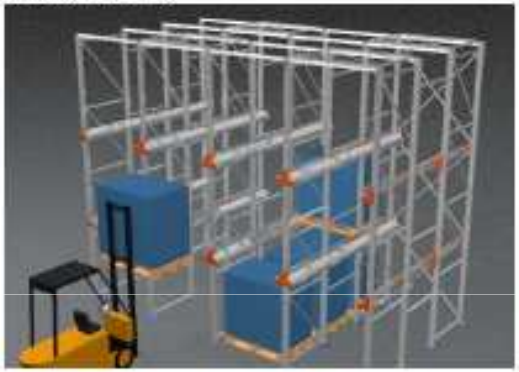
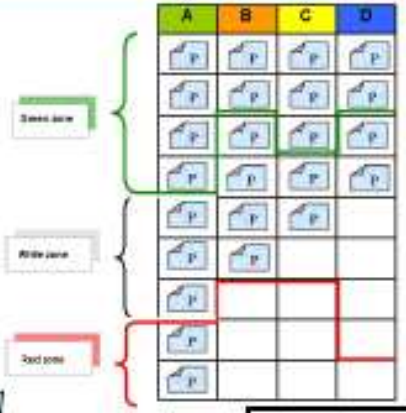
# MATHEMICAL MODELLING AND NUMERICAL SIMULATION OF PRODUCTION PROCESSES

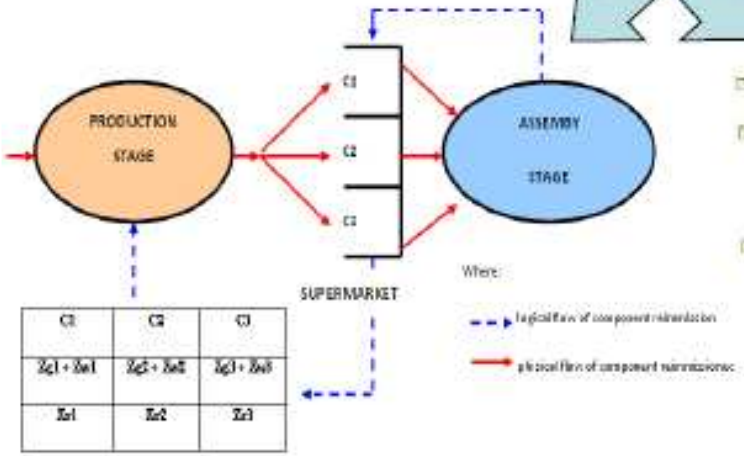
## *Optimal size of kanban board in a single stage multi product system*

The aim of this paper is to define a methodology for determining the optimal size of the supermarket through the optimization of the number of kanban in a kanban board.

