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# The integrated management of logistic chains in the white goods industry. A field research in Italy<sup>☆</sup>

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## Abstract

After having devoted many efforts and investments in improving their internal capacity to produce the right product at the right price at the right time, companies are now starting to discover that much of the value they deliver to their customers depends not only on their own performance, but also on the performance of all the other companies that belong to the same *logistic chain*. Thus, the integrated management of logistic chains has gained a large attention in the latest years, as one of the most effective tools to achieve an overall improvement in the economic as well as in the logistic value that is embodied in each product. This paper presents some results of a field research focused on logistic chain management, carried on by means of direct interviews on a sample of Italian companies, shops and final customers belonging to the white goods industry. Questions highlight the main cost and logistic effects that arise among different tiers of the chain when they interact. Here we illustrate the used methodology. Moreover, we discuss some of the empirical results achieved, with the aim of assessing the improvement potential that a tighter integration could achieve. In particular, it is shown that wide space for improving companies profitability is available both by reducing costs and by increasing sales. © 2001 Elsevier Science B.V. All rights reserved.

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## 1. Background

### 1.1. The logistic chain concept

In many branches of industry, the last decade has witnessed an unexperienced increase in the environmental complexity that manufacturing companies have to face. This is partially due to the increased customer requirements which usually

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characterises mature markets. Moreover, the concurrence of the widening of markets and therefore that one of an ever stronger competition has further fostered this trend.

In order to cope with global and mature markets, manufacturers have striven not only to increase their product range, but also to enrich their products with a set of features that might create a difference with respect to competitors. This, in turn, has led to the need to master a wider range of manufacturing technologies than before. Given the considerable hurdle that has risen by the need to be the leader in such amount of different technological areas, many companies have preferred to reduce their level of vertical integration and to focus on their core technologies, rather than trying to be excellent in all of them [1]. A typical example of this way of doing is supplied by the PC industry, where each component (motherboard processor, hard drive, screen, operating system, printer, etc.) is usually manufactured by a small number of focused and global companies.

In such a context, if customers are to obtain a whole system (e.g. PC, screen, printer and modem) at a reasonable price, with a good quality and within a reduced lead time after the order, this can be obtained owing to the combination of efforts of all the actors connected to this system [2,3]. Just to cite some of the well-known brands: Intel will supply the processor and Seagate or IBM the hard drive; Compaq will take care of PC assembly; Sony will provide the monitor; Hewlett-Packard will provide the printer; 3COM the lan board or the modem, Microsoft will supply the operating system and the dealer will do SW installation, product packaging and final delivery.

We will call the whole set of companies mentioned above a *logistic chain*, in that not only these companies perform the logistic phases of the PC value chain, but they also contribute to the “*logistic value*” that is embodied in the PC. In other words, these companies not only contribute to determine the inherent value of the PC as a product, but they also determine the service parameters that are connected to the delivery process, such as: response time, tardiness, etc.

## 1.2. Competition among logistic chains

Given the remarkable changes in the manufacturing industry that have been outlined in the previous section, companies have started to think how to link themselves inside a logistic chain in a way to generate more value for the customers and ultimately also for themselves. The integrated operations management of a whole logistic chain, is relevant due to two different competitive effects, owing to either different types of customers or the positioning of each industry in its life cycle.

Let us think about one customer buying a car. For first-time buyers, the act of buying their first car may well be considered as a “must”, due to the mobility requirements it fulfils. Conversely, when you have already bought your car, buying another one could be just a matter of fashion or status. In this latter case, which refers to a mature customer, the act of purchasing might well be deferred to next year, while the same amount of money might be allocated to something else (e.g. a fashionable dress or suit, a new piece of furniture or even a vacation) or simply saved.

In the former case of the first-time buyer, the question to be answered is: *which car to buy?*, so the competition is *within* the automotive industry. Thus, each car manufacturer, together with dealers and components manufacturers (e.g. one automotive chain) compete against other ones, inside the automotive industry. On the contrary, the latter type of customer gives rise to a new kind of competition, which is *among* different industries. In this case, different automotive chains are competing against other chains that deliver furniture, dresses, or eventually anything else.

An additional difference between first-time customers and mature customers, is in that the first ones will presumably make their choice based on a combination of features and price (e.g. car within certain dimensions, ensuring given performances, under a pre-determined price threshold). So, given the purchase is needed, they will go ahead searching on the market, until finding the appropriate product. On the contrary, mature customers can give up the purchase, so they are likely to be less focused on functions and price than on other features like design, service or brand name. Further-

more, if they do not find immediately a car fitting their needs, they are likely to change their mind and to switch to another type of product.

