

**Scuola di Dottorato in
“High Mechanics and Automotive Design & Technology”
“Meccanica Avanzata e Tecnica del Veicolo”**

QUADERNI

**Quaderno n. 2:
Correzione dell’Inglese in un articolo tecnico
prof. Michael Collins**



Meccanismo greco di Anticitera,
Museo nazionale archeologico, Atene

*All'alta fantasia qui mancò possa;
ma già volgeva il mio disio e 'l velle,
sì come rota ch'igualmente è mossa,
l'amore che move il sole e l'altre stelle.*

Dante, Paradiso

Introduzione

Il secondo quaderno della Scuola di Dottorato in “High Mechanics and Automotive Design & Technology”/“Meccanica Avanzata e Tecnica del Veicolo” riguarda la correzione della lingua Inglese con riferimento alla stesura di un articolo tecnico.

Tale lavoro di correzione è stato effettuato dal prof. M. Collins, Brunel University, London, durante una delle visite presso il Dipartimento di Ingegneria Meccanica e Civile della Facoltà di Ingegneria dell’Università di Modena e Reggio Emilia, Sede di Modena. Infatti, oltre all’attività principale, quella cioè seminariale nel campo della termofluidodinamica, il prof. Collins si è gentilmente prestato a tenere alcune lezioni specialistiche di Inglese tecnico, e di questa sua disponibilità gliene siamo tutti grati. Questa attività ha incluso una correzione a livello molto particolareggiato di un articolo tecnico. I risultati di questo paziente lavoro sono inclusi in questo secondo quaderno, dove la prima parte di questo file contiene il testo originale largamente imperfetto, e la seconda parte evidenzia le correzioni cortesine apportate dal prof. Collins.

Questo secondo quaderno ribadisce il carattere principale che questi quaderni devono possedere: quello di trasmettere stimoli culturali. Risulta evidente a tutti che un articolo ben scritto non significa necessariamente un articolo scientificamente valido. E’ però altrettanto vero che un articolo scientificamente rilevante ma mal scritto in termini di lingua e di stile rende più indigesto il lavoro di comprensione del lettore. In altre parole, una buona capacità di scrittura in lingua Inglese è un prerequisito per un ricercatore, è cioè una condizione necessaria per poter esprimere efficacemente il contenuto tecnico-scientifico.

Prof. Antonio Strozzi
Coordinatore della scuola di Dottorato in
Meccanica Avanzata e Tecnica del Veicolo

A stochastic simulation approach for production scheduling and investment planning in the tile industry

Eliminato: supporting tile enterprise in ...in ... [1]

Authors

Abstract

Purpose

In this research paper the creation of a simulation tool for tile manufacturing companies is described. Also it is demonstrated how simulation results can be useful in supporting management decisions relating to production scheduling and investment planning. In particular the aim is to demonstrate the importance of an information system in tile firms.

Eliminato: This gives an approach to create ...simulating firms and demonstrates ...to support ...in ...s...the ... [2]

Design/methodology/approach

The Factory Data Model (FDM) parameter is used to describe the activities in ceramic tile industries in various European countries based on information both from a literature review and directly from the company Assopiastrelle. A process based analysis of tile manufacturers is undertaken and individual company performance is quantified by the Key Performance Index (KPI). The overall model is comprised of individual processes, each of which are translated into Matlab code and matched together to create a stochastic simulator. The results of the simulations are used to show how management decisions can significantly affect the KPI.

Eliminato: tiles ...basing up ...firms ...done ...are individuated ...split into processes and this processes ...in order ...point out the influences of ...decis ... [3]

Findings

The results are based on the study of a generic tile company. The simulations highlight the effects on KPI of three specific parameters: the length of scheduling period, the quantity of stock needed and the reliability of the information system for orders. The results clearly show that the effect of allowing the presence of unattended orders within the outstanding orders list always has a non-negligible negative influence on KPI. Results also suggest that the presence of sub-groups of homogeneous tiles, based on color variation, is one of the most important factors affecting a tile manufacturer's performance.

Eliminato: result ...description of a ...firm ...due to the 3 studied ...wanted ...if... orders... Simulation results point out ...between outstanding orders of...ones has ...not ... and...factor for tile firms performances. ... [4]

Research limitations/implications

The main limitation of this study is the validity of the enterprise model that has been developed. The lack of well-established literature relating to any such model for the ceramic tile industries prevents the generalisation of the results to all ceramic tile enterprises.

Eliminato: paper ...developed ...about enterprise...in ...tiles industry prevent from enlarging the ...s... ... [5]

Practical implications

The results of the simulations have two distinct practical implications. Firstly, they demonstrate the importance of information systems in tile companies suggest that their managers evaluate investment in information technology and indicate the value of promoting an information culture in their entire work forces. Secondly, they show the potential of the creation of simulation tools useful to support decision making by management.

Eliminato: result has different... First it points out ...the ...system in tile firms and ...to ...investments and to promote...widespread over all enterprise employees. Second it shows...followed approach to create simulating ...in decisions making ... [6]

Originality/value

This is the first known simulation approach based on the FDM parameter for tile companies.

Eliminato: Factory Data Model referring to ...firms ... [7]

Keywords

Simulation, tiles, scheduling, investments, management, information system, lean production.

Paper type

Research

Introduction

The tile industries in Europe are concentrated in two countries: there is a Spanish cluster in the area of "Castellon" and an Italian one in the "Emilian" region (Harvas-Oliver, 2007).

An exhaustive description of the production system in the tile industries was given by Andrés in 2005. These industries are dedicated to the production of ceramic products, which are used in the construction sector to isolate floors and walls. The raw material used is clay, previously ground in a special mill. The layout for the

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Eliminato: Tile ...physical areas: the ...the italian ... [8]

Eliminato: tile industries ...is Tile ... starting from clay. These products...or ...In tile industries, the ... that has been...been ... [9]

production system can be schematized (see Fig. 1) as a three stage hybrid flowshop with four facilities at the first stage (A+B), an intermediate buffer (first C), two facilities at the second stage (kiln D), another buffer (second C) and three facilities at the final stage (sorting and packing cells, E).

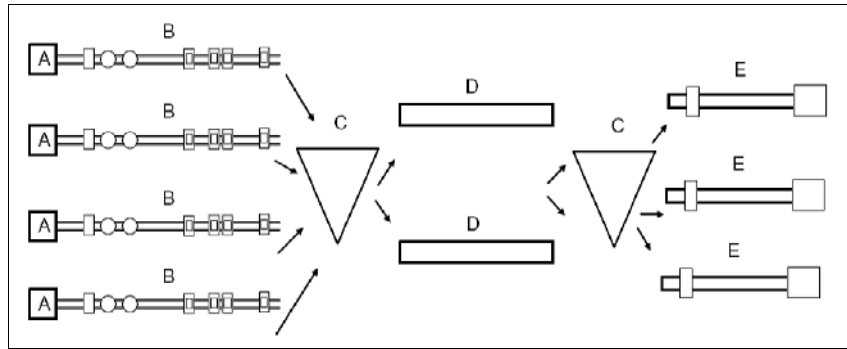


Fig.1 Production system layout (Andrés, 2005)

In more detail, the clay is placed into presses (A) where the tiles are manufactured. They are transported by conveyors (B) along which are sequences of machines which insert different additives as the tiles pass through them. These additives are: colours (represented in Fig. 1 by small squares), dust (by small circles) and smalts (by small double squares). These processes give the tiles their final physical appearance. At the ends of the lines B a loader inserts the tiles into an automated guided vehicle which delivers them to an intermediate buffer (first C). They are then loaded into a large kiln (D) where the tiles are cooked at temperatures over 1500 °C. This high temperature causes the fusion of the colours, dust and smalts and improves the hardness of the tiles. After the cooking activity they are unloaded from the kiln and brought into another intermediate buffer (second C). The final stage is a workcentre where the products are classified and packed using automated machines and conveyors (E) (Andrés, 2005).

The tile industry production system suffers from problems of quality control and, in fact, addressing the phenomenon of undesired coloring is one of the most important needs in the ceramic sector (Erginel, 2004). Each piece has to be inspected and classified in most companies and individual (product) models are usually stored in sub-groups based on the tone (colour degree) and the calibre (thickness)... (Tortajada, 2006). There is a total absence in the recent literature of reference to investigations of the degree of tone variation, with no publications dedicated to this topic. However, it is possible to argue that the range for tone variation is related to the sorting machine lines. A technical paper for the industry (SACMI, 2007) reveals that the number of exits from classic sorting lines range from a minimum of 3 to a maximum of 9. A standard product classification into 1st, 2nd and 3rd qualities may be hypothesised based on the defects and tone classification allowed for a 1st quality product. While the 3 exits configuration implies only 1 tone, in a 1st quality product, that for 9 exits implies 7 tones.

Originally the tile industries were characterized by large scale production of a limited range of products. Over the last few decades consumer demand for tiles has changed, becoming more sophisticated. Currently tile industries produce a considerable variety of products with shorter life cycles (Harväs-Oliver, 2007) (Andrés, 2005) (Regueiro, 2000) (Bonavia, 2006) (Vallada, 2005). These characteristics are much more significant for the Italian (Emilian) cluster of companies because they are focused on higher end more sophisticated markets and give more attention to product differentiation (Harväs-Oliver, 2007). This increase in the number of products creates scheduling problems because shortening lead times and decreasing batch sizes are both features that are not very compatible with tile production systems.

Lean Production practices in tile industries

Adapting the tile production system to an increasing number of products is one of the main challenges for the industry. From other industrial manufacturing experience, such as in the mechanical sector, Lean Production (LP) practices (including especially Group Technology (GT)) could be a possible solution. A case study of GT implementation within the tile industry was reported by Andreas in 2005. The set up time was reduced and a specific algorithm used to solve the scheduling problem (Andrés, 2005), and mainly due to the former of the two actions some advantages were gained. These advantages were:

- the effective production capacity of the factory increased by almost 10%;
- the lot size was reduced by an average of 7%.

Eliminato: (press ... glazing line ...)... (E) ... third ... (see Fig. 1). ... [10]

Eliminato: The ... put ... the press ... tile is ... After the press, the tiles ... a conveyor. There are different machines ... the conveyor, ... put different products when a tile passes ... Some machines put the ... in the picture ... represented ... in the picture) or ... represented ... in the picture). These products will produce the ... when they are cooked ... the kilns. When the parts arrive to the end of the line, a loader put them in brings ... The products are ... with ... produces ... (... [11]

Eliminato: Something more should be said about the results of ... industries ... In phenomenon ... problems ... of this implies that each model ... must ... be ... by ... In ... is investigated by ... one and there are no works ... Arguing a range for tone variation ... by technical paper of ... machines ... line has got ... exits exits (SACMI technical paper, 2007). The hypothesis of a quality ... only ... is taken. The ... and ... configuratio ... [12]

Eliminato: At ... beginning few types ... In ... tile markets change and become ... Nowadays ... produce d a great ... and ... cycle of each product become shorter ... This factors ... important ... firms belonging to ... in ... the ... of the product ... The ... crates a problem to tile industries ... time ... size ... instances ... don't fit with the ... system of tile industries ... [13]

Eliminato: Fitting ... with product ... challenge ... tile industries. According with experiences made in ... sector, one, Group Technology (GT) and ... shall be thought to s ... practices ... in a ... is the GT was implemented by reducing ... using ...). The paper report that implementation ... GT methodology has produced ... due principally to set up time reduction. T ... [14]

Eliminato: has ... in ... [15]

Eliminato: has been ... [16]

The results suggest that a wide implementation of LP concepts and practice, including GT, could be a promising way to transform the tile industries production system.