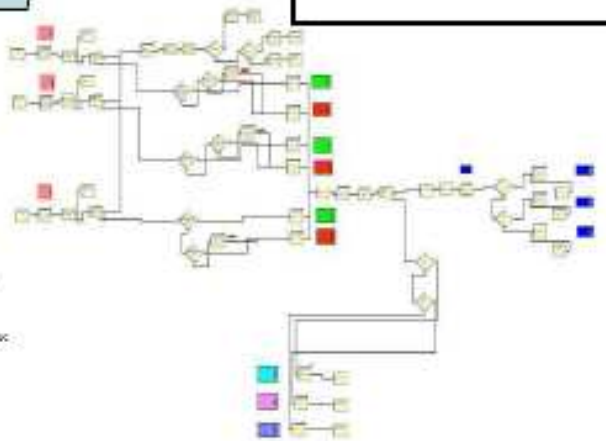




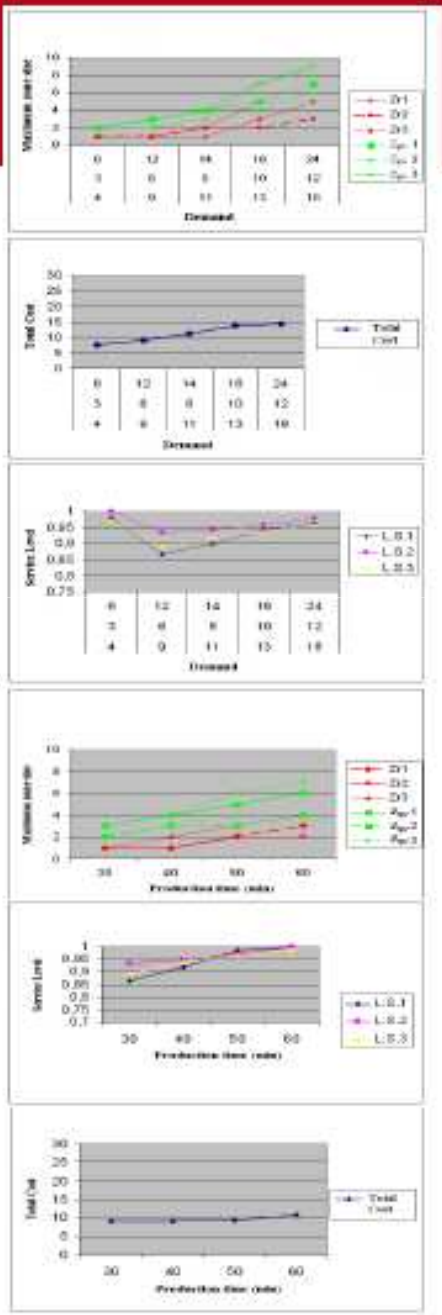

T. Murino, G. Naviglio, E. Romano, "*Optimal size of kanban board in a single stage multi product system*", WSEAS TRANSACTIONS on SYSTEMS and CONTROL, Issue 6, Volume 5, pp 464-473, June 2010. ISSN 1991-8763.




Single-stage multi-product kanban system



Model implemented in the Arena environment



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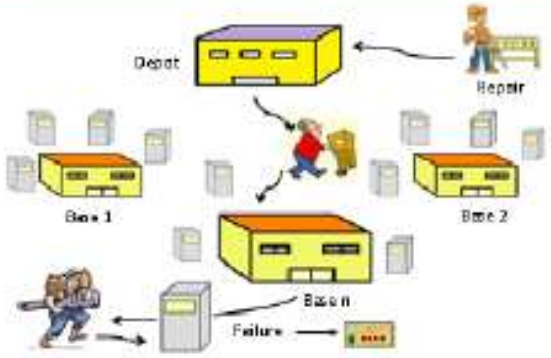
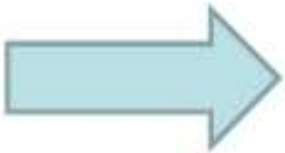
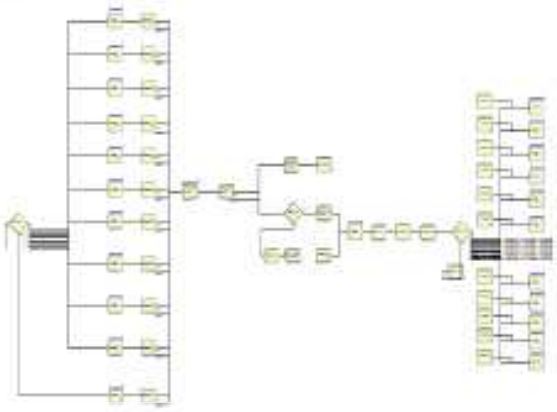
# MATHEMICAL MODELLING AND NUMERICAL SIMULATION OF PRODUCTION PROCESSES

