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The Rise of A District Lead Firm:
The Case of Wam (1968-2003)

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Abstract:

In recent times one major evolution in several industrial districts in Italy has been emergence of new hierarchical structures that led to the rise of lead firms. These are firms that – contrary to canonical district firms which tend to remain small – pursue size grow, invest in marketing, distribution and R&D, reorganize their subcontracting networks, and become international by establishing commercial subsidiaries and production facilities abroad. However, lead firms' histories remain largely unexplored. This article contributes to fill this gap by examining the case of one of such lead firms: Wam, a company set up in 1968 in the mechanical engineering district of Modena, which at the beginning of the 21st century had become the world leader in the production of bulk material handling and dust filtration machinery. The article in particular focuses on the strategy of growth and internationalization that this company has pursued and its effects in both the host nations and in its Italian ID of origin.

JEL Classification: N24, P12, C63

One key element of Italy's good economic performance since the 1960s has been the success of those production systems that economists call "industrial districts" [henceforth IDs]. These are clusters of small firms that exploit external economies of scale and economies of specialization generated by the division of labor between firms and flexible production organization within them.[1]

This peculiar model of economic development was considered as the natural evolution of Italy's industrial history after the 1970s, when both the private and the state-owned big business experienced a long lasting crisis.[2] However, in the 1990s competition from low wage countries and large firm restructuring forced IDs to compete almost exclusively in quality-conscious markets. At the same time, changes in demand composition, a need for a higher intrinsic production quality, shorter delivery times and a more active product commercialization prompted a restructuring of the organizational framework of several Italian IDs with the emergence of new hierarchical structures (holdings, groups, formalized networks) that led to the rise of lead firms.[3]

Lead firms are companies that – contrary to "canonical" district firms which tended to remain "small" – pursue size growth, offer a wide range of products and extend their markets, often acquiring other firms both within and outside their ID of origin. Lead firms introduce complex innovation that results in fundamental changes in the entrepreneurial formula and in the organizational model of the firm. At the same time, such innovation requires a high level of formal knowledge (transferable and, therefore, available to the firm outside the ID) that can be contextualized inside the firm.[4]

Since the 1990s lead firms tended to play a paramount role in orchestrating the activity of several Italian IDs. They selected and re-qualified ID subcontractors by promoting an upgrading of their competences and developing stable cooperative relations with them involving co-design as well as manufacturing. Learning through relationship with a lead firm helped many subcontractors to upgrade their technical and organizational competences and extend their potential market outside their ID. Lead firms also explored new commercial avenues and invested in R&D. Their role

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[1] Federico L. Signorini (ed.), *Lo sviluppo locale. Un'indagine della Banca d'Italia sui distretti industriali* (Rome, 2000); Ivana Paniccia, *Industrial Districts. Evolution and Competitiveness in Italian Firms* (Cheltenham, UK-Northampton, Mass., 2002); Banca d'Italia (ed.), *Local Economies and Internationalization in Italy* (Rome, 2005).

[2] Franco Amatori and Andrea Colli, *Impresa e industria in Italia dell'Unità a oggi* (Venice, 1999), 315-338.

[3] Josh Whitford, "The Decline of a Model? Challenge and Response in the Italian Industrial Districts", *Economy and Society* 30 (2001): 58; Francesco Brioschi, Maria S. Brioschi and Giulio Cainelli, "From the Industrial District to the District Group: An Insight into the Evolution of Local Capitalism in Italy", *Regional Studies* 36 (2002): 1037-52.

[4] Giancarlo Corò and Roberto Grandinetti, "Industrial district responses to the network economy: vertical integration versus pluralist global exploration", *Human Systems Management* 20 (2001): 191.

became more and more relevant to provide IDs with international market access, strategic leadership, and resources.[5]

In recent years some district lead firms experienced an accelerated internationalization process with the establishment of commercial subsidiaries and production facilities abroad. Now these companies hold a dominant position in well-defined world-sized market niches – i.e., machine tools and other durable goods, clothing, luxury goods, and other branches of the so-called "Made in Italy" – while at the same time maintaining deep roots in their ID of origin.[6]

Unfortunately, existing literature lacks – with a few exceptions – in-depth studies of Italian district lead firms' histories. This article aims to give a contribution to fill this gap by examining the case of one of such lead firms: Wam, a company set up in 1968 in the mechanical-engineering ID of Modena, which at the beginning of 21th century had established itself as the world leader in the production of bulk material handling and dust filtration machinery. Drawing on Wam's archive, interviews with Wam's managers and a number of other sources, this article deals in particular with the strategy of growth and internationalization that this company has pursued and its effects in both the host nations and the ID of origin.

1. The birth of the company and the acquisition of the competitive advantage

Wam was set up in 1968 as a owner-run company by Vainer Marchesini, at that time a 22-year-old technician who in 1965 had taken a diploma at Modena technical school and then had spent three years by working at Ime, a local concrete batching plant manufacturer.[7]

In the beginning, Wam worked with only three employees in a garage near Modena as a subcontractor which produced cement screw conveyors for concrete batching plants.[8] At that time, the screw conveyor was a typical custom-built product. Every batching plant manufacturer had his own trustworthy locksmith, to whom he ordered the screw conveyors he needed. Every screw conveyor differed from the others in length, diameter, slope, burden, positioning of the inlet and

[5] Mark H. Lazerson and Gianni Lorenzoni, "The Firms that Feed Industrial Districts: A Return to the Italian Source", *Industrial and Corporate Change* 8 (1999): 237-8; Ash Amin, "The Emilian Model: Institutional Challenges", *European Planning Studies* 7 (1999): 397.