The above considerations outline the increasing importance of an integrated approach in managing the logistic chains, especially in mature markets and industries. In fact, logistic integration among companies belonging to the same logistic chain may well be the strategy that allows the chain to jointly achieve overall superior performances in terms of:

- a superior availability of goods delivered, thus minimizing the loss of sales against other chains within its industry and chains belonging to other industries [4, 5];
- a lean stock profile, which in turn allows to minimize running capital expenditure, as well as any drawback connected to obsolete items [6–8].

### 1.3. Objectives of the paper

This paper comes as a partial report of a wide research program carried out within a partnership between the Dipartimento di Economia e Produzione of the Politecnico di Milano and the Milan branch of McKinsey & Co. Within this research program, two other branches of industry were investigated together with white goods, namely textile and apparel and books publishing.

The standpoint of this research program has been illustrated in Sections 1.1 and 1.2.: given the outlined competitive environment, we make the assumption that the integrated management of logistic chains is one suitable strategy firms should apply in order to jointly improve effectiveness and efficiency along the whole chain, as affirmed by Armistead and Mapes [9] and Davis [10]. This, in turn, should allow them to deliver more value to customers, and, ultimately it should foster the performances of the whole chain.

Thus, the objective of the research program is to evaluate the following aspects, in the investigated branches of industry in Italy.

1. To assess *companies' commitment* about the integrated management of logistic chains. In other words: to evaluate their knowledge on this subject, the importance they set on it and the

specific actions they have taken or that are still in the process of deploying towards this direction.

2. To evaluate the *potential improvement* which is connected to the integrated management of logistic chains, in terms of cost reduction and/or sales increase.
3. To identify *actions and strategies* that chains and companies should put in practice in order to actually achieve (part of) the potential that is ensured by an integrated management of logistic chains.
4. To compare *different industries' behaviour* about the items above, in order to identify similarities and differences and to suggest a cross-fertilisation process.

Given the general context of the research within which this paper has been developed, the specific objective pursued by this paper is that one described in point 2 above, regarding the potential improvement that could be gained overall by logistic chains and by each single actor on its own if a tighter coordination among different companies within chains were in place.

According to the above-mentioned objective, the rest of the paper is organised as follows: in Section 2 the methodology adopted is discussed. In Section 3, a set of empirical results is presented. Finally, in Section 4 we will discuss the general outcomes of the research and its possible developments.

## 2. Research methodology

This section presents the research methodology followed to fulfil the objectives stated in Section 1.3. In more detail, Section 2.1 deals with the criteria used to choose the samples of interviewees and to collect the corresponding data; Section 2.2 describes the sample of companies interviewed and Section 2.3 discusses the cost model used to describe the cost structure of a logistic chain.

### 2.1. Samples and data collection

The study has been based on empirical analysis in field. Despite the fact that this methodology

allows to collect data referring to a large number of companies, we preferred to avoid questionnaires, since they do not ensure an adequate level of confidence about the collected data. Rather, interviewing relevant people within the various organisations considered was preferred. This aspect set a constraint on the number of organisations that we were able to consider in the study. However, we considered it important to ensure as much as possible the correctness of the collected data.

Each interview was supported by a written list of questions that was sent by fax in advance, when possible, in order to allow for a more efficient and complete data collection. Three different types of interviews were performed, with three different types of subjects.

1. *Companies.* A half-day interview was carried out at each company considered. Together with top executives, we interviewed functional managers of: logistics, sales and marketing, production, purchasing. They were asked to quote more than 200 data, regarding: the company's general and logistic performances, the managers' perceived importance of logistics and chain integration, the actions performed or the ongoing projects in this area, and a set of hard and soft characteristics of the company. Data collected were integrated by asking the balance sheet of last 3 years. We globally interviewed 34 companies, all of them located in Northern Italy.
2. *Dealers.* While large distribution chains were categorized as companies, the small dealers (shops or local chains) were interviewed in a different fashion. The question list was much reduced (less than 50 questions) and one interview (usually with the owner or the director) was considered sufficient. The type of questions addressed to interviewed people was roughly the same as those asked to companies managers. We interviewed 10 relevant shops of the area around Milan, Italy.
3. *Customers.* The third set of interviews performed was with people getting out of shops, stores and, broadly speaking, points of sale. The contents of this last interview was designed in order to determine the average customer purchase behaviour. Questions asked were, for

instance, whether they had a specific brand in mind when entering the shop; whether they had found what they were searching for, whether they had bought something and for which reason. Overall, we interviewed around 150 customers, coming out of points of sale of various type.