***Optimization and analysis of multi-echelon systems***





$$\text{MIN } C_t = \sum_{i=1}^{11}\sum_{j=1}^{4} N_{i,j} \times c + \sum_{i=1}^{11}\sum_{j=1}^{4} G_{i,j} * c_b + \sum_{j=1}^{4} H_j \times c_D$$

$$0.99 \leq L_s \leq 0.995$$

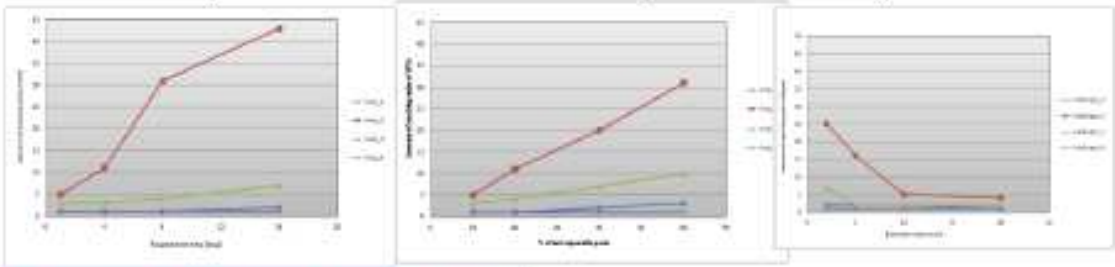
M. Gallo, G. Naviglio, L.C. Santillo, "Optimization and Parametric Analysis of a Multi-Echelon System", Proceedings of the 9th WSEAS International Conference on System Science and Simulation in Engineering (ICOSSE 10), pp.364-369, 4-6 October, 2010. Iwate, Japan. ISBN: 978-960-474-230-1.

System parameters

| | |
|---|---|
| Repair time at the depot | 24 days |
| % not repairable items | 10% |
| Transportation time from the Depot | 1 day |
| Time between two faults for type 1part | N(43.6, 34.8) |
| Time between two faults for type 2part | N(3.04, 4.3) |
| Time between two faults for type 3part | N(9.4, 9.5) |
| Time between two faults for type 4part | N(365, 366) |

Optimizations results

| | *Number of units* | | *Number of units* |
|---|---|---|---|
| ***Iniz_1*** | 1 | InizDepot_1 | 2 |
| ***Iniz_2*** | 5 | InizDepot_2 | 16 |
| ***Iniz_3*** | 3 | InizDepot_3 | 2 |
| **Iniz_4** | 1 | InizDepot_4 | 1 |



*the model represents a valid tool to support company's tactical and strategic decisions*

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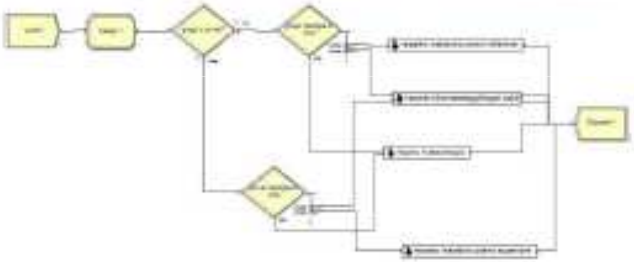
# MATHEMICAL MODELLING AND NUMERICAL SIMULATION OF SERVICE PROCESSES

## Thermal Infrastructures: design and optimization



- Infrastructure costs:

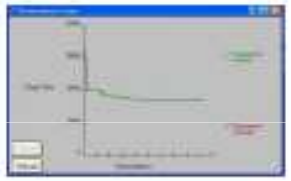
$\beta_1 * [(n\_idro + n\_solo\ bagno\ caldo) * C_{u}\_idro/b) + (n\_aerosol * C_{u}\_aerosol) + (n\_inalazione * C_{u}\_inal) + (n\_doccianasale * C_{u}\_dn) + (n\_mass * C_{u}\_mass)]$

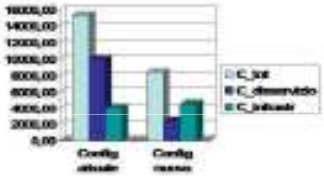
- Human resources costs:

$\beta_2 * [(n\_op\_mass * C_{u}\_op\_mass) + (n\_op\_idro * C_{u}\_op\_idro) + (n\_op\_repartoinal * Cu\_op\_repartoinal)]$