[6] Andrea Colli, "'Pocket Multinationals': Some Reflections on 'New' Actors in Italian Industrial Capitalism", in *Transnational Companies. 19th-20th Centuries*, ed. Hubert Bonin *et al.* (Paris, 2002), 155-78; Andrea Colli, *The History of Family Business. 1850-2000* (Cambridge, 2003), 61-63.

[7] Archivio della Cancelleria del Tribunale di Modena, Registro delle Imprese, Imprese in vita, n. 8952, Wam Spa.

[8] A screw conveyor consists of a helical flight fastened around a pipe or solid shaft, mounted within a tubolar or U-shaped trough. As the screw rotates, material heaps up in front of the advancing flight and is pushed through the trough. Particles in the heap next to the flight surface are carried part way up the flight surface, and then flow down on the forward-moving side of the heap. A screw conveyor has an electric motor with an incorporated gear reducer which transmits motion necessary for the functioning of the whole system.

outlet spouts, and so on. Customers gave Wam a drawing of the screw conveyor that they ordered. Wam in turn outsourced the production of nearly all the screw conveyor's components to local subcontractors, usually locksmiths and very small mechanical-engineering firms. Within its own shop Wam ground the components that had been shipped by its subcontractors, assembled them and made the final testing of the screw conveyor.[9]

From 1977 to 1980, Wam undertook a systematic study of the cement screw conveyor, its components and applications. The aim was to find those configurations that could best improve the performance and functionality of the screw conveyor and lay the foundation for standardized production. The result was a re-design and re-engineering of the product, that was now subdivided into modules which could be standardized and combined together in a wide range of ways. As a consequence, product customization was maintained, but at the same time module standardization enabled the company to gain economies of scale and achieve a decisive competitive advantage over the artisans that produced the screw conveyor in a traditional way.[10]

Besides, Wam developed and constructed most of the production equipment that it needed to manufacture the screw conveyors according to new product design, which at that time was not available on the market.

Within a few years, the new modular product design was applied to other industries and modified according to their requirements, thereby realizing those economies of scope that come "from opportunities to use existing production, marketing, and research facilities and personnel by developing products for new and more profitable markets".[11] After cement came asphalt industry, lime and plaster works, screw conveyors for dehydrated sludge, for animal feed and flour mills, screw feeders for the chemical, the food and the glass industry. Besides, butterfly valves, slide valves and dust filters were added to the product range.[12]

The implementation of such a strategy enabled Wam to grow from seven employees in 1973 to 27 in 1978 and to 59 in 1980. In the same year Wam became a joint-stock company.[13]

2. From the Wam Company to the Wam group

In 1978 the Wam Company set up its first subsidiary – named Sp.Eco – to further realize economies of scope. Sp.Eco was localized near Wam's headquarters and specialized in the production of solid-

[9] Vittorio Caprari (Wam's Works Manager from 1968 to 1999), Interview, 23 November 1999.
[10] *Wamgroup News*, 2 (2007) (1): 4.
[11] Alfred D. Chandler, Jr., *Scale and Scope. The Dynamics of Industrial Capitalism* (Cambridge, Mass., 1990), p. 38.
[12] Caprari, Interview, 23 November 1999.
[13] Archivio della Cancelleria del Tribunale di Modena, Registro delle Imprese, Imprese in vita, n. 8952, Wam Spa.

liquid separation equipment: screen presses, screw compactors, grid classifiers, concrete reclaimers and heavy-duty screw flightings. Since then Wam assumed a group structure.[14]

In 1981 Wam was one of the first small-sized firms in Emilia-Romagna to create a R&D laboratory – named Srmp – specializing in both pure and applied research concerning powdery and granular materials, as well as the development of bulk solids handling and processing equipment.

In the 1980s, Wam established another three subsidiaries, all of them localized inside Modena mechanical-engineering ID: Map (1983) for the manufacturing of industrial mixing equipment; Analysis (1986) specialized in weigh belt feeders production; and Rotex (1987) that produced loading bellows, flexible helix conveyors and level monitoring equipment.

At the head of these subsidiaries Marchesini appointed some experienced managers, who had worked with him at Wam for many years. Each of these individuals was given a minority shareholding in the subsidiary that he managed. Anyway, the parent-company Wam kept carrying out several functions essential to the subsidiaries' activity, such as accountancy, personnel, sales and purchasing management.[15]

Since the mid-1980s Wam added to this internal growth strategy, characterized by the creation of juridically autonomous companies controlled by the Wam Company itself, an external growth strategy, with the acquisition of a few companies specialized in productions complementary to those of Wam. The aim was to have access to knowledge and competences relevant to Wam's growth strategy and to broaden the Wam group's product range.