Eliminato: This ...could Lean Production (...)s, whose GT is a part of, ...in ord (... [17]

An empirical study was made by Bonavia of implementation of LP in the Spanish tile industry (Bonavia, 2006). The study verified that most LP-derived practices are still not widespread. Cellular manufacturing and kanban were totally absent and only a few cases were found of reductions in set-up times and employees being multi-functional. Moreover, it was underlined that firms making most use of set-up time reduction are those which hold the greatest inventories and have the longest lead times. This combination may be logical, because the complete absence of pull systems suggests that the companies should take advantage of faster format changes to build up their stocks.

Eliminato: about LP industries by ... in the ... in tile industry...case...time reduction practices... employees were find...that make...the ones that...most inventory...association...make sense...firms... (Bonavi (... [18]

The correlation between reduction in set-up time and an increase in stock is explained in terms of an increase in effective production capacity. This explanation, however, omits consideration of the fact that set-up time reduction is usually implemented to allow the production of more varied tile designs in smaller lot sizes. The increased production capacity is used to accommodate more product changes. A different explanation for this increase in stock may be found in the increased number of sub-groups due to variations in quality and tone. These variations have to be checked during the sorting process. A smaller lot size involves a smaller sub-group size of product tiles.

Eliminato: set-up time the...of...with...of the ... doesn't consider...most of all allowed to produce with a smaller lot size...different products...do...of the increased...could...find...s variety (... [19]

It might be argued that the existence of sub-groups due to the production process and the limited advantages foreseen both constitute an obstacle to implementing LP in the tile industries. Also, it has to be remembered that the sector is composed mainly of SMEs. It therefore follows that only limited resources are available to the industry to devote to the introduction of LP techniques and it will not embark on them unless it is convinced of the benefits that will accrue and is sure that the aspects of LP are suited to the specific circumstances of each firm (Bonavia, 2006).

Eliminato: both ...Lastly...it has ...introducing ...abc (... [20]

In the light of the above we can conclude that companies need tools that enable them to attempt the redesign of production and management processes, but only involving a limited amount of financial commitment, and without affecting production.

Eliminato: According with this assumption...said...firms...mak e...able ...try ... with few money spending... stop (... [21]

Enterprise modeling

A reusable enterprise model is needed in order to create a paradigm that can be applied to the entire tile industry. In this way the virtual enterprise, based on the model, can be adapted to any real company. The factory data model (FDM) (Yu,2000) was chosen for this purpose. The choice was made because of the flexibility of the model and the possibility of its use even when only partially complete. The model was developed by specifically focusing on the process involved in the fulfilment of orders, according to the concept of enterprise redesign shown in Fig.2. The generic tile firm model developed here is incomplete, because of the above focus on fulfilment of orders, together with information flow.

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Eliminato: all...industries...ent erprises...firm...is ...to create a tile enterprise model...to...the model ...if it was in... fulfillment...contest...showed... t is focusing... fulfillment (... [22]

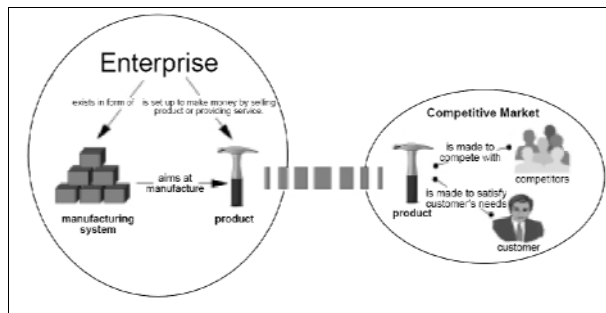


Fig.2 Contest of enterprise redesign (Yu, 2000)

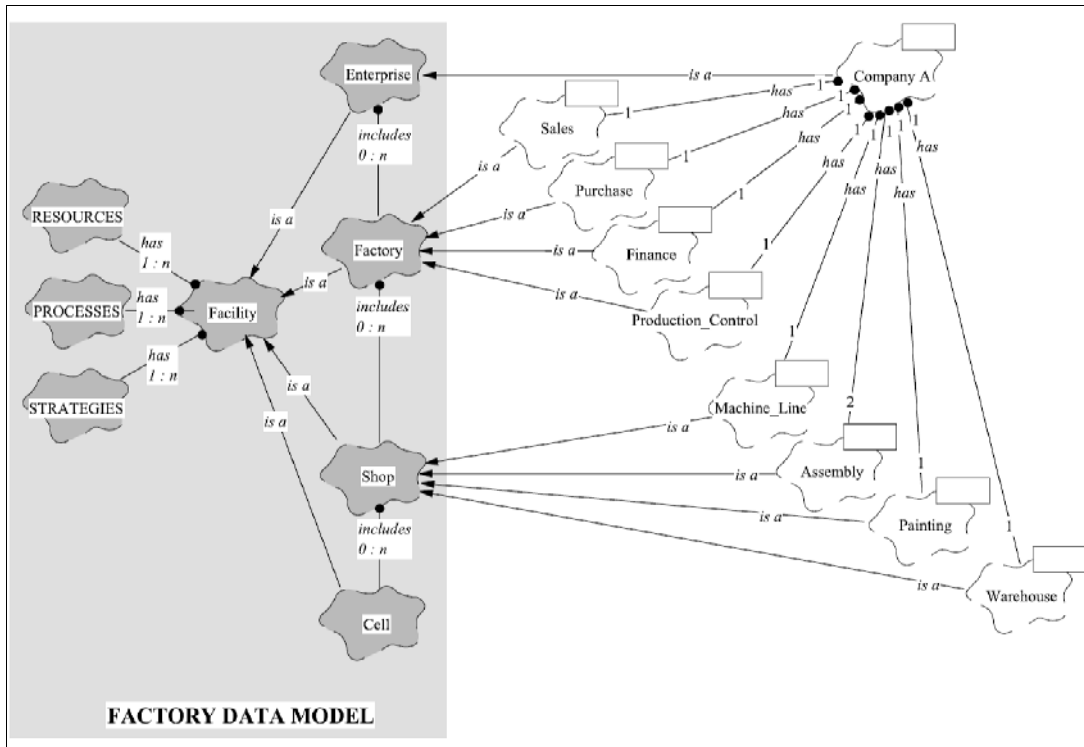


Fig.3 Example of FDM application (Yu, 2000)

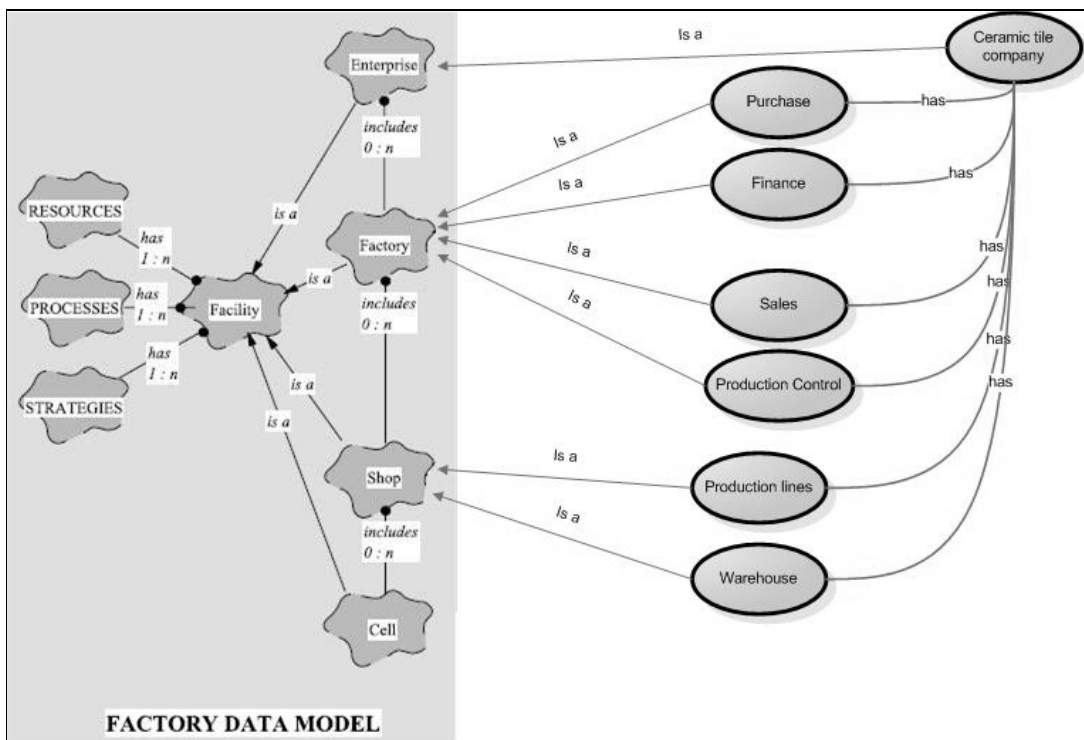


Fig.4 The tile enterprise FDM model

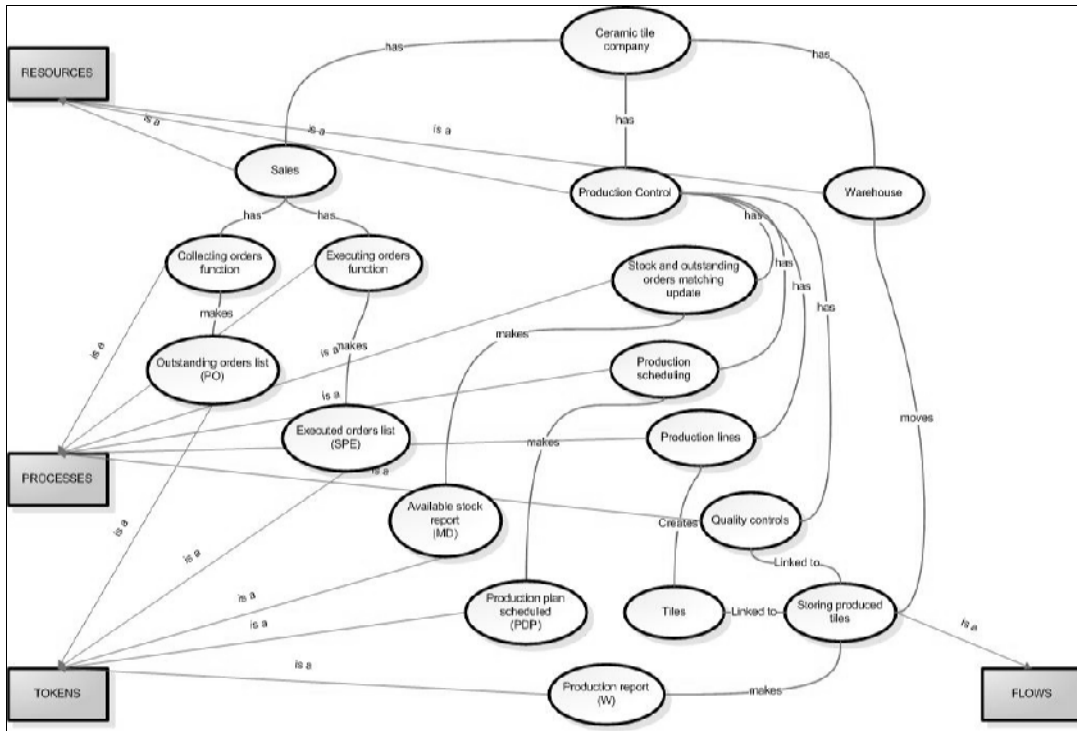


Fig.5 The tile enterprise implemented model

Virtual enterprise

In order to create a virtual enterprise it is **necessary to make** an input – output chart for each **process** in the model **and to provide** a complete processes interaction chart. The **processes described** are codified to **allow implementation** into a Matlab environment. A list of virtual products has been done in order to provide all the necessary information for processes. The sum of the average **quantities sold for each product** **should be** equal to **the** production capacity, **so balancing demand and production capacity**. **In view of the discussion** above about color variation and sub-groups of tiles, the products in the list are characterized by 3 or 4 tones for each production batch and **the distribution of relative tones**.