- Perceived waiting costs:

$\beta_3 * C_{u}\_disservizio * \sum_i [Max(Tm\_coda\_process_i - T\_attesa\_toll, 0)]$



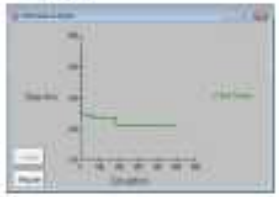



## Airport Terminal: Check – in design and optimization

$\sum_i C_1 x_i + \sum_j C_2 y_j + C_3 Max(NmcodaA-Nt, 0) + C_4 Max(NmcodaBd-Nt, 0) + C_5 Max [\sum_k (NmcodaK-Nt, 0)] + C_4 Max(Nmcodabus-Nt, 0) + C_5 Max(NmcodaT-Nt, 0)$

$x_i = 0,1$

$Y_j = 0,1$

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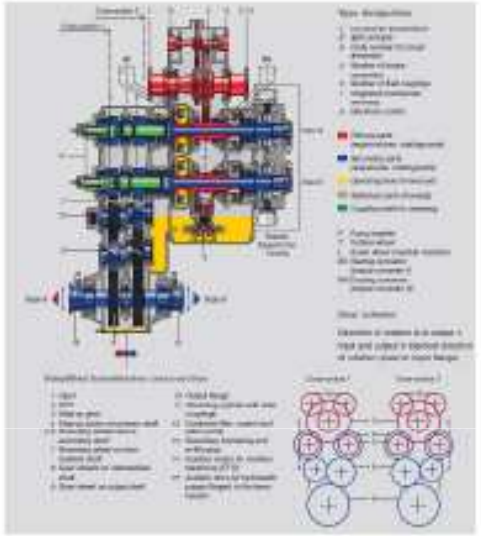
# SYSTEM ENGINEERING RESERACH AREA

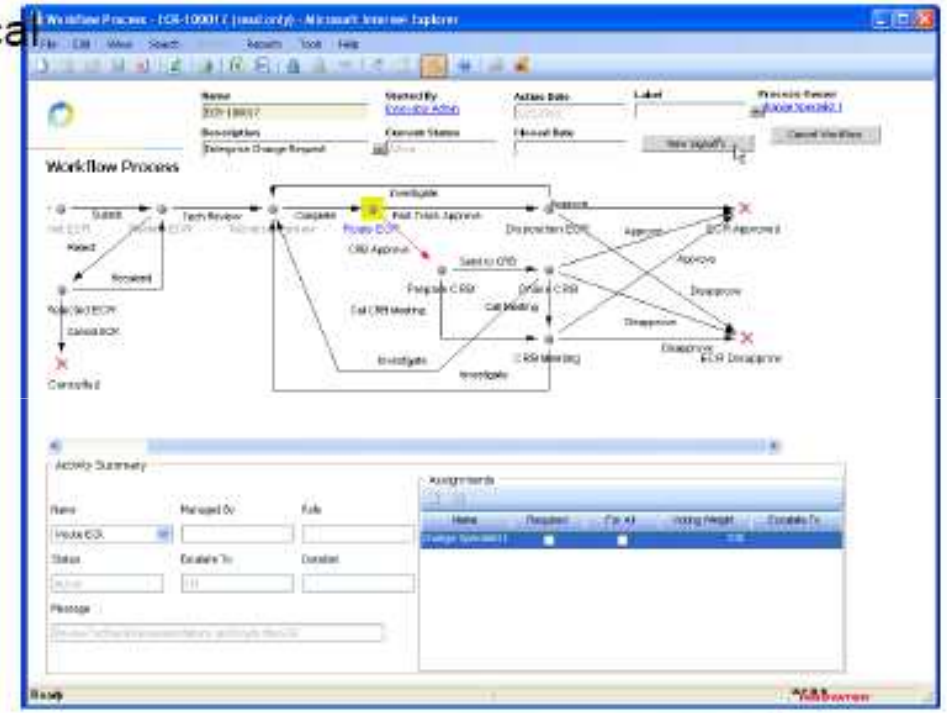


## Devolvement of integrated complex systems: Railway Mechanical Engineering

## Configuration Management in Aeronautical Industry

Controls change evaluation, implementation and documentation processes

Provides impact analysis, BOM synchronization, coordination and communication, and change history