The first acquisition occurred in 1985, when Wam took over Agritec of Modena, a company specialized in the production of agricultural and gardening equipment. However, because of poor economic performance Agritec was reconverted in 1991 to the manufacturing of bulk solids discharging equipment.[16]

In 1998 Wam acquired Oli of Milan, that produced vibrators. In the same year Oli was transfer to Modena next to Wam's headquarters.[17]

In 1999 Wam acquired Roncuzzi of Ravenna, a company founded in 1901 which specialized in the manufacturing of bucket elevators and chain and belt conveyors used to handle bulk material in ports. In the same year, another acquisition was Tecno Cm of Modena, a small firms specialized in the production of components in polyurethane, which for a few years had been working as a subcontractor for Wam.[18]

[14] Michael Grass (Wam's Communications Manager), Interview, 2 November 1999.
[15] Grass, Interview, 11 November 1999.
[16] Claudio Sgarbi (Wam's Administration Manager), Interview, 30 March 2000.
[17] Archivio Wam, Verbali del Consiglio di Amministrazione (VCA), 27 March 1998.
[18] Archivio Wam, VCA, 14 December 1998.

3. Wam as a district firm

Wam's growth was undoubtely favored by the fact that the company was located inside an ID. The training of the company's founder followed a path common to a whole generation of Modena mechanical-engineering entrepreneurs. In fact, his training was characterized by an intermingling of formal skills learnt at the city's technical school and of practical skills learnt on the job at Ime, and by a nurturing of technical and market competences concerning Ime's business relationships which were favored by the fact that this company operated inside an ID.[19]

Moreover, since its foundation Wam built a dense web of relationships with several firms inside the Modena mechanical-engineering ID. We have seen that in the beginning Wam was little more than an assembler which outsourced nearly all the components of its screw conveyors.

With the development of the new modular product design Wam increased its level of vertical integration and brought in-house most of the tubular bodywork manufacturing process. However, also in this new phase Wam kept relying on the local network of subcontractors. In fact, the screw conveyor is an artefact whose production requires both metal fabricating and machining operations. Wam specialized in the execution of a part of the former: cutting of pipe; openings for inlet and outlet spouts, as well as for inspection hatches; welding of flanges, spouts and hatches; bending and welding of the screws. Instead, Wam resorted to local subcontractors for the remaining part of metal fabricating (cutting, bending and welding of metal sheets) and all the machining (on reduction gears and intermediate and end bearings).[20]

Thus, Wam, that in the late 1970s had opened a machining department where gears for the screw conveyor's reducer were lathed and toothed, soon realized that it was more convenient to outsource gear machining as well as the supply of all other components of the reducer to local subcontractors. After a couple of years, the machining department was closed down and Wam decided to make in-house only the assembly of the gear reducers.[21]

4. The conquest of the domestic market's leadership

[19] Paola Mengoli and Margherita Russo, *Skills, innovation and local development*, Materiali di discussione del Dipartimento di Economia politica, n. 297 (Modena, 2000), 7-8.
[20] Claudio Mariuzzo (Wam's Product Control Manager), Interview, 17 March 2000.
[21] Caprari, Interview, 23 November 1999.

In 1981, Wam had already established itself as the market leader in Italy for cement screw conveyors with a share of about 40% (Table 1). Wam's leadership was further strengthened in the following decade and in 1991 its market share had risen to 60%. However, in 2000, it had decreased to 50%, eroded by the competition of some small firms that had been founded by former Wam employees and had adopted the same modular product design originally developed by Wam. The production volumes of these competitors were much lower than Wam's (the largest of them produced no more than 300 screw conveyors a year against 10,000 of Wam). Therefore, they could not realize the same scale economies as Wam, but also their overheads were lower. Nevertheless, in 2003 Wam's market share went up again to 55%.

The conquest of the domestic market for dust filters was slower but more linear. Wam's share for this product growth gradually from 20% in 1981 to 40% in 1991, 50% in 2000, and 60% in 2003.

In addition to cement screw conveyors and dust filters, that were the company's more important products,[22] Wam became the market leader in Italy also for butterfly and slide valves, mixers, vibrators, and other equipment.[23]

5. The establishment of commercial subsidiaries abroad

The expansion on the domestic market was added, in 1977, by the first sales abroad, directed to France and West Germany.[24] Since then, exports grew rapidly and were addressed towards a increasing number of countries. Exports rose from 31% of the company's turnover in 1981 to 52% in 1990 and to 63% in 1998.[25]

In the mid-1980s Wam decided to establish commercial subsidiaries in those foreign countries whose markets were large or promising enough to justify such an investment. The aim of this strategy was to develop a better knowledge of such markets, build stronger ties with local actors and provide customers with faster post-sale assistance. The first foreign subsidiary was Wam France, that was set up in 1984. Then other commercial subsidiaries followed in Germany (1986), UK (1987), USA (1987), Denmark (1992), Japan (1994), Belgium (1995), Australia (1996), Thailand

[22] In 1999 cement screw feeders accounted for 40% of Wam's turnover, dust filters for 20%, and the rest of the product range for the remaining 40% (Archivio Wam, Vendite in quantità e valore negli ultimi due esercizi ed in quello in corso [2000]).
[23] Ibid.
[24] Grass, Interview, 2 November 1999.
[25] Archivio Wam, Vendite in quantità e valore negli ultimi due esercizi ed in quello in corso. Quota di export per ognuno dei suindicati tre anni [1998].