All interviews were carried out within the branch of industry of domestic appliances, encompassing such sectors as: food refrigeration, air conditioning, cooking, washing and dishwashing. Small white goods (from vacuum cleaners to hair driers) were – on the contrary – excluded from the sample, given the much different type of product, production and distribution process.

## 2.2. Model of white goods logistic chain

A preliminary splitting of the chain in three phases (components or raw material *supply*; finite goods *production*; finite goods *distribution*) was firstly made. Then, through one or two sample interviews, the fine tuning of the logistic chain model for white goods was performed, by identifying which actor could operate within each phase and which role could each actor play inside it. Fig. 1 presents the model that was worked out for supply chains within the white goods industry.

According to Fig. 1, the following actors and material flows were pinpointed.

1. *Suppliers*, that are usually manufacturers of components and subassemblies of many different types, such as steel parts for the body, electrical engines, pumps or compressors, electronic boards and control units, heating electrical resistors, and so on. The flow of components towards the producer is indicated by letter A. Overall, we interviewed 12 suppliers of components and subgroups: their average dimension, measured by their 1998 turnover is around 132 billion lire (around 80 US\$ millions at 1998 rates);
2. *Producer*, usually performing the final assembly of ready-made components and groups, with reduced manufacturing operations. Producers usually have central and regional distribution warehouses, from where they feed the various distribution systems downstream (see flows B,

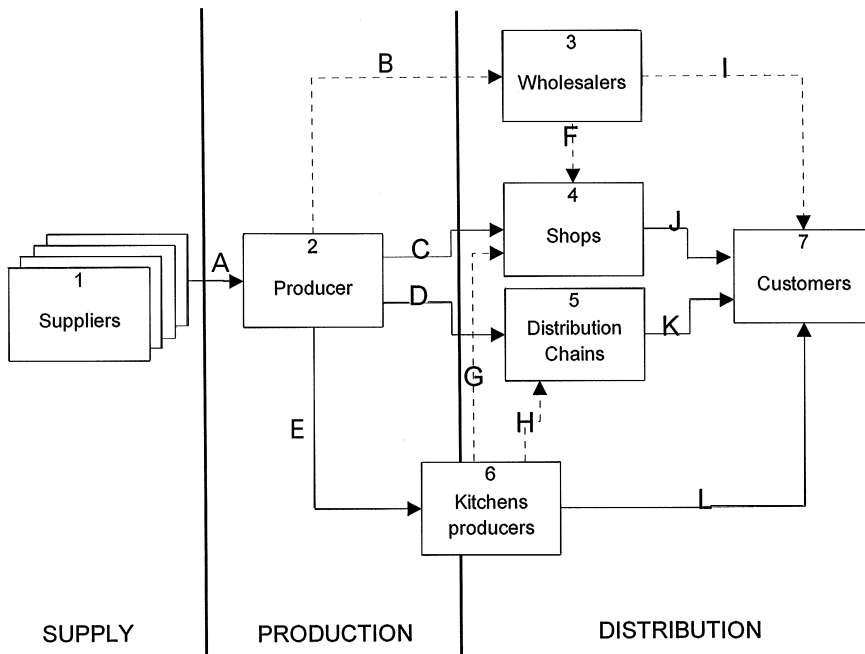


Fig. 1. The supply chain model for white good industry.

C and D). A particular case is that of kitchen producers (see square 6), that are usually fed by central warehouse (see flow E). Globally we interviewed 11 producers of various types of apparatuses, with average 1998 turnover of 764 billion lire (US\$ 450 millions). We considered as an individual producer each separate business interviewed, regardless of the fact that it could belong to the same industrial group as other businesses interviewed.

3. *Wholesalers*, that may be either independent companies (though it is a form of distribution currently disappearing) or consortia/co-operatives/purchase groups of shopkeepers. Anyway, wholesalers buy great amounts of finished goods (B) in order to achieve a price advantage, and re-sell them to shops (F). Increasingly, they are setting up their own sales facilities (I), in a way to compete with Distribution chains (see square 5). We interviewed 2 wholesalers, with average 1998 turnover of 40 billion lire (or US\$ 23 millions).
4. *Shops*, that may purchase their finished goods directly from the producers (C) or from wholesalers (F). They are sales facilities with small

floor space whose main competitive advantage is the location at the centre of towns and cities. As of 1998, they accounted for more than 90% of white goods sales in Italy. More precisely, independent shops made around 50% of the sales, while those associated in purchase groups made another 43%. As it was referred in Section 3.1, we interviewed 10 shops.