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Eliminato: be implemented
Eliminato: quantity
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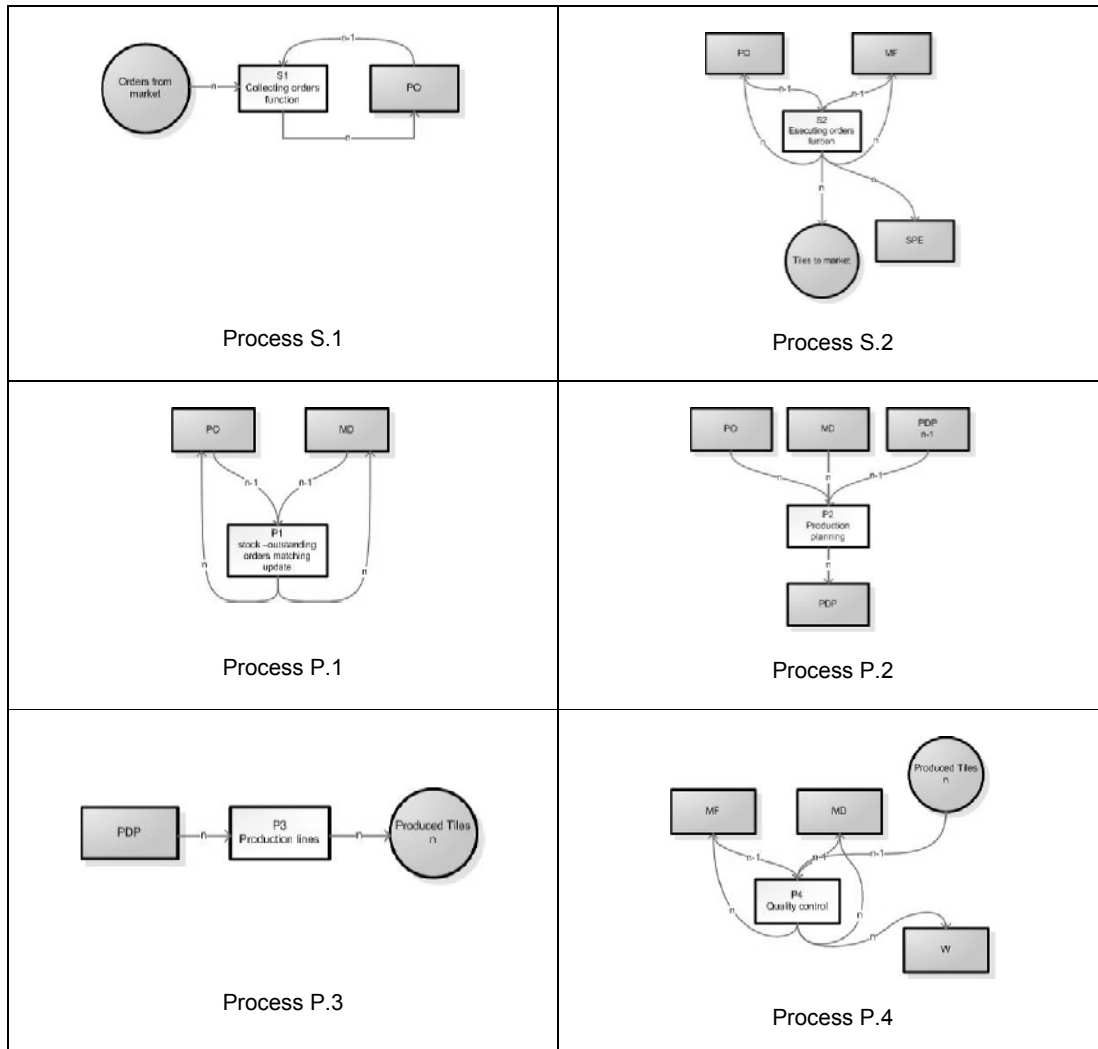


Fig.6 Singles processes input – output charts

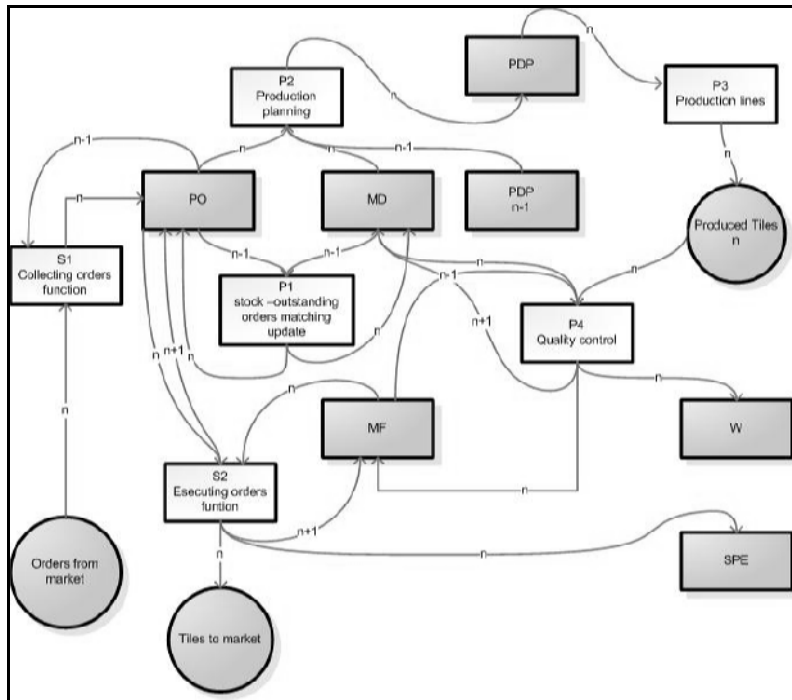


Fig.7 Processes interaction chart

MF	RESOURCES NAME	DESCRIPTION	NOTES
	Warehouse	Stock of goods produced	Day by day state
PO	TOKENS NAME	DESCRIPTION	NOTES
	Outstanding orders list	The complete list of outstanding orders. It is made of 2 types of orders. Orders matched with available goods and orders waiting for production of goods.	Day by day state
MD	Available goods list	The list of available goods	MD = (MF) – (matched orders from PO)
SPE	Sold goods list	The list of sold goods	Progressive recording
PDP	Production program	The sequence of products to produce	Progressive recording
W	Produced goods list	The list of produced goods	Progressive recording
P.S1	PROCESSES NAME	FUNCTION	NOTES
	Collecting orders function	Collect orders from market and update outstanding orders list	
	Executing orders function	Execute confirmed orders	
	Stock – outstanding orders matching update	Match outstanding orders with available good and update stock	
	Production planning	Schedule the production	
	Production lines	Execute the scheduled program and produce goods	
	Quality control	Check goods produced and update stock	

Tab.I. Resources, tokens and processes.

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¶

	PROCESSES NAME	INPUT	VIRTUAL PROCESS	OUTPUT	
P.S1	Collecting orders process	Customers orders (market)	The P.S1 process creates orders using a random function. Orders can be created of 2 different types. Orders of both available products and unavailable products at generation time. Every order has been generated with a set of characteristics: - Product - Quality - Quantity - Day of creation - Day of delivery	Outstanding orders list (PO) updated	Eliminato: orders of Eliminato: ones
P.P1	Stock – outstanding orders matching update	PO and MD (n)	The P.P1 process matches orders with available goods. The matching is based on a set of characteristics: - Product - Quality - Tone - Available quantity	PO and MD updated (n+1)	
P.S2	Executing orders process	PO and MF state (n)	The P.S2 process executes orders that were matched with available goods according with the day of delivery .	PO, MF state and sold goods SPE updated (n+1)	
P.P2	Production planning	PO, MD and running PDP (n)	The P.P2 process schedules products to produce basing itself on: - Scheduling strategy - PO - MD The aim of the adopted scheduling strategy is to keep a certain quantity of goods in the warehouse for each product. The amount is determined by the formula: $LDS \times DM$ where: - LDS is a fixed number of days equal for all products - DAQ is the average quantity of products sold in a day, given within the product characteristics set So for every product it is possible to have the amount of goods needed to achieve the imposed LDS, this quantity being termed (LDSS). The PDP is made for a certain number of days (NPDP) so an algorithm provide to allocate the production capacity proportionally to LDSS for each product. Implemented scheduling strategy parameters are: - LDS (stored tiles in days of production) - NPDP (scheduling period in days)	Next PDP (n +1)	Eliminato: aim Eliminato: amount Eliminato: quantity Eliminato: determinate Eliminato: product Eliminato: this DAQ in Eliminato: products Eliminato: is called Eliminato: of
P.P3	Production lines	Running PDP	The P.P3 is the production process and executes the PDP. A deterministic process is implemented. This means that the process producing each product is included within the PDP according to the production characteristics of the products. For each product is given a set of production characteristics is given composed of: % of 1,2 and 3 quality - n° of tones for each batch of production - quantity of product for each tone. No set up times are implemented. Minimum batch size is implemented.	goods	Eliminato: execute Eliminato: mean Eliminato: produce Eliminato: into Eliminato: with Eliminato: made Eliminato: s
P.P4	Quality control	goods	The P.P4 process checks the goods produced and updates the stock. It is assumed that all goods produced goods are stored in the warehouse.	MF , MD and W updated (n+1)	Eliminato: checked Eliminato: produces Eliminato: update Eliminato: ¶

Tab.II. Process description table

PRODUCTS ID	QUALITY (%1, %2; %3)			N° TONES FOR BATCH	TONES DISTRIBUTION (ONLY FOR 1 QUALITY)				DAILY AVERAGE QUANTITY SOLD (m ²)
1001	0.9	0.05	0.05	3	0.25	0.50	0.25	0.00	1000
1002	0.8	0.10	0.10	3	0.33	0.33	0.34	0.00	1000
1003	0.9	0.10	0.10	4	0.25	0.25	0.25	0.25	500
1004	0.85	0.15	0.10	4	0.25	0.25	0.25	0.25	500
1005	0.9	0.10	0.10	4	0.25	0.25	0.25	0.25	500
1006	0.9	0.10	0.10	3	0.34	0.33	0.33	0.00	250
...	...	...	...	...	...	...	...	...	
100(n-1)	0.9	0.10	0.10	3	0.34	0.33	0.33	0.00	250
100(n)	0.9	0.10	0.10	3	0.34	0.33	0.33	0.00	250

Tab.III. Virtual products list

Definition of KPI

The processes defined above create a virtual enterprise that interacts with the external environment, receiving orders from customers and selling goods to fulfill those orders. The aim of the virtual enterprise is to facilitate experimenting with changes in the processes. In order to judge the effectiveness of any change, key performance indices (KPI) are needed. The total amount of sold goods, and the amount of 1st quality goods stocked in the warehouse, were chosen as the KPI. This choice is made in consistency with the assumption that the aim of the enterprise is to produce goods in order to satisfy customers' orders. The KPI at the end of every simulated day was recorded, using a function termed "KPI recording".