(1996), India (1998), Brazil (1999), Holland (1999), Switzerland (1999), Finland (2001), Chile (2003), Korea (2003) e Spain (2003).[26]

This strategy enabled Wam to rapidly expand its sales in the European market, where it became the leader for both screw conveyors and dust filters (in this latter case with the exception of the UK). As it is shown in Table 1, in 2000 Wam had a market share for screw conveyors of 70% in France and Germany and 60% in the UK, whilst the corresponding figures for dust filters were 50% in France, 20% in Germany and 10% in the UK.

The circumstance that market shares for screw conveyors were higher than those for dust filters was due to two fundamental reasons: 1) on the one hand, Wam started later to invest substantially in dust filters, only in the second half of the 1980s, after the Černobyl nuclear disaster had prompted greater attention to environment problems throughout the world; 2) on the other hand, to different nature of competition in the two sectors.

In fact, competition for screw conveyors was someway less tight, being constituted – both in Italy and abroad – by a multitude of very small firms whose technological and commercial capabilities were much inferior to Wam's. On the contrary, the world markets for dust filters was characterized by stiffer oligopolistic competition. Here Wam faced a limited number of competitors, that were often larger in size and had a strong commercial organization: Dce and R-Master (UK), Infa-Staub and Ats (Germany), Fda (France), Griffin and Flex-Clean (USA). Some products of these competitors were technologically superior to Wam's, whose main competitive advantage was constituted by lower production costs (and prices).[27]

We have seen that since 1987 Wam set up commercial subsidiaries also in a number of extra-European countries. However, contrary to what happened in Europe, such a move turned out to be largely ineffective to penetrate extra-European markets.

In the 1980s and 1990s the largest extra-European markets for bulk material handling and dust filtration machinery were the USA and Japan. Wam opened a commercial subsidiary in the USA in 1987. However, at that time "nobody wanted our screw conveyors, even if we had gifted them. This occurred because no American batching plant manufacturer would have been available to wait eight weeks to be delivered a screw conveyor: the time we would have taken to manufacture it in Italy and transport it by sea to the USA".[28] Besides, transport costs were very high and this made Wam

[26] Archivio Wam, VCA, 18 January 1984, 10 July 1986, 15 January 1987, 24 December 1987, 21 January 1992, 22 November 1994, 3 October 1995, 1 October 1996, 26 March 1998, 12 January 1999, 28 March 2001; 19 November 2003.

[27] William Fantini (Wam's General Manager), Interview, 26 April 2000.

[28] Vainer Marchesini (Wam's Chairman and Ceo), *Fare impresa in Italia, Stati Uniti e Cina*, presentation given at the Faculty of Economics, University of Modena and Reggio Emilia, 2 December 2003.

screw conveyors not competitive in terms of price in the American market.[29] Thus, Wam USA's activity was limited to the commercialization of low volumes of filters (whose transport costs could be reduced by shipping these products semi-assembled), valves and other fittings for batching plants.[30]

Also Wam Japan (founded in 1994) focused on the commercialization of the two products that had lower transport cost: dust filters and valves. The selling of screw conveyors manufactured in Italy was not attempted either, for the same reasons as in the USA. The penetration of the Japanese market was nonetheless extremely difficult also for dust filters and valves. Wam's market share has always been very low: no more than 3% for filters and no more than 8% for valves. Wam products were more cost-effective, but their quality was lower than that of the Japanese products. And this amounted to a big competitive disadvantage as Japan was the most demanding market in the world for quality. Moreover, Wam's penetration in Japan was also hindered by cultural barriers and by the structure of the Japanese mechanical-engineering industry: "the Japanese market is very closed: many of our potential clients speak only Japanese and are constituted by companies linked or belonging to the large keiretsu operating in that country, to which also our Japanese competitors are tied".[31]

6. The establishment of manufacturing subsidiaries abroad

Sales in extra-European countries soared only after Wam could establish its own production facilities there to serve those markets.

The first step in this respect took place in 1995 with the setting-up of Shanghai Wam – Wam's subsidiary in the People's Republic of China – that, differently from the company's other foreign subsidiaries, operated from beginning as a manufacturing unit. Such a choice was someway imposed by the Chinese authorities that were not interested in acquiring goods but know-how and see in this solution the way to have access to Wam's technology.[32]

In the beginning, the idea was to produce in China castings and other mechanical components to be shipped and assembled at Wam plant in Italy. Shanghai Wam was set up as a joint-venture with a Chinese partner. The parent-company Wam provided production equipment and training for the Chinese personnel.

[29] The screw conveyor is a product which is very difficult to ship: it is very cumbersome and its handling and transport costs are very high.
[30] Grass, Interview, 16 November 1999.
[31] Fantini, Interview, 30 April 2004.
[32] Grass, Interview, 16 November 1999.

Production started in 1996 and in January 1997 Shanghai Wam shipped its first components to the Wam factory in Italy.

In March 1998 the Wam Company took full control of Shanghai Wam.[33] Since then the main strategic goal assigned to Shanghai Wam was changed too. Shanghai Wam would now have to operate not only as subcontractor for the Wam Company in Italy, but also and foremost as a firm producing finished goods – principally, cement screw conveyors and dust filters – for the Chinese market that in the 1990s had started to grow very fast.[34]

Thus, in 1999 Shanghai Wam manufactured the first dust filters for the Chinese market, which were followed one year after by the first cement screw conveyors. By 2003 Wam had become the market leader in China for both products, with a share of 40% for cement screw conveyors and 20% for dust filters (Table 1).