5. *Distribution chains*, that purchase directly from the source the finished good (D) in great quantities. They can be further divided into department stores, selling white goods together with many other items of different industries, and large surface superstores, that offer large selection and low prices. As of 1998, this form of distribution accounted for only 7% of sales in the Italian white goods market. We interviewed 3 large distribution chains, with an average 1998 turnover of 200 billion lire (or US\$ 115 millions).
6. *Kitchens producers*, that buy white goods from producers (E) to equip their kitchens. Kitchens are put on the market directly (L), through distribution chains (H) or shops (G). We interviewed 2 kitchen producers, with average

1998 turnover of 40 billion lire (or US\$ 23 millions).

7. *Customers*, that buy white goods as self standing items or as equipment of ready-made kitchens, from wholesalers (I), shops (J), distribution chains (K) or kitchen producers (L). Overall, we interviewed around 150 customers, as it was anticipated in Section 2.1.

### 2.3. Logistic chain costs

In order to assess the potential improvement connected to an effective integrated management of the logistic chain, it is necessary to identify and measure the relevant performances in terms of *effectiveness* of the chain to supply the right product in the right place and at the right time and in terms of *efficiency*, to do so without badly affecting costs.

Various researchers, among all New [11] have proposed frameworks of physical indices in order to measure the performances of logistic chains. Of course, this method is the most appropriate if a comprehensive evaluation of the various aspects affected by different implementation techniques is sought for. However, the perspective of this study is that of measuring up the overall economic potential of the integrated management of logistic chains, rather than disclosing the practical effects it can have in the physical performances of the chain, or measuring up the advantages achieved by a single implementation technique.

Thus, we concentrated on defining and evaluating the relevant costs, with the aim of identifying the specific cost structures of each single actor of the chain, the average structure of each stage of the chain and, finally, the overall cost structure of the average white goods logistic chain. In order to achieve these results, we adopted a very simple cost model for each single actor, by identifying the following cost items: (a) *industrial cost*, that is all direct and indirect, fixed and variable operating costs, encompassing such cost items as: fixed capital, labour, direct and indirect materials, energy, industrial overheads, etc. (b) *logistic costs*, i.e. those operating and opportunity cost items that can be influenced by logistic decisions, and, broadly speaking, by the integration of management practi-

ces and activities throughout the logistic chain, and (c) *profits*, defined as the difference of the net operating margin less running capital cost, that is already included in logistic costs category.

All of the cost items considered above can be computed for each actor in the chain. By averaging out results achieved at various actors at the same stage of the chain, it is possible to figure out the average logistic cost structure of that specific stage. Moreover, by simply summing up the results achieved at the various tiers of the chain illustrated in Section 2.2, the overall cost structure of the logistic chain was obtained. Since the sum of the aforementioned cost items equals, by definition, overall sales, results of our investigations could be represented as a percentage of total sales of the average logistic chain, or as a percentage of the customer price of one average piece of white good.

As anticipated above, logistic costs were defined as all the cost items whose value can be influenced by logistic decisions. More in detail, the list of cost items included in this cost category is presented in Table 1. As seen in Table 1, logistic costs were subdivided in two classes, effectiveness and efficiency.

Effectiveness logistic costs arise whenever the logistic chain fails in providing customers with the required product, at the required point of sale and at the required time. In this case, the whole logistic chain, or one part of it might experience a loss of sales, so that effectiveness logistic costs can be better described as opportunity costs connected to a loss of sales. More in detail, given the structure of the logistic chain described in Section 2.2, this cost was divided into the following components.

1. *Sales lost for the whole industry*. This is the case when customers who are looking for a specific product, cannot find it and, as a consequence, they employ their money otherwise. This may be the typical behaviour of the mature buyer (see Section 1.2). Quite obviously, these lost sales affect all the actors within the chain: the dealer, the producer and the components suppliers.
2. *Sales lost for the dealer*. The required product is not found at the first visited dealer: so customers buy it at another dealer. In this case, while the

Table 1  
Logistic chain cost items considered

Effectiveness	Efficiency
Lost sales costs: • for the chain • for the dealer only • for the producer and the suppliers only	• Obsolete stocks • Running capital • Transportation and handling • Set-up and scrap

finished good and the components producers do not suffer any loss, the dealer is affected. This might be the case for a newcomer of this kind of products, as discussed in Section 1.2.