EMA

## Safety Management Systems

Workflows and documentation tracebility

Due date management in safety processes

INAIL
ISTITUTO NAZIONALE PER L'ASSICURAZIONE CONTRO GLI INFORTUNI SUL LAVORO

Open source Solutions

aras corp

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## Industrial Partners

ERICSSON
TAKING YOU FORWARD

ELASIS

EMA

SIEMENS

AleniaAeronautica
A Finmeccanica Company

CO.PRO. S.p.A.
COOLING PRODUCTION

Ansaldo

RBD

Whirlpool

SAP

HP

Barilla

Acqua Minerale Naturale
SANGEMINI

Schneider Electric

mistrall

COELMO

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# Top 10 Publications Last 4 years (2007 – 2011)

| Authors | Title | Journal/Conference | Year-Vol.-pp. |
|---|---|---|---|
| Gallo, Guido Guizzi, Pasquale Zoppoli | **Production yield improvement in a series system by a multithreshold CBM Model** | International Journal of System Applications, Engineering & Development | Issue 4, Volume 1, 2007, pp. 100-111 |
| M. Gallo, L. Guerra, G. Guizzi | **The Effect of Secondary Markets on Remanufacturing Decisions** | Book of Computing and Computational Techniques in Sciences, Selected Papers from the WSEAS Conferences in Spain | September 2008, pp. 64-69, Santander, Spain. ISBN: 978-960-474-009-3 |
| E. Romano, L. C. Santillo, P. Zoppoli | **A static algorithm to solve the air traffic sequencing problem** | WSEAS TRANSACTIONS on SYSTEMS | June 2008. Volume 7 Issue 6, pp. 682-695. ISSN: 1109-2777 |
| E. Romano, L. C. Santillo, P. Zoppoli | **Transformation of a production/assembly washing machine lines into a lean manufacturing system** | WSEAS Transactions on Systems and Control | Feb 2009. Volume 4 Issue 2, pp. 65-76. ISSN: 1991-8763 |
| Gabriella Caputo, Mosè Gallo, Guido Guizzi | **Optimization of production plan through simulation techniques** | WSEAS Transaction on Information Science and Application | Issue 3, Volume 6, March 2009, ISSN 1789-0832, pp. 352-362 |
| Mosè Gallo, Luigi Guerra, Guido Guizzi | **Hybrid Remanufacturing/Manufacturing Systems: secondary markets issues and opportunities** | WSEAS Transaction on Business and Economics | Issue 1, Volume 6, January 2009, pp. 31-41, ISSN 1109-9526 |
| T. Murino, G. Naviglio, E. Romano | **Optimal size of kanban board in a single stage multi product system** | WSEAS Transactions on Systems and Control | June 2010. Volume 5 Issue 6. ISSN: 1991-8763 |
| Guido Guizzi, Teresa Murino, Elpidio Romano | **Modelling and Optimization of Check-In Desks and Security Check Points in the Airport** | Book: Computer and Simulation in Modern Science | Volume 3, Wseas Press, 2010, chapter 48, pp. 513-523, ISBN 978-960-474-256-1, ISSN 1792-6882 |
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# Research Project Industrial Parteners Last 4 years (2007 – 2011)

| Project | Year | Description |
|---|---|---|
| GPS | 2007 – DM 29214 | Re.Lo.A.D. – WEEE Design and Management quantitative Reverse Logistics models. |
| Legge 5 | 2007 | Decision model for integrated planning and production for the remanufacturing control systems. |
| Industria 2015 | 2010 | GLOB-ID - global Identification of logistic in health care packaging. |