In 1999 the Wam group set up another two joint-ventures in China. The first one was established by the subsidiary Sp.Eco for the production of water screw pumps and screw compactors for the wastewater sludge purification plant of the Chinese city of Chengdu. The second one was instead established by Wam's other subsidiary Oli in Shangyu for the production of components of vibrating equipments. In this case the aim was outsourcing: vibrators were a standardized product and Wam realized it was convenient to resort to this newly-created joint-venture in China for the provision, at a much lower cost than in Italy, of most of their its (amounting to about 80% of the value of the finished product) while the final assembly was maintained in Italy.[35]

In 1995 also Wam's subsidiary in the United States started a manufacturing activity by installing an assembly line for round dust filters. Semi-assembled filter components kept coming from Italy. In 1998 Wam USA moved from its originary location in Gainesville, FL, into new and larger premises in Lawrenceville, GA. Here the company constructed a new factory with warehouse facilities which produced screw conveyors and dust filters for the American market.[36]

In 2002 Wam opened a second manufacturing unit in the United States, located in Fort Worth, TX. Since then, the Lawrenceville plant was specialized in the production of screw conveyors and dust filters according to the European standard Uni whose demand was growing very fast also in the United States. Conversely, the Fort Worth plant produced screw conveyors and filters according to the traditional North-American standard Cema (Conveyor Equipment Manufacturers Association).[37]

[33] Archivio Wam, VCA, 25 March 1998.
[34] Grass, Interview, 30 April 2004.
[35] Archivio Wam, VCA,
[36] Grass, Interview, 16 November 1999.
[37] Marchesini, *Fare impresa.*

Undertaking production in loco enabled Wam to soon become the market leader in the United States for screw conveyors with a 40% share in 2003. Wam established its own presence also in the US market for dust filters, but with a share that in the same year amounted to only 10% (Table 1).
In 2002 Wam set up a manufacturing subsidiary also in Rumania for the manufacturing of mechanical components for screw conveyors and dust filters that are assembled in the Modena plant.[38] Lasty, in 2003 Wam established a manufacturing subsidiary in Croatia, which produced bolted silos, an innovative product with respect to traditional welded silos. The goal was to supply the world market by relying on the Wam group's commercial organization.[39]

7. Some balance-sheet indexes of Wam performance

Balance sheets of the Wam Company (Wam group's oldest and largest company) are available since 1981 (Table 3), while the Wam group's consolidated balance sheets are available only since 1997.
Tables 2, 3 and 4 report the numbers of employees and some selected balance sheet data and indexes for both the Wam Company and the Wam group.
As in 1981 the Wam Company accounted for nearly all employees, turnover and assets of the Wam group, we can take the first as a proxy of the second for that year. Thus, we can observe that from 1981 to 2003 employees in the Wam group rose by 14 times (from 68 to 967 employees). Conversely, in the same period the turnover increased, in real terms, by seven times (from 14 to 97 million euro). The faster growth of employment as compared with turnover was principally due to an augment of the Wam group's level of vertical integration, which will be dealt with in the next section.
The two profitability indexes (Roe and Roi) show some differences. Roi oscillates around 10% over the whole period considered. The lowest value (5.8%) was observed in 1993, when an international recession occurred, but only three years after it reached the apical value of 14%. The drop in 2003 was mainly a consequence of the revaluation of the euro. In fact, this had the consequence of reducing Wam's profitability as the company decided not increase its sale prices outside the euro zone not to loose market shares, despite factors of production were purchased mainly in Italy and therefore paid in euro.[40]

[38] Marchesini, Interview, 26 October 2004.
[39] Grass, Interview, 30 April 2004.
[40] Archivio Wam, Bilanci annuali. 2003. Relazione sulla gestione, p. 4.

Roe shows wider oscillations than Roi. In particular, between 1982 and 1988 it exhibited very low values, never higher than 2%. As it is known, Roe reflects the result not only of a company's production management but also of its financial management. The low value of Roe throughout most of the 1980s was a consequence of Wam's high resorting to borrowed capital (see column 3 in Table 4) at a time when interest rates in Italy were very high, with the result that the satisfactory result of the production management was eroded by financial expenses, whose weight on total turnover in the early 1980s was above 10%.

In the 1990s Wam reduced its reliance on borrowed capital and, at the same time, interest rates in Italy fell sharply. As a result, Roe showed higher values than in the previous decade, with a peak of 27.4% in 1994.

8. The introduction of automation at Wam plant in Italy

In the 1990s, Wam's production rose from about 5,500 to 10,000 screw conveyors and from 2,000 to 6,000 filters.[41] An important part in making this increase in production possible was played by the investments the company carried out in the automation of the Modena plant. The advent of automation in turns prompted a further increase in the company's level of vertical integration.