3. *Sales lost both for the producer and the suppliers.* The required product is not available at the first visited dealer. Yet, the dealer addresses customers to another equivalent product, and they buy it. In this case, while the dealer will protect its sales, the manufacturer of the originally searched product, together with its suppliers, suffers the loss. This case too might be for the newcomer purchasing this kind of products (see Section 1.2).

Within this research, the costs of lost sales was computed in two ways. First, an estimation of its value was asked to the interviewed companies. Second, a sample of customers was interviewed outside points of sale (see Section 2.1, item 3), and the average purchasing behaviour of white goods customers was singled out. Following this scheme, the cost of lost sales was evaluated by averaging the percentage of customers willing to buy one white good that have to change their mind due to logistic reasons (that is, because the required product is not available due to stockout, nor it will be within a sufficiently short time span). Despite being particularly time-consuming, this second methodology appeared to be much more reliable, due to the specific nature of the addressed costs, that are not considered by traditional accounting systems, given that they correspond to missed opportunities rather than to negative cash flows.

The second class of logistic costs considered by this study is that one of *efficiency* logistic costs, encompassing the various cost items that depend on production planning and control or materials

management decisions [12]. Running capital cost accounts for the financial expenditure corresponding to all materials that have been already purchased from vendors, but have not yet been sold to customers, and are therefore kept in stock or within the various stages of the chain, as WIP; this cost was estimated by multiplying the average value of materials stocks kept in each company, by the average cost of borrowed capital. Obsolete stocks cost refers to all materials that lose part or all of their value after being kept in stock for a long time; in the white good sector this proved to be quite a common occurrence, both with finished products and subgroups, especially during the phase out of an old product that is replaced by a new one. Transportation and handling costs refer to physical materials movement, both within each manufacturing or assembly plant, and among suppliers and customers plants; they were estimated by summing up all the related cost items found in the balance sheet of interviewed companies. Finally, set-up costs refer to changeover operations, when a machine or production system have to be stopped and tuned to accommodate production of a new item; these costs too were estimated by analysing the detailed balance sheets provided by companies.

### 3. Empirical results

#### 3.1. Efficiency logistic cost structure

Fig. 2 illustrates the cost structure of the average white goods logistics chain, with reference to the average selling price of one item (set equal to 100).

Given that Fig. 2 deals about physical costs and revenues, logistic costs highlighted in Fig. 2, are

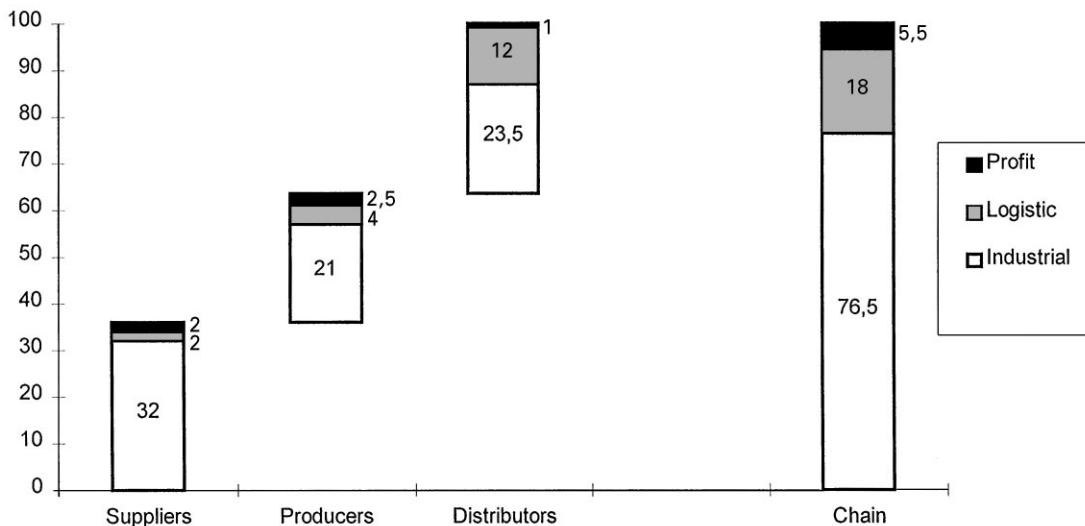


Fig. 2. Cost structure for the average white goods logistic chain (100 = average customer cost of one item).

only those listed in the column referred to as the *efficiency* in Table 1 (see Section 2.3). As shown in Fig. 2, logistic costs account for 18% of the overall chain turnover. At the same time, the overall chain profit is merely 5.5% of turnover. Thus, if logistic costs could only be cut by one third, almost without any additional decision, the chain's overall profitability would be more than doubled. If a better integration of logistic chain can achieve an improvement in overall efficiency of the chain, as it was postulated in Section 1.3, this aspect shows at first that a large space is available to improve overall chain's profitability.