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Eliminato: A function, called "KPI recording", was provided to record

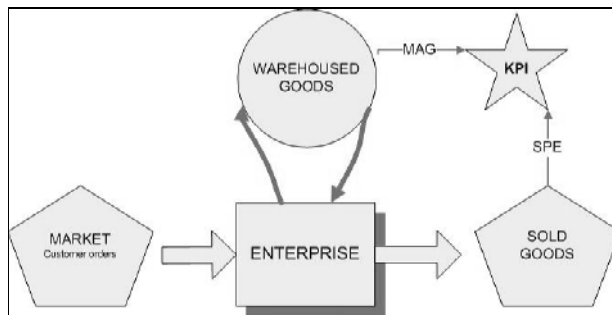


Fig.8 Enterprise environment interactions and KPI

TYPE	NAME	DESCRIPTION
KPI	SPE	The progressive total amount of sold goods
KPI	MAG	The total amount of stored 1 st quality goods

Tab.IV. KPI table

Main simulation sequence

The defined processes are listed in a sequence to simulate the daily work of the enterprise. To initialize a simulation a special process, called "INI" (see Fig.14) runs at the beginning of the first day and provides the initial amount of tiles in the warehouse and the production plan for the first period. The sequence (see Fig.15) represents the general scheme followed by the simulator. Using this main simulation sequence it is possible to investigate the change in performance, correlated with:

- Characteristics of orders (variety of products, quantity, days between date of order and estimated date of delivery),
- Stock – strategy of matching outstanding orders;
- Scheduling strategy;
- Minimum batch size;
- Number of products listed;
- Characteristics of products (quality and tone variation for each batch);
- LDS and NPDP.

ID	PROCESSES NAME	PARAMETERS	SET
INI	Initializing sequence	○ Create a stock amount of goods ○ Create a random PDP for the first period	○ Initial stock amount equal to LDSx1,5 ○ Equal to NPDP

Tab.V. Initializing process

PROCESS ID	PROCESS NAME	CONDITION
INI	Initializing sequence	Only the first day
P.S1	Collecting orders process	Each day
P.P1	Stock – outstanding orders matching update	Each day
P.P2	Production planning	Only the established days according with NPDP
P.P3	Production lines	Each day
P.P4	Quality control	Each day
P.S2	Executing orders process	Each day
REC	KPI recording	Each day

Tab.VI. Main simulation sequence

Add-on to perform simulation focusing on information flow

In order to simulate the effect of the reliability of information on the performance of a tile company, a specific add-on was implemented. The add-on is made of a modified S.1 process together with a new process called S.3 (see Fig.16) and a new parameter termed "TA". The TA parameter indicates the rate of unreliable orders generated each day. The S.1 process is modified to create a number of orders which increase the TA rate. The S.1 process marks this excess of orders as "unreliable". The S.3 process inspects all the orders outstanding and deletes the "unreliable" ones which have a delivery date less than 3 days from the current day of simulation. In this way unreliable orders enter the system for a certain period and affect scheduling process before expiry. The modified simulation sequence is shown in Table VII.

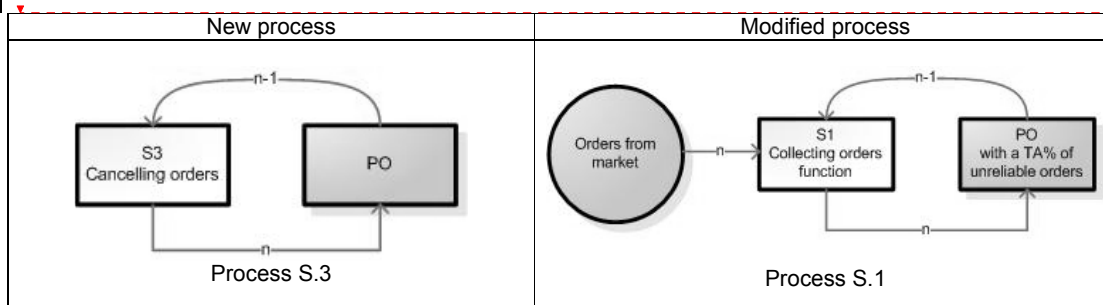


Fig.9 Process S.3

PROCESS ID	PROCESS NAME	CONDITION	NOTE
INI	Initializing sequence	Only the first day	

Eliminato: enterprise

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Eliminato: Orders characteristics

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Eliminato: about

Eliminato: perform simulation about information

Eliminato: impact

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Eliminato: ¶

P.S1	Collecting orders process	Each day	modified
P.P1	Stock – outstanding orders matching update	Each day	
P.P2	Production planning	Only the established days according with NPDP	
P.P3	Production lines	Each day	
P.P4	Quality control	Each day	
P.S3	Cancelling orders process	Each day	added
P.S2	Executing orders process	Each day	
REC	KPI recording	Each day	

Tab.VII.Modified simulation sequence

Purpose of Experiment

Using data supplied by Assopiastrelle and other enterprises directly involved in this research, a promising area in which a process may be redesigned was identified as the information flow, that is the process from the collection of an order through scheduling to the selling of a product. To enable the influence of the information process on the company's performance to be quantified, but without interfering with its daily activity, the virtual enterprise as described above, was adapted to incorporate a specific add-on. This models the presence of what are termed unreliable orders. It represents the degree of reliability of the information system that, in the real world, supports and on which are based the scheduling decisions. A comparison between rate of TA and other parameters is needed to evaluate the relative importance of the TA rate itself. In our current study all simulation parameters are fixed to representative values for a typical or 'average' company, in accordance with the experience of, and information supplied by, Assopiastrelle. Only NPDP and LDS are studied here, and within a predetermined range. We chose to investigate NPDP and LDS because these are the parameters that managers can handle more easily. In fact a slight variation in these 2 parameters can be achieved in practice without either financial investment or process redesign. The full setting of parameters is provided in Tab. VIII.

ID	PROCESS NAME	PARAMETERS	SET
P.S1	Collecting orders process	- Daily orders number (N) - Random function for Products generation - Random function for Quality generation - Random function for Quantity generation - Random function for Day of delivery generation - TA rate, unreliability of information system	$N = (\text{Production capacity}) / (\text{Average order amount})$ - Simple random function - Only 1 quality - Simple random function from 50 to 900 m² - Simple random function from 5 to 45 days 00% and 20%
P.P1	Stock – outstanding orders matching update	Matching rules	Matching for product, quality and a single tone is needed for each order
P.S2	Execution of orders	Order characteristics to be executed	- Already matched - Current day equal or superior to delivery day
P.P2	Production planning	Implemented scheduling strategy parameters are: - Production capacity - LDS - NPDP	20.000 m² every day - from 45 to 75 days - from 10 to 30 days
P.P3	Production lines	Minimum batch size	5.000 m²

Tab.VIII. Setting of process parameters

Eliminato: purpose

Eliminato: Thanks to information collected from

Eliminato: some

Eliminato: to

Eliminato: redesign is detected in

Eliminato: ;

Eliminato: order

Eliminato: till

Eliminato: and products

Eliminato: make possible quantifying

Eliminato: firm performances

Eliminato: the

Eliminato: with the

Eliminato: was developed. The

Eliminato: the

Eliminato: , in the model,

Eliminato: word, support

Eliminato: decision are based on

Eliminato: TA

Eliminato: this research

Eliminato: value

Eliminato: an average firm, according

Eliminato: the

Eliminato: from

Eliminato: in a determinate

Eliminato: This work chooses

Eliminato: this

Eliminato: easier

Eliminato: of this

Eliminato: done

Eliminato: any investments

Eliminato: parameters

Eliminato: ES

Eliminato: wanted

Eliminato: Executing

Eliminato: process

Eliminato: Processes

Eliminato: setting

Computer experiments DOE

To make a comparison between the performance of companies with satisfactory and poor information flows, LDS and NPDP are fixed at central values within the ranges indicated. For LDS a target value of 60 days was taken. This value approximated the mean of 65.25 days for warehoused tiles reported by Bonavia (2006). NPDP was fixed at 20 days in accordance with information supplied by Assopiastrelle. Using these values 3 runs, named group A, were performed using the main simulation sequence, for which TA = 0%. A second group of 3 runs, B, was performed using the add-on sequence with a TA of 20%. Within group B 1 order out of 5 was assumed to be unreliable, and the two group comparison was used to confirm the validity of the model itself.

Using the DOE web application at www.webdoe.cc (Crary, 2001) other simulations were performed to investigate the influence of changes in LDS and NPDP. This series of simulations was useful in comparing the effects of unreliability in information on KPI with those of other controlling parameters. The ranges selected for LDS and NPDP were 45 to 75 days and 10 to 30 days respectively. The DOE application indicates how the simulations should be set (see Fig. 10) and Tab. IX shows the entire sets of parameters for the series of runs. Every run is marked by a 3-record label, for instance 20.60.000 signifies a run for which LDS = 20 days NPDP = 60 days and TA = 0%.

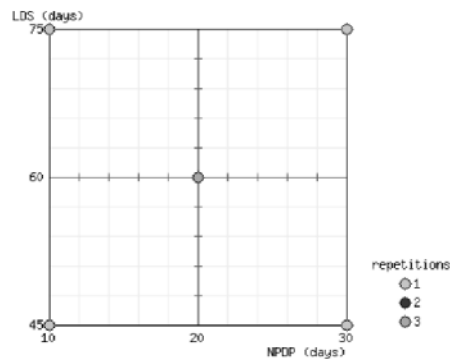


Fig.10 DOE for NPDP and LDS parameters

Group	Simulation label	LDS (days)	NPDP (days)	TA (%)
A	1x20.60.000	20	60	000
A	2x20.60.000	20	60	000
A	3x20.60.000	20	60	000
B	1x20.60.020	20	60	020
B	2x20.60.020	20	60	020
B	3x20.60.020	20	60	020
	10.45.000	10	45	000
	30.45.000	30	45	000
	10.75.000	10	75	000
	30.75.000	30	75	000
	10.45.020	10	45	020
	30.45.020	30	45	020
	10.75.020	10	75	020
	30.75.020	30	75	020

Tab.IX. Simulation DOE

Eliminato: To perform a comparison between the performances of firms with a good information flow and a the performances of firms with a poor one, are fixed even NPDP and LDS at the middle value of the indicated ranges.

Eliminato: is taken

Eliminato: , this value is approximately the same

Eliminato: the

Eliminato: amount

Eliminato: ,

Eliminato: fact he indicates a mean of 65.25 days (Bonavia, 2006). For NPDP is fixed a value of 20 days, this value is due to the

Eliminato: collected from

Eliminato: Then

Eliminato: simulations

Eliminato: are

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Eliminato: %) and othe ... [23]

Eliminato: ed

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Eliminato: . The

Eliminato: are

Eliminato: even

Eliminato: determinate ... [24]

Eliminato: are

Eliminato: impact

Eliminato: parameters ... [25]

Eliminato: The

Eliminato: range

Eliminato: is from

Eliminato: the NPDP c ... [26]

Eliminato: .

Eliminato: to

Eliminato: the simulations

Eliminato:).

Eliminato: simulation ... [27]

Eliminato: .

Eliminato: records

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Eliminato: means

Eliminato: with this setting:

Eliminato: 20 days, LDS =

Eliminato: ¶

Findings

Full graphical information for KPI1 (SPE, sold goods) and KPI2 (MAG, stored goods) is presented for group A in Figs. 11-12 and B in Figs. 13-14 respectively. Findings for these groups may be compared to assess the reliability of the model itself and to choose the observation period. The standard deviation is calculated for groups A and B in Figs. 15 and 16 respectively. Finally the results for all the simulations are presented in Fig 17 and Tab. X.

Groups A and B simulations

Eliminato: The full charts about

Eliminato: are

Eliminato: groups

Eliminato: .

Eliminato: of A and B groups are used

Eliminato: determinate

Eliminato: both

Eliminato: (see Fig.15,16). Then all

Eliminato: of

Eliminato: (see

Eliminato:).