We have seen that at the end of the 1980s Wam resorted to outsourcing for machining and metal fabricating processing on metal sheets. At the beginning of the 1990s, the availability of new automating punching machines for metal sheet cutting pushed Wam to transfer these phase of the production process in-house. A new production department was created for it – named "metal fabricating department" – and placed upstream of the production cycle. As a result, in-house production capacity was increased with the realization of economies of scale that enabled the company to have lower production costs.[42]

Thus, in 1990 Wam acquired a combination plasma cutting punches, and a numerically controlled punching machine was purchased in 1992. In the three following years another three automatic machines were installed in the metal fabricating department: a sheet metal welding robot, a numerically controlled folding machine and a laser cutting machine.[43] Between 1997 and 2000

[41] Fantini, Interview, 30 April 2004.

[42] As a Wam manager remembers, "the subcontracting artisan firms we relied on were to small to afford the investments necessary to introduce these new automatic machines. Therefore, we decided to transfer this processing in-house and purchased the most modern and efficient machinery available on the market." (Mariuzzo, Interview, 28 March 2000).

[43] Mariuzzo, Interview, 17 March 2000.

another two laser cutting machines, two numerically controlled folding machines and three spinning lathes for cold forming of metal sheets were added. [44]

The introduction of automatic machinery and the ensuing production increase in the metal fabricating department pushed Wam to expand the production capacity also of the downstream departments: pipe and spout cutting and welding, painting, and assembly. Thus, in 1994 a robot for plasma cutting and welding of screw conveyors was installed in the welding department, which was followed in 1995 by a numerically controlled grooving machine for inlet and outlet spouts. Another two robots for plasma cutting and welding of screw conveyors were added between 1998 and 2000.[45]

The introduction of robots in the welding department was a troublesome event because at that time there were no robots available on the market that had been designed to cut and weld screw conveyors. Thus, "we searched among 6-7 robot distributors and saw which robot could best suit our needs. We eventually chose a Motoman robot. Three of our staff went to their distributor in Modena to attend a training course to learn how to programme and use this robot. At the same time, we brought with us some pieces of screw conveyor that were used to develop a software which enabled that robot to actually cut and weld screw conveyors. That software was developed by them according to the needs expressed by Wam."[46]

In 2000 Wam introduced also a painting robot, while the final assembly still remained a very labor intensive task. However, this was speeded up by the fact that for every component a computer releases all the documents necessary for production management.[47]

Moreover, a small machining department was created in 2001 after Wam took over the Lgm Company, one of its major suppliers of mechanical components within the Modena ID.[48]

The advent of automation was accompanied by an increased attention to the quality standard standards. In 1994 the Wam Company received the Uni-En-Iso 9001 quality certification for the procedures that it had adopted internally.[49]

In the 1990s Wam also made an intense effort for personnel training in order to enable its employees to properly use the new computer-aided process technology and comply with the Uni-En-Iso quality procedures. This led, in 1997, the Wam Company and the labor unions to sign and agreement that established a training programme which would involve all employees. These would

[44] Lorenzo Bravaglieri (Wam's Production Manager), Interview, 27 July 2000.
[45] Mariuzzo, Interview, 17 March 2000.
[46] Ibid.
[47] Ibid.
[48] Archivio Wam, VCA, 2 October 2001.
[49] Archivio Wam, Stefania Medici, *Manuale assicurazione qualità*, (mimeo, 1995): 1.

have been provided a monetary incentive to attend.[50] The organization of the courses were entrusted to a specialized training centre, certified by the regional government of Emilia-Romagna: Ial of Carpi, controlled by the Catholic union Cisl.[51]

9. The configurator

By the end of the 1990s, the most sophisticated application of ICT at Wam was represented by the configurator: a software capable of configuring a product (screw conveyor, valve, filter, and other) by following the user's answers to a succession of questions put by the computer.

The first configurators appeared on the market in the 1970s to serve the demand of very large customers. Between the late 1980s and early 1990s Wam also tried to introduce a configuartor. However, that project failed. That failure was due to the fact that Wam developed a software in which the drawing configurator was cabled inside a programming language. This architecture required a dedicated programme for each of the products included in the sales catalogue. However, such a solution could not meet the needs of Wam, which at that time was small and had a very diversified product range.

Thus, that project was soon abandoned and after a few years and Wam began to look for a different way of developing a configurator. On that purpose, in the mid-1990s Wam started a collaboration with software house in the neighboring town of Reggio Emilia and with Democenter, one of the real service centres set up by the regional government of Emilia-Romagna, which was located in Modena.[52]

[50] Archivio Wam, Wam spa, Contratto collettivo aziendale, 2 December 1997.

[51] Fabio Luppi (Wam's Personnel Manager), Interview, 12 July 2000. A Wam manager set out the goals of the training programme: "We thought it was necessary that workers had not only a good knowledge of the screw conveyors and the metal fabricating and machining operations that must be executed to produce them, but also that they had a good knowledge of the production equipment they had to use on the job, including software and the principal programming languages. They are required to know all these aspects of their job as only in such a way they can give that 'extra special touch ' that is so important to meet the company's production quality targets" (Mariuzzo, Interview, 23 March 2000).