Note that logistic costs tend to increase downstream to the chain. So, while suppliers experience logistic costs at a mere 5.5% of their sales (2% of global chain sales), and producers account for almost 6.5% (4% of total sales), around two thirds of the global logistic costs are accumulated in the distribution phase, where they account on average for 12% of sales. By comparison, here profits are a mere 1% of overall sales. This second remark highlights the crucial relevance of activating an integrated approach in the management of the logistic chains especially for companies operating within the distribution phase.

Fig. 3 presents in a more detailed way both the value and positioning of the efficiency-related logistic costs throughout the white goods logistic chain. As shown in Fig. 3., more than two-thirds of efficiency logistic costs in white goods industry is generated by transportation and handling operations. This might well be due to the fact that white goods are basically "large and empty". Given that logistic costs as a whole account for 18% of the selling price per unit, we can conclude that transportation costs account for more than 12% of the overall sales for this industry.

As seen in the figure, handling and transportation costs badly affect in particular the distribution phase. In fact, considering in a comparative manner results presented in Fig. 2 and Fig. 3, it is possible to derive that transportation and handling costs alone account for almost one-tenth of the distributors' turnover. This figure is rather impressive, especially if we compare it with distributors profits, that account for only 1% of their turnover.

It should be noted that also running capital costs are quite relevant (almost 17% of total logistic costs). Again, around two-thirds of those costs are concentrated in the distribution phase. Finally, this phase is also badly affected by obsolete items costs,



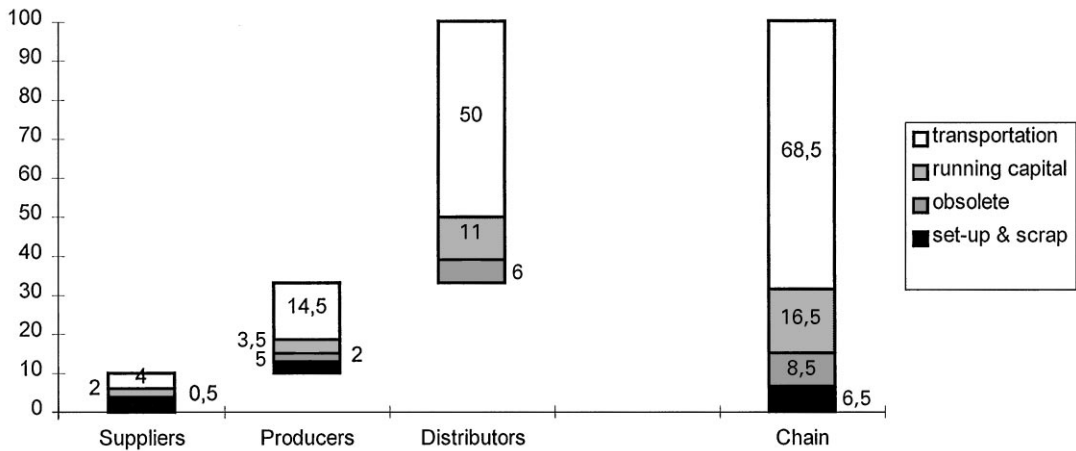


Fig. 3. Logistic cost structure for the average white goods logistic chain (100 = average logistic cost per unit).

that account on average for more than 0.7% of its average turnover. In order to fully evaluate the relevance of these amounts, it is necessary to compare them to that of the distributors average profitability, that is only slightly larger than obsolete items cost.

Data presented in Fig. 3 fit well with the reality of Italian white goods distribution system (see Section 2.3). In particular, a high transportation cost, together with high stocks and obsolescence costs seem nothing less than obvious consequences of a distribution system which mainly consists of a large amount of very small selling facilities.

### 3.2. Effectiveness logistic costs structure

Fig. 4 presents data regarding the costs of lost sales, as computed on the basis of customers interviews (actual) and as these costs are estimated by the average actor at each stage of the logistic chain. At each stage of the chain, and for each computation strategy, lost sales costs were computed as the contribution margin lost due to the experienced loss of sales. Each actor's loss of sales was computed as explained in Section 2.3, while the contribution margin was again calculated starting from the balance sheet. For clarity sake, values presented in Fig. 4 are expressed as a percentage of each actor turnover.