Eliminato: ¶

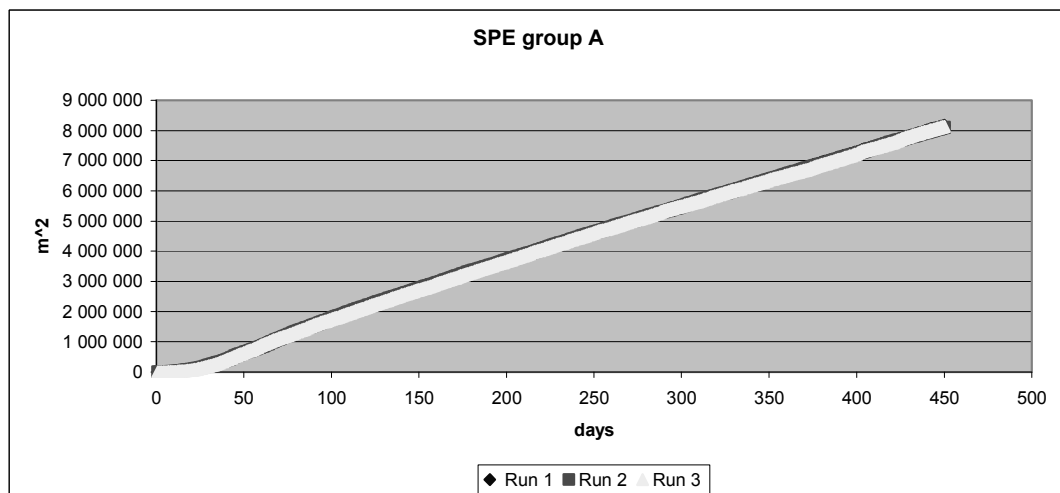


Fig.11 SPE indicators for A group

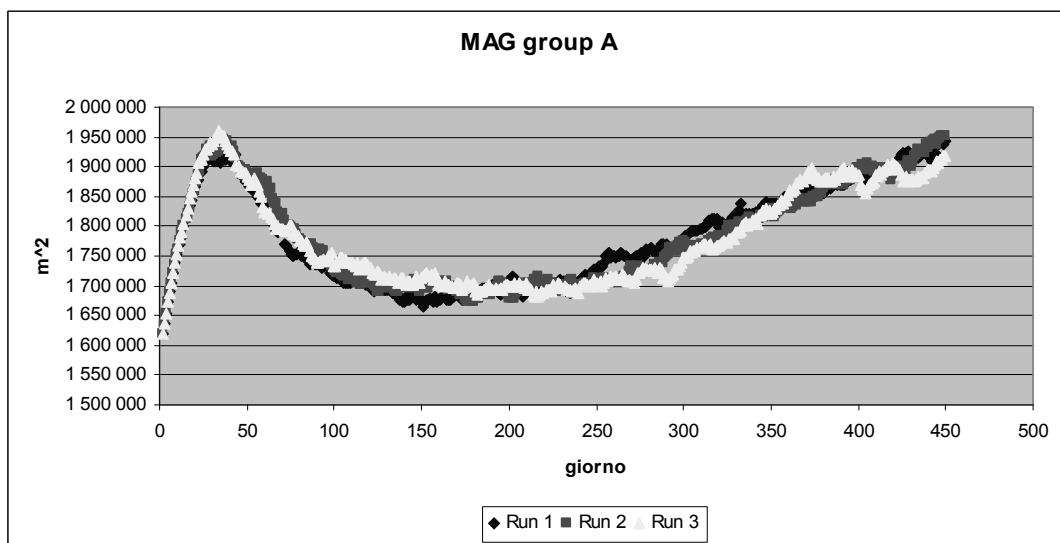


Fig.12 MAG indicator for A group

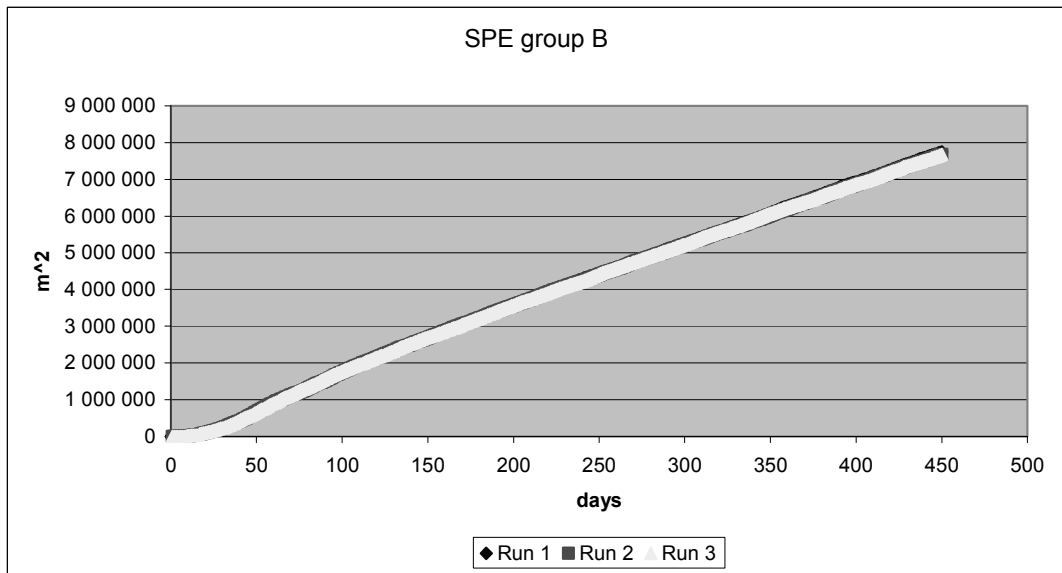


Fig.13 SPE indicator for B group

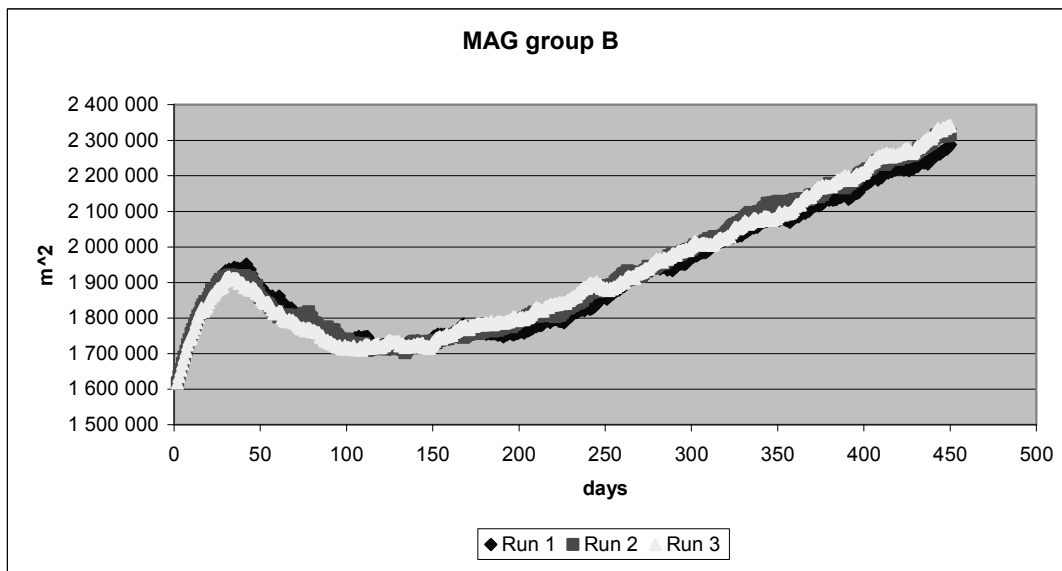


Fig.14 MAG indicator for B group

Eliminato: Model reliability

Reliability of model and observation period

These were assessed in terms of the standard deviation for SPE and MAG in m^2 of tiles.

Eliminato: Standard

Eliminato: ¶

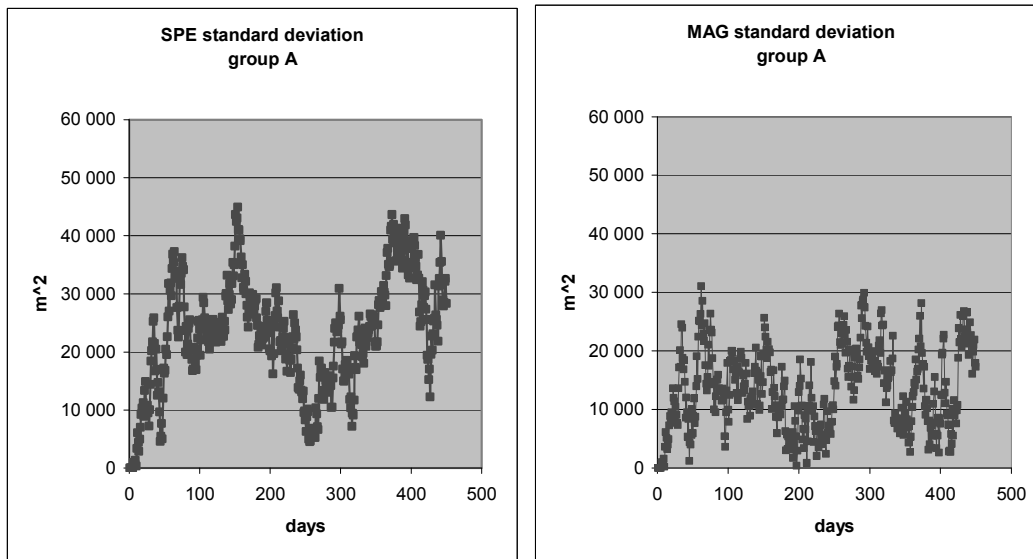


Fig.15 Standard deviation of SPE and MAG for A group in m^2 of tiles.

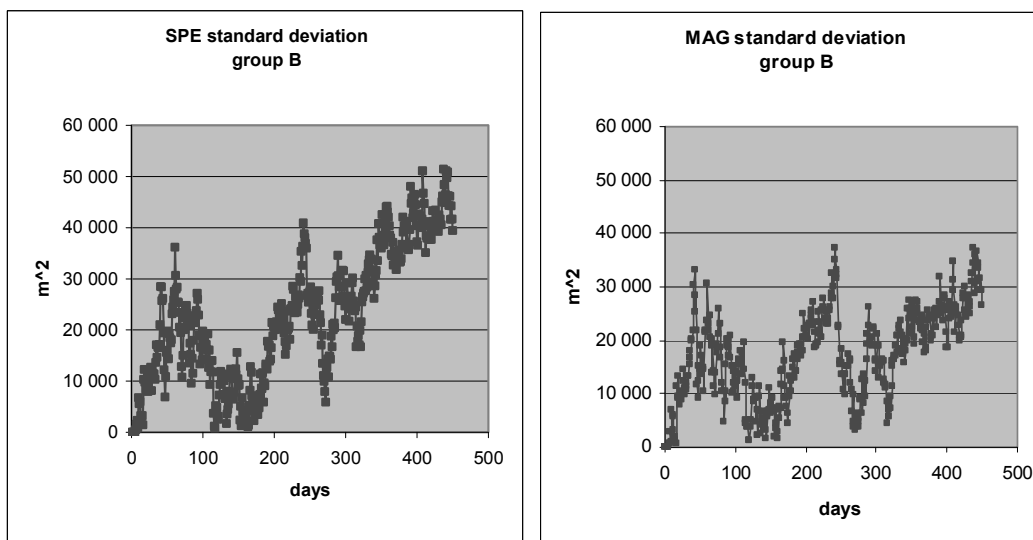


Fig.16 Standard deviation of SPE and MAG for B group in m^2 of tiles.