[52] The setting-up of real service centres was, since the late 1970s, one of the major industrial policy actions of the Emilia-Romagna region. The provision of real services involved offering companies the services they needed, rather than financial incentives, to prompt innovation. Typically such services concerned corporate strategy; organizational development and management; financial and administrative systems; production and service management; research activities; management of human resources; information technology and systems. For an in-depth analysis of the real service policy in Emilia-Romagna, see Sebastiano Brusco and Ezio Righi, "Local Government, Industrial Policy and Social Consensus: The Case of Modena (Italy)", *Economy and Society* 18 (1989): 414-419; Nicola Bellini, Maria Grazia Giordani and Flavia Pasquini, "The Industrial Policy of Emilia-Romagna: The Business Service Centres", in *The Regions and European Integration*, ed. Robert Leonardi and Raffaella Y. Nanetti (London, 1990), 171-185; Sebastiano Brusco, "Small Firms and the Provision of Real Services", in *Industrial Districts and Local Economic Regeneration*, ed. Frank Pyke and Werner Sengenberger (Geneva, 1992), 177-196.

This collaboration led in a few years to the development of a new configurator targeted on Wam's needs. The major novelty was that this new software functioned within an operating system which did not need to be re-programmed for each product that had to be configured. Thus, the company's engineering staff could now easily insert in the configurator the specifications of all products included in the sales catalogue which constituted the database that had to be used by the commercial department in the management of orders. This platform could be installed on a personal computer and enabled its user to configure nearly all Wam products and accessories without the need to write an *ad hoc* programme for each of them.[53]

10. R&D and innovation

As we have seen, in 1981 Wam was one of the first mechanical-engineering companies in Emilia-Romagna to set up a R&D laboratory. Since then, Wam invested in the average 2% of its annual turnover in R&D. The company developed both pure and applied research and participated at a number of international research programmes funded by the European Union. For that purpose, Wam often partnered with the universities of Bologna and of Modena and Reggio Emilia.[54]

At the beginning of the 21st century Wam's R&D laboratory had a staff of about ten people. Research concerned in particular:

1. Studies regarding the behaviour of granular materials when being conveyed or mixed;
2. Interaction of bulk solids with container and conveyor casing materials;
3. Studies regarding innovative construction materials for the manufacture of equipment components for screw conveyors, dust filters, industrial mixers, flow intercepting valves, and others.
4. Studies regarding new technologies and production processes for the manufacture of screw conveyors, dust filters, industrial mixers, flow intercepting valves, and others.[55]

Over the course of time, the activities of the R&D laboratory led to the registration of numerous Italian and international patents.[56]

11. Wam Inc. (USA) at the beginning of the 21st century

[53] Marco Bortolamasi (Wam's Technical Manager), Interview, 27 June 2000.
[54] Marchesini, *Fare impresa*.
[55] Archivio Wam, Bilanci annuali. 2001. Relazione sulla gestione.
[56] In the year 2000 Wam was the holder of 90 patents. Fifty-one of them were Italian, twelve European, nine German, seven French, four US, three Japanese, two UK, one Brazilian and one international (Archivio Wam, Brevetti, b. 1).

The lay-out of Wam's two manufacturing plants in the United States resembled that of the Wam Company's plant in Italy. However, there were some differences concerning the levels of vertical integration and, above all, the type of production equipment installed.

The two factories in the United States were largely equipped with the machinery that was dismantled from the Modena plant to make room for the new computer-aided machines in the 1990s.

In the Lawrenceville plant (the oldest of the two), differently from Modena, there is neither a machining department, as electric motors and gear reducers must comply with the US Nema standards and are purchased from North-American suppliers, nor a metal fabricating department, as sheet metal cutting, folding and welding are also outsourced to North-American subcontractors.

The production cycle in Lawrenceville starts with the cutting and welding of pipe, which are carried out with a plasma MIG system which was used in the Modena plant before robot installation. Moreover, in the welding department there are some positioners that assure pipe alignment with the end bearing supports which are of the same type as those used in Modena.

Then, once the inlet and outlet spouts have been welded to the pipe, the product is sandblasted and painted. Differently from the Modena plant, painting in Lawrenceville is not robot-aided, but is carried out directly by the operator with a pain spray gun.

Lastly, the screw conveyor passes to the final assembly. Also in this department there is a difference with respect to Modena. In fact, in Modena the body of the screw conveyor is hung to a chain conveyor and the components are assembled to it as this moves forward. Instead, in Lawrenceville the body of the screw conveyor is placed on a trolley which is pushed forward directly by the operators once the components have been installed. Such a system lengthen by about one quarter the time needed to assemble a screw conveyor.[57]

Lastly, in Lawrenceville there is also a dust filter department, which mostly assembles components that are outsourced to North-American subcontractors. In this department there is also a plasma punching machine, which produces a part of the sheet metal panels for the body of the filters, while the remaining panels are purchased by local suppliers.

The organization of the Forth Worth plant is similar to the Lawrenceville one. Thus, there are no computer-aided machines in Wam's North-American plants and, more generally, production equipment is less sophisticated than in the Modena plant. Such a circumstance can be explained by the size and the production runs of the two US plants, that are too small to make an investment in costly and sophisticated production equipment convenient. In fact, in 2003 the Lawrenceville plant

[57] Maurizio Magnoni (Wam's technician), Interview, 4 August 2004.

had a covered surface of 4,000 square meters and 18 employees, while the Fort Worth plant had a covered surface of 8,400 square meters and 26 employees. Their overall production was only 1,000 screw conveyors and 1,500 filters. Conversely, in the same year the Modena plant had a covered surface of 70,000 square meters, more than 300 employees and produced about 10,000 screw conveyors and 8,000 filters to serve Europe, Northern Africa and the Middle East.[58]

Wam's headquarters in Modena provided technical support for the optimization of the organization of the production cycle in the two North-American plants, as well as for the development of products and production equipment tailored to the needs of the US market.[59]

As we have seen, by 2003 Wam had succeeded to become the market leader for cement screw conveyors in the United States with a share of 40% and also held a 10% market share for dust filters. This achievement was the result of a fully-fledged strategy aimed at capturing the US market. In fact, to be present in the United States with its own production facilities would not have sufficient to Wam to conquer the market leadership in that country as American customers pay a great attention not only to product quality, quality-price ratio and delivery time, but also to service and post-sale assistance and also to the product image.