If we examine the absolute value of actual costs as compared to each stage's average sales, Fig. 4 points out that actual lost sales costs are remarkable at all the stages of the chain, and particularly high at the distribution phase. Contrary to that, it is interesting to note that if we measure the cost of sales lost on average by the whole white goods industry (i.e. cost due to the inter-industry competition, see Section 1.2), the value is almost null. This outcome, directly derived by the average behaviour declared by the interviewed customers, shows that in the Italian market almost all potential purchasers of household white goods behave as newcomers, in the sense that they only consider a deal when it is actually necessary: as a consequence, they will go on searching points of sales until they find a suitable product, rather than give up the purchase.

As a consequence, the costs of lost sales shown in Fig. 4 must be interpreted as follows. If the effectiveness performances of all the logistic chains in the white goods sector are almost the same, each actor will experience a loss much similar to all other actors of the same type, so that sales lost because of one actor's ineffectiveness are balanced by sales gained by the same actor out of other actors' losses. Therefore, if there are 10 washing machines manufacturers on the market, and each one loses 20% of its sales potential because of bad

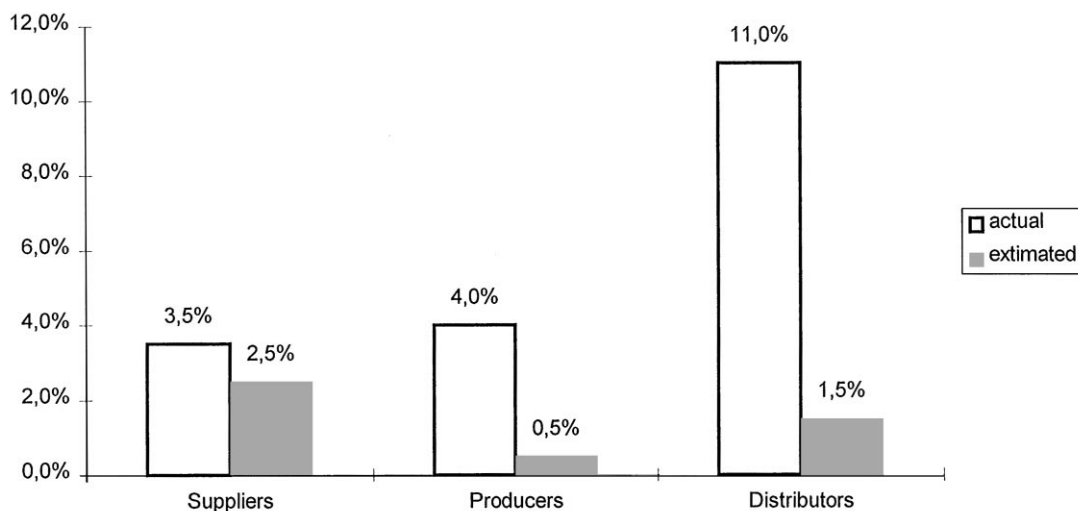


Fig. 4. Cost of lost sales by stage of the chain: actual versus estimated values (100 = average sales of each stage).

service, a pool worth  $10 \times 20 = 200\%$  the average sales of one manufacturer will be at hand. Since each manufacturer has roughly the same level of service as others, each will achieve one-tenth of the pool, resulting again in 20% of its sales. Thus, if service levels are balanced, so are sales losses. Yet, if a *first mover* succeeds in achieving a much better level of service than competitors, its loss of sales will tend to nil, and its sales will reach 120%. Consistently, each competitor will experience an average 2% sales loss. Moreover, if we hypothesize that – sooner or later – all competitors will improve their level of service, apart from one (the *last mover*), this last company will experience a loss of 20% of its sales, and its sales will reach 80%, while all competitors would find a new steady state at 102%. Hence, the lost sales opportunity costs highlighted in Fig. 4 can only become physical money when the service level equilibrium is broken. Moreover, the difference among the first mover and the last mover is, in fact, greater than the average loss sales cost computed.

By comparing the estimated versus actual value of lost sales costs, Fig. 4 also points out that there is not a clear view among the different actors throughout the chain about lost sales costs, given the considerable differences in the values. Indeed, companies are used to roughly estimate these costs rather than controlling them. To strengthen this

statement, most of the accounting systems are focused on physical costs that emerge through any kind of registered transaction that can take place. On the contrary, lost sales costs are by definition opportunity costs and thus they correspond to a lost opportunity to generate income rather than to a negative cash flow.