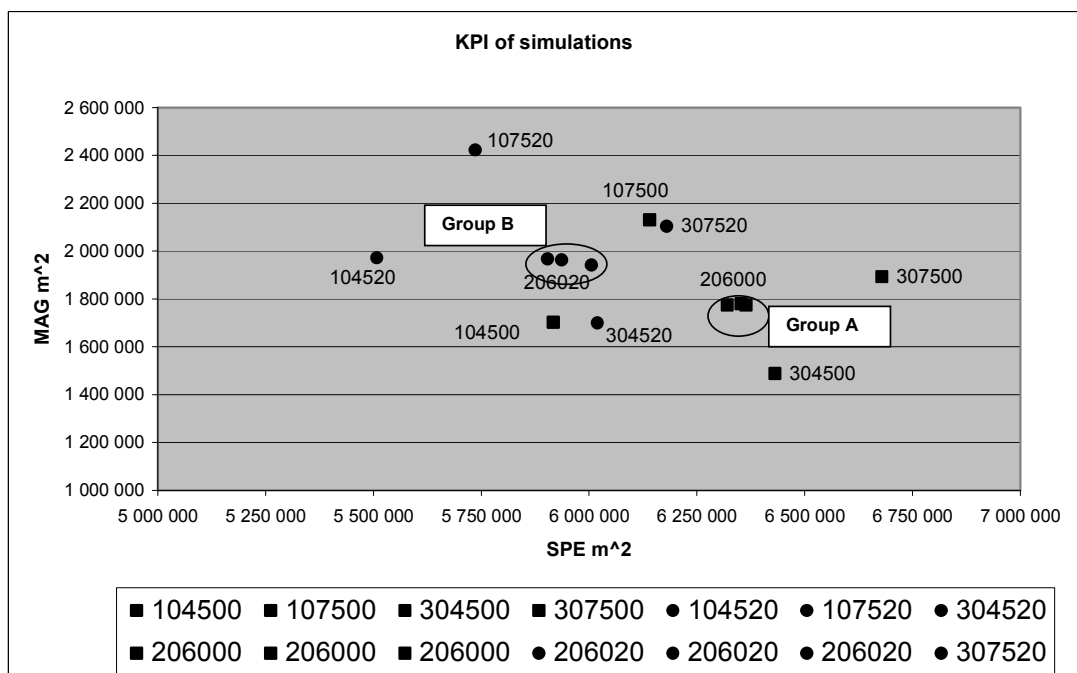


Fig.17 **Chart of the simulation results**

Eliminato: All

Group	Simulation label	LDS (days)	NPDP (days)	TA (%)	KPI1-SPE m ²	KPI2-MAG m ²
A	1x20.60.000	20	60	00	6.364.163	1.773.900
A	2x20.60.000	20	60	00	6.352.804	1.779.131
A	3x20.60.000	20	60	00	6.320.481	1.774.061
B	1x20.60.020	20	60	20	6.005.767	1.941.348
B	2x20.60.020	20	60	20	5.936.722	1.963.021
B	3x20.60.020	20	60	20	5.903.869	1.967.253
	10.45.000	10	45	00	5.916.906	1.701.886
	30.45.000	30	45	00	6.140.876	2.129.712
	10.75.000	10	75	00	6.431.394	1.488.631
	30.75.000	30	75	00	6.679.229	1.893.034
	10.45.020	10	45	20	5.508.119	1.971.940
	30.45.020	30	45	20	5.736.430	2.422.074
	10.75.020	10	75	20	6.019.342	1.699.432
	30.75.020	30	75	20	6.180.411	2.103.763

Tab.X. All simulations results

Interpretation of results

The KPI graphs of Figs. 11-14 indicate that a transition period exists from the initialization process to the 100th day of the simulation. Hence the observation period proper is taken from the 100th to the 450th day of the simulation, so referring to about a year of operation of the company.

Eliminato: From the findings we can see that the charts (see Fig. 12-13-...) present transitory... due to... till s... So... this mean that results from simulations refer an ... firm work. ... [28]

Figs. 11 and 13 show that SPE has a linear trend over the observation period. The only difference between the TA rates of 0% and 20% is in the gradient of the graphs.

Eliminato: SPE charts... in... rate... 00% cases... TA rate of ... cases only... charts (see Fig. 1... [29]

Figs. 12 and 14 for MAG show an increasing tendency in both cases. This finding was expected, because the residual tiles of homogeneous sub-groups constitute what could be termed 'dead' groups when their quantities become too small to satisfy the orders. This is because there is a minimum quantity per order of 50 m², so a sub-group whose amount is below this never leaves the stock in hand. In the real world, the residual tiles which would cause this anomaly are declassified and enter a clearance sale. This does, however, represent an additional operational cost.

Eliminato: charts ... case (see Fig. 13-14)... result... began a sort of "dead"... amounts is fulfill... Orders are created from 50 to 900 square meters each, so a sub-group whose amount is smaller than 50 square meters is stocked forever. This phenomenon, in real word, is prevented by declassification and clearance sale of sub-groups residual tiles and it represents a cost. ... [30]

The graphs for standard deviations in the results (Figs. 15 and 16) show series of oscillations with no evidence of any tendency toward a stabilized value. Their values are higher for the case of 20% TA rate. It may be noted from Fig. 17 that the area for group B area is larger than that for A. Also, the absolute value of the standard deviation is very small in comparison with the magnitude of the correlated quantity: in the worst case it is about 1% for SPE and 3% for MAG. We interpreted the maximum of the standard deviation, over the entire observation period, as the basic uncertainty of the model itself: 51.500 m² for SPE and 37.500 m² for MAG.

Eliminato: The standard deviation charts (see Fig. 13-14)... present a ... and there is evidences of a... The standard deviation... bigger in ... We can observe (see Fig. ...) ... bigger than group ... one. By ... way he front of the amount... The... during ... [31]

A linear model function is used to describe the correlation of SPE and MAG with the following parameters: NPDP, LDS and TA. The functions for SPE and MAG are calculated at www.webdoe.cc using the same linear model function for both.

Eliminato: studied

$$Y = \beta_0 + \beta_1 * NPDP + \beta_2 * LDS + \beta_3 * TA + \varepsilon$$

Fig. 18 Model function $Y = [SPE \text{ m}^2, MAG \text{ m}^2]$

Y	β_0	β_1	β_2	β_3	$\varepsilon_{\max}$
SPE	5.095.803	16.734	10.765	-20.823	± 51.500
Y	α_0	α_1	α_2	α_3	$\varepsilon_{\max}$
MAG	1.890.182	-8.673	21.084	10.918	± 37.500

Tab.XI. Calculated coefficients for model function

Y	β_0 / α_3	β_1 / α_3	β_2 / α_3	β_3 / α_3	β_3 / α_3
SPE	467	1,53	0,99	-1,91	4,72
Y	α_0 / α_3	α_1 / α_3	α_2 / α_3	α_3 / α_3	α_3 / α_3
MAG	173	-0,79	1,93	1,00	3,43

Tab.XII. Normalized coefficients on α_3 for SPE and for MAG

The normalized coefficients show that the influence of the information reliability (TA) on KPI is comparable with the influence of the other parameters studied (NPDP and LDS).

Eliminato: parameter

In the case of SPE the most important factors are TA and NPDP. It can be argued that the importance to scheduling of a long period points to a larger batch size in tile production involving and this results in a small number of sub-groups based on a classification in terms of tone. It is more important to have less sub-groups than to have a more reactive production system. The same consideration holds about the influence of NPDP upon MAG. These findings support the conclusion that the correlation between reduction in set-up time and increase in stock is due to having more sub-groups of products.

Eliminato: schedule admit... produce tiles with bigger... produce ... tones The importance ... is more important ... can be made... the ... This ... fact... set-up time ... with the ... of ... [32]

Regarding SPE analysis of the coefficients indicates that LDS is the less important parameter. This outcome results from the influence of the choices made in the very implementation of the model itself. This is due to the balance between production and the market request for tiles being a defined constituent of the model. A flat production capacity, which is a practical characteristic for a tile company, has in the model an implication of a matching flat market request. This may underestimate the importance of LDS upon SPE. Nevertheless, the growing internationalization of markets contributes to the stabilization of market demand over the year by removing the influence of purely national seasons and holiday periods.

The importance of TA is well indicated from the result that a single point percentage change in rate of TA affects both SPE and MAG more than a one day change in NPDP.

Eliminato: About the... the... this finding is affected... one... that... In fact... model is balanced for what concern the... of... typical... firm, is matched with a ... contribute to stabilized the request along... and to remove... [33]

Eliminato: fact... percent of TA ... of ... [34]

Eliminato: s/benefits

Cost/benefit analysis

To enable a full cost/benefit analysis to be carried out, a simple function is proposed, termed the "Earning function". Maximizing the proposed function means that the performance of the company, as defined in the model, is optimised in terms of enterprise profit.

Eliminato: make possible... it is called: Maximize... mean to maximize... firm performances... looking ... [35]

$$f(SPE, MAG) = M * SPE - C_m * MAG$$

Fig.19 Earning function

Where:

- M is the spread between the average sale price and the average cost for 1 m² of tiles;
- C_m is the average warehousing cost for 1 m² of tiles;
- As presented above it is possible to have a linear function that correlated the KPI with the parameters studied: $SPE = \beta_0 + \beta_1 * NPDP + \beta_2 * LDS - \beta_3 * TA$;
- $MAG = \alpha_0 - \alpha_1 * NPDP + \alpha_2 * LDS + \alpha_3 * TA$.

Eliminato: studied $SPE = \beta_0 + \beta_1 * NPDP + \beta_2 * LDS - \beta_3 * TA$... [36]

Eliminato: $MAG = \alpha_0 - \alpha_1 * NPDP + \alpha_2 * LDS + \alpha_3 * TA$

After substitution, the earning function can be written as a dependent variable of the model parameters:

$$f(SPE, MAG) = f(NPDP, LDS, TA) = (M\beta_0 - C_m\alpha_0) + (M\beta_1 + C_m\alpha_1) * NPDP + (M\beta_2 - C_m\alpha_2) * LDS - (M\beta_3 + C_m\alpha_3) * TA$$

Fig.20 Earning function

$$(M\beta_2 - C_m\alpha_2) > 0 \Rightarrow \frac{M}{C_m} > \frac{\alpha_2}{\beta_2}$$

Fig.21 Coefficient of LDS term

The function, as expressed in Fig. 20, allows some considerations to be made about the management of a tile firm. The first term on the right hand side is the most important one, due to the weight of the coefficients. A more competitive market scenario reduces the spread M (Assopiastrelle, 2000) and contributes to an increase in warehousing cost due to increased storage of products and a more rapid obsolescence of the products themselves. This tendency highlights the importance of taking the other factors into account that in a previously strong growing market were neglected by management.

A longer NPDP always has a positive impact on the function because of the production of a smaller number of larger homogeneous sub-groups of tiles. The effect of NPDP is significant for a range close to the fixed central value of 20 days. It is presumed that a threshold value exists for NPDP. Above this value the production system became too slow in responding to a market request and the company loses outstanding orders because of the waiting time. This option is not implemented in the model as we have used it.

The LDS term in Fig. 21 suggests that the facility of a larger warehouse correlates directly with the ratio between M spread and C_m cost. The simulations indicate that in this case a larger warehouse is to be preferred only if the M spread is more than double the C_m cost.

The TA term indicates that an unreliable information system always negatively affects a firm's performance and the importance of this factor is comparable with those of the other parameters.

Eliminato: permits...tile firms coefficients ... the more storing ...the faster...market previous ... [38]

Eliminato: has bigger...center...The existence of...valued... is supposed. Over...threshold ...answering the...firm losses...used ... [39]

Eliminato: (see Fig. 21) ...a bigger...convenience is strictly connected...bigger...pr... [40]

Eliminato: indicate...affects the firm performances...factor ones studied ... [41]

Conclusions

In this work we have described the development of a model of a tile company which can be successfully used to investigate the influence of any parameter on its performance. The FDM model is implemented to create a virtual enterprise. The specific advantage of the FDM model is that it is possible to utilise it with only a partial modeling of the firm. This allows the creation of a model which focuses on a particular aspect without having to spend resources and time in creating a full, but demanding, enterprise model.