No matter how paradoxical it may seem, Fig. 4 confirms that companies that are more likely to rightly consider their opportunity costs belong to the supplier level of the logistic chain, while the greatest error in the estimates is that of distributors, even though these actors are directly subject to the loss of sales. A possible explanation of this finding relies in the comparative dimensions of the average company within each stage of the chain. Given their rather small average dimension, Italian shops and points of sale have not yet worked out systems to control customers behaviour and therefore estimate the level of lost sales. Conversely, given the rather large size of many manufacturers of white goods, scarcely ever do distributors cancel orders, once they have been placed, regardless of the demand they are actually experiencing: thus, the very limited amount of loss of sales noticed by manufacturers. Finally, producers are more likely to actually cancel orders to suppliers, given the balance of dimensions, that is in their favour.

## 4. Conclusions

### 4.1. Discussion

The research methodology illustrated in Section 2, allowed us to collect and analyse some very meaningful data regarding the white goods logistic chain. The resources available to this research program have not ensured an adequate number of interviews, in order to achieve a statistical significance with reference to the collected data. However, a satisfactory level of consistency and completeness is granted by the fact that numerical values were achieved by means of direct interviews, immediately checked and eventually discussed directly with the interviewed people. Results presented in Section 3 allow us to point out three main concluding remarks.

First, evidence is shown about the overall importance of logistic costs for the white goods industry, both in terms of their impact on the operating costs and the consolidated turnover of the average logistic chain within this industry. To this regard, strong evidence is set on the fact that the sum of logistic costs and lost sales costs account for almost 30% of the overall chain turnover, while chain profitability is very low, around 5%. Thus, if only the overall sum of logistic costs and lost sales costs could be reduced by one fifth, profits could be more than doubled. If we accept the assumption made in Section 1.3, that the integrated management of logistic chains is a suitable tool to jointly improve both efficiency and effectiveness of the whole chain, we can conclude that this strategy can gain conspicuous advantages both in terms of reduced costs, and increased sales, with the possibility to improve dramatically the overall profitability of the whole chain and of each of its actors.

Second, data collected in field show that almost 80% of total logistic costs, and a large chunk of lost sales effect are concentrated at the distribution phase. In particular, the performed analyses outlined that almost half of costs found at that phase are lost sales and nearly one third are due to transportation. This tier of the Italian white goods logistic chain emerges therefore as one evident criticality of the whole system. The apparently inconsistent occurrence of large efficiency logistic costs (i.e.

stock, obsolete products, transportations) together with large effectiveness cost (i.e. lost sales) at the sales level can be understood by considering the combination of the large amount of different products that are put on the market by modern white goods producers (around 1.000 stock keeping units per business in Italy) and the particularly small dimensions of the average Italian dealer of such items (on average around 1.000 units sold per annum). Due to this combination, we can explain the simultaneous presence of seemingly exaggerated stock levels, frequent urgent deliveries and relevant lost sales costs. While the mix variety can hardly be controlled by the chain actors, as being an inherent characteristic of white goods current life cycle stage, the structure, size and type of dealers can be changed from within the chain, even if through a major and structural re-engineering of the chain itself.

Third, there does not seem to exist much integration among various actors within the white goods logistic chains regarding the exchange of updated sales information, as it was shown by highlighting the large difference among the perceived and actual values of lost sales. This aspect is particularly serious, in that it prevents managers from having a complete vision on the whole chain's cost structure. One has to recall that, the more stocks are increased and moved downstream the chain, the more the chain will experience high-efficiency and low-effectiveness costs, and vice versa. To say it simply, the job of logistic managers within the chain is that one of figuring out the appropriate level and positioning of material stocks, together with the appropriate level of flexibility and readiness, so that both cost classes are minimized for the whole chain. It seems very difficult to achieve this goal if part of the information needed is missing.

### 4.2. Further developments

Further analyses in progress on the same data sample, will try to investigate in order to fulfil other objectives, namely: to assess companies commitment towards the integrated management of logistic chains; to actually identify which actions could gain companies the potential that has been measured up in this paper; and to compare techniques,

leverages, practices and approaches throughout the three investigated branches of industry.

However, it was noted at the beginning of this section that a crucial issue of this research program, is in the weak statistical significance of data collected. To this purpose, the sample of interviewed firms should be at least doubled. This way of doing in the Italian market alone might prove to be ineffective, almost for two reasons. On the one hand, some types of the actors identified for this research are very few in Italy (e.g. large white goods distribution chains). On the other hand, to analyse companies belonging to different countries, can lead to a wider range of examples, which can in turn be used to cross-fertilise industrial practices among countries or check the thoroughness of hypotheses worked out.

For instance, the issues recalled above in this section regarding the possibility to achieve an advantage by enlarging the average size of distributors, could be supported by empirical evidence collected from countries where distribution chains have a larger market share than in Italy.

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