The paper presents the application of the proposed approach to a generic tile firm. In this case the model represents the whole manufacturing sector of the tile industry. The FDM-related model is based on the common features of tile firms obtained mainly from a literature review and collaboration with Assopiastrelle. The model is split into a series of functions, each of which is implemented in Matlab. The functions are arranged into a basic sequence and a set of KPI is identified to evaluate the firm's performance. The basic sequence of functions may be upgraded to investigate any particular aspect of company management, in this specific case the importance of the reliability of the information system. This add-on demonstrates how the final Matlab code maintains the characteristics of the FDM model while being easily extendable and upgradeable. When the set of parameters and the model specific to the application are fixed, the simulations, performed with the Matlab code, allows the empirical equation to be determined that connects the parameters studied with the KPI. This equation is useful in allowing the management to make a cost/benefit analysis. A simple "Earning function" is proposed to connect the parameters together. Finding the best set for the parameters for an individual case is possible by maximizing the "Earning function". A cost analysis is needed to explicitly relate the cost to the parameter setting and the minimization of investment needed.

In this paper the model focuses on the importance of the system, which collects and handles the information about the orders. This focus was identified because it was evident from the experience of Assopiastrelle that the information aspects of business constitute one of the areas of tile firms activities which needs improvement. The simulations performed here involve the construction of the equations, which explicitly connect the dependence of KPI with 3 selected parameters. These are: NPDP (scheduling period in days), LDS (warehouse consistency in days of production capacity) and TA (rate of unreliable orders which penetrate the information system). The results indicate that the rate of TA is always negative and its importance is comparable with that of the other two parameters above. Moreover the results suggest that one of the most important factors in tile industry performance is the presence of sub-groups of tiles due to variations in tile coloring.

The proposed approach is well suited to instances of tile enterprises because the Matlab model we have developed represents a starting point from which it is possible to create a model for a specific firm. The development of such a model can be carried out with modest financial and other resources. This is because the approach is deliberately planned to start from any specific aspect of activity, and to enlarge the model as needed. The implementation of this approach forms a useful tool for the enterprise in that it can support management decision-making and investment planning.

Eliminato: This work shows how following the proposed approach it is possible to build on a firm model and use it to investigate to influence of any parameters on firms performances...strong side...make ... This allowed to create ...focusing on a specific spending...trying to create...hard ... [42]

Eliminato: present...represent tiles. An ...done basing...s...the literatures...from the Assopiastrelle ... and every functions...writing a ... code...es to perform the firm work...firm performances...was ...a specific...firm...feature...to be expendable and upgradeable...is fixed ...is developed...allowed to find...joints ...parameters ... equations are...making cost/benefits analysis by... In this paper...get ... the parameters...studied parameters...explicit ...related to minimize the investm... [43]

Eliminato: is focusing...Information that...is done...emerged are... area for tile firms...performed ...allow to write...explicating the dependences of KPI with ...get into...TA ...the importance...studied ...parameter for tile industries performances...variatic... [44]

Eliminato: fits the...instances developed ...the ...each ...the on...a small resource...money spending ...forecast...a makes available ...a useful tool in order to...decisions in... [45]

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Pagina 1: [1] Eliminato	*	03/03/2008 11.34
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Pagina 1: [1] Eliminato	*	03/03/2008 11.34
in investments		
Pagina 1: [2] Eliminato	*	03/03/2008 11.34
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gives an approach to create		
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simulating		
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firms and demonstrates		
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point out the influences of		
Pagina 1: [3] Eliminato	*	03/03/2008 11.34
decision on		
Pagina 1: [4] Eliminato	*	03/03/2008 11.34

result

Pagina 1: [4] Eliminato	*	03/03/2008 11.34
description of a		
Pagina 1: [4] Eliminato	*	03/03/2008 11.34
firm		
Pagina 1: [4] Eliminato	*	03/03/2008 11.34
due to the 3 studied		
Pagina 1: [4] Eliminato	*	03/03/2008 11.34
wanted		
Pagina 1: [4] Eliminato	*	03/03/2008 11.34
if		
Pagina 1: [4] Eliminato	*	03/03/2008 11.34
orders		
Pagina 1: [4] Eliminato	*	03/03/2008 11.34
. Simulation results point out		
Pagina 1: [4] Eliminato	*	03/03/2008 11.34
between outstanding orders of		
Pagina 1: [4] Eliminato	*	03/03/2008 11.34
ones has		
Pagina 1: [4] Eliminato	*	03/03/2008 11.34
not		
Pagina 1: [4] Eliminato	*	03/03/2008 11.34
and		
Pagina 1: [4] Eliminato	*	03/03/2008 11.34
factor for tile firms performances.		
Pagina 1: [5] Eliminato	*	03/03/2008 11.34
paper		
Pagina 1: [5] Eliminato	*	03/03/2008 11.34
developed		
Pagina 1: [5] Eliminato	*	03/03/2008 11.34
Pagina 1: [5] Eliminato	*	03/03/2008 11.34
about enterprise		
Pagina 1: [5] Eliminato	*	03/03/2008 11.34
in		
Pagina 1: [5] Eliminato	*	03/03/2008 11.34
tiles industry prevent from enlarging the		
Pagina 1: [5] Eliminato	*	03/03/2008 11.34
s		
Pagina 1: [5] Eliminato	*	03/03/2008 11.34
Pagina 1: [6] Eliminato	*	03/03/2008 11.34
result has		
Pagina 1: [6] Eliminato	*	03/03/2008 11.34
different		
Pagina 1: [6] Eliminato	*	03/03/2008 11.34
. First it points out		

Pagina 1: [6] Eliminato	*	03/03/2008 11.34
the		
Pagina 1: [6] Eliminato	*	03/03/2008 11.34
system in tile firms and		
Pagina 1: [6] Eliminato	*	03/03/2008 11.34
to		
Pagina 1: [6] Eliminato	*	03/03/2008 11.34
investments and to promote		
Pagina 1: [6] Eliminato	*	03/03/2008 11.34
widespread over all enterprise employees. Second it shows		
Pagina 1: [6] Eliminato	*	03/03/2008 11.34
followed approach to create simulating		
Pagina 1: [6] Eliminato	*	03/03/2008 11.34
in decisions making		
Pagina 1: [7] Eliminato	*	03/03/2008 11.34
Factory Data Model referring to		
Pagina 1: [7] Eliminato	*	03/03/2008 11.34
firms		
Pagina 1: [8] Eliminato	*	03/03/2008 11.34
Tile		
Pagina 1: [8] Eliminato	*	03/03/2008 11.34
physical areas: the		
Pagina 1: [8] Eliminato	*	03/03/2008 11.34
the italian		
Pagina 1: [9] Eliminato	*	03/03/2008 11.34
tile industries		
Pagina 1: [9] Eliminato	*	03/03/2008 11.34
is		
Pagina 1: [9] Eliminato	*	03/03/2008 11.34
Tile		
Pagina 1: [9] Eliminato	*	03/03/2008 11.34
starting from clay. These products		
Pagina 1: [9] Eliminato	*	03/03/2008 11.34
or		
Pagina 1: [9] Eliminato	*	03/03/2008 11.34
In tile industries, the		
Pagina 1: [9] Eliminato	*	03/03/2008 11.34
that has been		
Pagina 1: [9] Eliminato	*	03/03/2008 11.34
been grinded		
Pagina 1: [9] Eliminato	*	03/03/2008 11.34
Productive system		
Pagina 2: [10] Eliminato	*	03/03/2008 11.34
(press		
Pagina 2: [10] Eliminato	*	03/03/2008 11.34

glazing line

Pagina 2: [10] Eliminato	*	03/03/2008 11.34
)		
Pagina 2: [10] Eliminato	*	03/03/2008 11.34
)		
Pagina 2: [10] Eliminato	*	03/03/2008 11.34
(E)		
Pagina 2: [10] Eliminato	*	03/03/2008 11.34
third		
Pagina 2: [10] Eliminato	*	03/03/2008 11.34
) (see Fig. 1).		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34
The		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34
put		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34
the press		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34
tile is		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34
After the press, the tiles		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34
a conveyor. There are different machines		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34
the conveyor,		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34
put different products when a tile passes		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34
Some machines put the		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34
in the picture		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34
represented		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34
in the picture) or		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34
represented		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34
in the picture). These products will produce the		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34
when they are cooked		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34
the kilns. When the parts arrive to the end of the line, a loader put them in		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34
brings		
Pagina 2: [11] Eliminato	*	03/03/2008 11.34

The products are

Pagina 2: [11] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

with

Pagina 2: [11] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

produces

Pagina 2: [11] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

or

Pagina 2: [11] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

Once the parts have finished

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

Something more should be said about the results of

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

industries

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

. In

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

phenomenon

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

problems

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

of

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

this implies that each model

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

must

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

be

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

by

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

In

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

is investigated by

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

-one and there are no works

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

Arguing a range for tone variation

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

by technical paper of

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

machines

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

line has got

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

exits

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
---------------------------------	----------	-------------------------

exits (SACMI thecnical paper, 2007). The hypothesis of a

Pagina 2: [12] Eliminato	*	03/03/2008 11.34
quality		
Pagina 2: [12] Eliminato	*	03/03/2008 11.34
only		
Pagina 2: [12] Eliminato	*	03/03/2008 11.34
is taken. The		
Pagina 2: [12] Eliminato	*	03/03/2008 11.34
and		
Pagina 2: [12] Eliminato	*	03/03/2008 11.34
configuration		
Pagina 2: [12] Eliminato	*	03/03/2008 11.34
for 1 st quality product.		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
At		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
beginning		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
few types		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
In		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
tile markets change and become		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
Nowadays		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
produced a great		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
and		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
cycle of each product become shorter		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
This factors		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
important		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
firms belonging to		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
in		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
the		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
of the product		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
The		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34

crates a

Pagina 2: [13] Eliminato	*	03/03/2008 11.34
problem to tile industries		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
time		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
size		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
instances		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
don't fit with the		
Pagina 2: [13] Eliminato	*	03/03/2008 11.34
system of tile industries		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
Fitting		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
with		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
product		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
challenge		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
tile industries. According with		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
experiences made in		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
sector,		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
one, Group Technology (GT) and		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
shall be thought to		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
s		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
practices		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
in a		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
is		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
the		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
GT was implemented by reducing		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
using		

Pagina 2: [14] Eliminato	*	03/03/2008 11.34
). The paper report that		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
implementation		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
GT methodology has produced		
Pagina 2: [14] Eliminato	*	03/03/2008 11.34
due principally to set up time reduction. The		
Pagina 2: [15] Eliminato	*	03/03/2008 11.34
has		
Pagina 2: [15] Eliminato	*	03/03/2008 11.34
in		
Pagina 2: [16] Eliminato	*	03/03/2008 11.34
has been		
Pagina 2: [16] Eliminato	*	03/03/2008 11.34
in		
Pagina 3: [17] Eliminato	*	03/03/2008 11.34
This		
Pagina 3: [17] Eliminato	*	03/03/2008 11.34
could		
Pagina 3: [17] Eliminato	*	03/03/2008 11.34
Lean Production (		
Pagina 3: [17] Eliminato	*	03/03/2008 11.34
)		
Pagina 3: [17] Eliminato	*	03/03/2008 11.34
s, whose GT is a part of,		
Pagina 3: [17] Eliminato	*	03/03/2008 11.34
in order		
Pagina 3: [18] Eliminato	*	03/03/2008 11.34
about LP		
Pagina 3: [18] Eliminato	*	03/03/2008 11.34
industries by		
Pagina 3: [18] Eliminato	*	03/03/2008 11.34
in the		
Pagina 3: [18] Eliminato	*	03/03/2008 11.34
.		
Pagina 3: [18] Eliminato	*	03/03/2008 11.34
in tile industry		
Pagina 3: [18] Eliminato	*	03/03/2008 11.34
case		
Pagina 3: [18] Eliminato	*	03/03/2008 11.34
Pagina 3: [18] Eliminato	*	03/03/2008 11.34
time reduction practices		
Pagina 3: [18] Eliminato	*	03/03/2008 11.34
Pagina 3: [18] Eliminato	*	03/03/2008 11.34

employees were find

Pagina 3: [18] Eliminato	*	03/03/2008 11.34
that make		
Pagina 3: [18] Eliminato	*	03/03/2008 11.34
the ones that		
Pagina 3: [18] Eliminato	*	03/03/2008 11.34
most inventory		
Pagina 3: [18] Eliminato	*	03/03/2008 11.34
association		
Pagina 3: [18] Eliminato	*	03/03/2008 11.34
make sense		
Pagina 3: [18] Eliminato	*	03/03/2008 11.34
firms		
Pagina 3: [18] Eliminato	*	03/03/2008 11.34
(Bonavia, 2006).		
Pagina 3: [19] Eliminato	*	03/03/2008 11.34
set-up time		
Pagina 3: [19] Eliminato	*	03/03/2008 11.34
the		
Pagina 3: [19] Eliminato	*	03/03/2008 11.34
of		
Pagina 3: [19] Eliminato	*	03/03/2008 11.34
with		
Pagina 3: [19] Eliminato	*	03/03/2008 11.34
of the		
Pagina 3: [19] Eliminato	*	03/03/2008 11.34
doesn't consider		
Pagina 3: [19] Eliminato	*	03/03/2008 11.34
most of all		
Pagina 3: [19] Eliminato	*	03/03/2008 11.34
allowed to produce with a smaller lot size		
Pagina 3: [19] Eliminato	*	03/03/2008 11.34
different products		
Pagina 3: [19] Eliminato	*	03/03/2008 11.34
do		
Pagina 3: [19] Eliminato	*	03/03/2008 11.34
of the increased		
Pagina 3: [19] Eliminato	*	03/03/2008 11.34
could		
Pagina 3: [19] Eliminato	*	03/03/2008 11.34
find		
Pagina 3: [19] Eliminato	*	03/03/2008 11.34
s variety		
Pagina 3: [20] Eliminato	*	03/03/2008 11.34
both		
Pagina 3: [20] Eliminato	*	03/03/2008 11.34

Lastly

Pagina 3: [20] Eliminato	*	03/03/2008 11.34
it has		
Pagina 3: [20] Eliminato	*	03/03/2008 11.34
introducing		
Pagina 3: [20] Eliminato	*	03/03/2008 11.34
about with		
Pagina 3: [21] Eliminato	*	03/03/2008 11.34
According with this assumption		
Pagina 3: [21] Eliminato	*	03/03/2008 11.34
said		
Pagina 3: [21] Eliminato	*	03/03/2008 11.34
firms		
Pagina 3: [21] Eliminato	*	03/03/2008 11.34
make		
Pagina 3: [21] Eliminato	*	03/03/2008 11.34
able		
Pagina 3: [21] Eliminato	*	03/03/2008 11.34
try		
Pagina 3: [21] Eliminato	*	03/03/2008 11.34
with few money spending		
Pagina 3: [21] Eliminato	*	03/03/2008 11.34
stops or limitation		
Pagina 3: [22] Eliminato	*	03/03/2008 11.34
all		
Pagina 3: [22] Eliminato	*	03/03/2008 11.34
industries		
Pagina 3: [22] Eliminato	*	03/03/2008 11.34
enterprises		
Pagina 3: [22] Eliminato	*	03/03/2008 11.34
firm		
Pagina 3: [22] Eliminato	*	03/03/2008 11.34
is		
Pagina 3: [22] Eliminato	*	03/03/2008 11.34
to create a tile enterprise model		
Pagina 3: [22] Eliminato	*	03/03/2008 11.34
to		
Pagina 3: [22] Eliminato	*	03/03/2008 11.34
the model		
Pagina 3: [22] Eliminato	*	03/03/2008 11.34
if it was in		
Pagina 3: [22] Eliminato	*	03/03/2008 11.34
fulfillment		
Pagina 3: [22] Eliminato	*	03/03/2008 11.34
contest		
Pagina 3: [22] Eliminato	*	03/03/2008 11.34

showed

Pagina 3: [22] Eliminato	*	03/03/2008 11.34
it is focusing		
Pagina 3: [22] Eliminato	*	03/03/2008 11.34
fulfillment and		
Pagina 12: [23] Eliminato	*	03/03/2008 11.34
%) and other 3 runs, named group		
Pagina 12: [24] Eliminato	*	03/03/2008 11.34
determinate the reliability		
Pagina 12: [25] Eliminato	*	03/03/2008 11.34
parameters. This analysis is useful to compare the effect of information reliability with the effects of other managing parameters on KPI.		
Pagina 12: [26] Eliminato	*	03/03/2008 11.34
the NPDP one is from		
Pagina 12: [27] Eliminato	*	03/03/2008 11.34
simulation setting for all		
Pagina 17: [28] Eliminato	*	03/03/2008 11.34
From the findings we can see that the		
Pagina 17: [28] Eliminato	*	03/03/2008 11.34
charts (see Fig.		
Pagina 17: [28] Eliminato	*	03/03/2008 11.34
12-13-		
Pagina 17: [28] Eliminato	*	03/03/2008 11.34
) present		
Pagina 17: [28] Eliminato	*	03/03/2008 11.34
transitory		
Pagina 17: [28] Eliminato	*	03/03/2008 11.34
due to		
Pagina 17: [28] Eliminato	*	03/03/2008 11.34
till		
Pagina 17: [28] Eliminato	*	03/03/2008 11.34
s		
Pagina 17: [28] Eliminato	*	03/03/2008 11.34
So		
Pagina 17: [28] Eliminato	*	03/03/2008 11.34
, this mean that		
Pagina 17: [28] Eliminato	*	03/03/2008 11.34
results from simulations refer		
Pagina 17: [28] Eliminato	*	03/03/2008 11.34
an		
Pagina 17: [28] Eliminato	*	03/03/2008 11.34
firm work.		
Pagina 17: [29] Eliminato	*	03/03/2008 11.34
SPE charts		
Pagina 17: [29] Eliminato	*	03/03/2008 11.34
in		

Pagina 17: [29] Eliminato	*	03/03/2008 11.34
rate		
Pagina 17: [29] Eliminato	*	03/03/2008 11.34
00% cases		
Pagina 17: [29] Eliminato	*	03/03/2008 11.34
TA rate of		
Pagina 17: [29] Eliminato	*	03/03/2008 11.34
cases		
Pagina 17: [29] Eliminato	*	03/03/2008 11.34
only		
Pagina 17: [29] Eliminato	*	03/03/2008 11.34
charts (see Fig. 11–13).		
Pagina 17: [30] Eliminato	*	03/03/2008 11.34
charts		
Pagina 17: [30] Eliminato	*	03/03/2008 11.34
case (see Fig. 13–14).		
Pagina 17: [30] Eliminato	*	03/03/2008 11.34
result		
Pagina 17: [30] Eliminato	*	03/03/2008 11.34
began a sort of “dead”		
Pagina 17: [30] Eliminato	*	03/03/2008 11.34
amounts is		
Pagina 17: [30] Eliminato	*	03/03/2008 11.34
fulfill		
Pagina 17: [30] Eliminato	*	03/03/2008 11.34
Orders are created from 50 to 900 square meters each, so a sub-group whose amount is smaller than 50 square meters is stocked forever. This phenomenon, in real word, is prevented by declassification and clearance sale of sub-groups residual tiles and it represents a cost.		
Pagina 17: [31] Eliminato	*	03/03/2008 11.34
The standard deviation charts (see Fig.		
Pagina 17: [31] Eliminato	*	03/03/2008 11.34
-		
Pagina 17: [31] Eliminato	*	03/03/2008 11.34
present a		
Pagina 17: [31] Eliminato	*	03/03/2008 11.34
and there is		
Pagina 17: [31] Eliminato	*	03/03/2008 11.34
evidences of a		
Pagina 17: [31] Eliminato	*	03/03/2008 11.34
The standard deviation		
Pagina 17: [31] Eliminato	*	03/03/2008 11.34
bigger in		
Pagina 17: [31] Eliminato	*	03/03/2008 11.34
We can observe (see Fig.		
Pagina 17: [31] Eliminato	*	03/03/2008 11.34
)		
Pagina 17: [31] Eliminato	*	03/03/2008 11.34

bigger than group

Pagina 17: [31] Eliminato	*	03/03/2008 11.34
one. By		
Pagina 17: [31] Eliminato	*	03/03/2008 11.34
way he		
Pagina 17: [31] Eliminato	*	03/03/2008 11.34
front of the amount		
Pagina 17: [31] Eliminato	*	03/03/2008 11.34
,		
Pagina 17: [31] Eliminato	*	03/03/2008 11.34
The		
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was taken		
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admit		
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produce tiles with		
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tones		
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. The importance		
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is more important		
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can be made		
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the		
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This		
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with the		

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S		
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it is called:		
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Maximize		
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mean to maximize		
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firm performances		
Pagina 18: [35] Eliminato	*	03/03/2008 11.34
looking for the		
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studied		
Pagina 18: [36] Eliminato	*	03/03/2008 11.34
$SPE = \beta_0 + \beta_1 * NPDP + \beta_2 * LDS - \beta_3 * TA$		
Pagina 18: [37] Eliminato	*	03/03/2008 11.34
substituting		
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write in dependency		
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more storing		
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the faster		
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market		
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previous

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has

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bigger

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center

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The existence of

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valued

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is supposed. Over

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threshold

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answering the

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firm losses

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used

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(see Fig. 21)

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a bigger

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convenience is strictly connected

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bigger

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prefer

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than

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indicate

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affects

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the firm performances

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factor

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ones studied

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This work shows how following the proposed approach it is possible to build on a firm model and use it to investigate to influence of any parameters on firms performances.

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strong side		
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make		
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This allowed to create		
Pagina 19: [42] Eliminato	*	03/03/2008 11.34
focusing on a specific		
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spending		
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trying to create		
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hard		
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present		
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represent		
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tiles. An		
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done basing		
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Pagina 19: [43] Eliminato	*	03/03/2008 11.34
.		
Pagina 19: [43] Eliminato	*	03/03/2008 11.34
and every functions		
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writing a		
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code.		
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es to perform the firm work		
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firm performances.		
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was		
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a specific

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firm		
Pagina 19: [43] Eliminato	*	03/03/2008 11.34
feature		
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to be expendable and upgradeable		
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is fixed		
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is developed		
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allowed to find		
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joints		
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parameters		
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equations are		
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making cost/benefits analysis by		
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. In this paper		
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get		
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the parameters.		
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studied parameters		
Pagina 19: [43] Eliminato	*	03/03/2008 11.34
explicit		
Pagina 19: [43] Eliminato	*	03/03/2008 11.34
related		
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to minimize the investments request.		
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is focusing		
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information		
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that		
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is done

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emerged

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are

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area for tile firms.

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performed

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allow to write

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explicating the dependences of KPI with

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get into

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TA

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the importance

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studied

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parameter for tile industries performances

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variation

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fits the

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instances

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developed

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the

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each

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the

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on

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a small resource

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money spending

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forecast

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a

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makes available

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a useful tool in order to

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decisions in

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in

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