In this respect, Wam USA decided first of all not to appear as the local branch of a foreign parent-company but as an American company. On that purpose in the year 2000 Wam's subsidiary in the United States was renamed Wam Inc. and applied for membership of the American Conveyor Equipment Manufacturers Association.[60]

Besides, to promote its products Wam Inc. started to regularly participate at the four main fair trade in the building and construction industry in America, held in Atlanta, Chicago, Las Vegas and Orlando. The technical department and communication center of Wam's headquarters in Italy backed up the sales and marketing department of Wam Inc. in the preparation and management of Wam's showcases in these events.

But, above all, to capture the American market Wam needed to create, around its two manufacturing plants of Lawrenceville and Fort Worth, a ramified network of agents and representatives that assured quick post-sale assistance and spare parts delivery throughout the immense territory of that continent. By 2003 such an assistance network numbered 45 service points in the United States and eight service points in Canada.[61]

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[58] Marchesini, *Fare impresa*; Fantini, Interview, 30 April 2004.
[59] Magnoni, Interview, 4 August 2004.
[60] Grass, Interview, 30 April 2004. After the opening, in 2002, of the Fort Worth plant, the Lawrenceville establishment was named "Wam Inc. Georgia Division" and the Fort Worth one "Wam Inc. Texas Division" (Archivio Wam, VCA, 29 May 2002).
[61] Marchesini, *Fare impresa.*

12. Shanghai Wam at the beginning of the 21st century

The lay-out of the Shanghai Wam's plant in turns resembled that of the Modena and the US plants, even if some major differences existed. Also the Shanghai plant was largely equipped with the machinery that was dismantled from the Modena plant after the introduction of the new computer-aided machines in the 1990s.

In Shanghai, differently from both Modena and Lawrenceville, upstream there is a large machining department, which produces mechanical components. This existed since 1995, but it was much enlarged in 2001 after Wam took over the Lgm Company, one of its major suppliers of mechanical components within the Modena ID in Italy. After the takeover, most of the Lgm Company's machines tools (numerically controlled lathes, mills, drills, and small machining centres) were transferred to the Shanghai Wam's plant, while the remainder was transferred to the Wam Company's plant in Modena where a small machining department was established too. Thus, custom-built or short-run mechanical components – for prototypes and products that are manufactured in small batches – are produced in-house in Modena or outsourced to subcontractors in Italy, while long-run components are produced in the machining department of the Shanghai plant, that purchases castings directly from Chinese foundries.

In the Shanghai plant, next to the machining department there is a department where machined components are sub-assembled to make gear reducers, supports and end bearings. These products are partly shipped to Italy and partly assembled *in loco* in the screw conveyors produced for the Chinese market.

Then, there is the section of the Shanghai plant where the tubolar bodywork of the screw conveyor undergoes its manufacturing process. Here, similarly to Lawrenceville but differently from Modena, there is not a metal fabricating department for sheet metal cutting, folding and welding. The production cycle starts with the cutting and welding of pipe and spouts. There is also a department where the spirals are folded and welded as well as departments for the painting and final assembly of the screw conveyors, which are similar to those in Lawrenceville.

Lastly, in Shanghai there is a dust filters department, which, differently from the analogous departments in Modena and Lawrenceville, is exclusively an assembly department as all sheet metal panels of the body of the filters are purchased from Chinese subcontractors.[62]

In 2003 the Shanghai plant had a covered surface of 10,000 square meters and 165 employees who worked on three shifts.[63] In that year production amounted to about 2,000 screw conveyors and as

[62] Magnoni, Interview, 4 August 2004.

many dust filters.[64] Wages were about ten times lower than in Italy and therefore it was not surprising that the production technology was more labor-intensive than in Modena.[65]

However, this implied that the performance of Shanghai Wam relied even more on the human factor. Therefore the company paid a particular attention to employee training, which took place partly in Modena and partly in China.[66]

A great care was devoted to improve the quality of the procedures adopted within the company. In this respect, Shanghai Wam started introducing the Uni-En-Iso 9000:2000 quality system in 2003.[67] To achieve this goal, at the end of 2003 the company launched the "Continuous improvement programmes" at which all employees were encouraged to participate. Within this framework, four "Continuous improvement project teams" were established:

1. "Warehouse control team", to decrease stock volume and speed up stock rotation and reduce cost;
2. "Screw conveyor quality improvement team", to decrease the screw conveyor's rework and defect rate during the production process;
3. "Training system upgrade team", to optimize company training system and to obtain an average of 30 hours' employee training per year;
4. "Vfs-100-Tn valve quality improvement team", to improve the quality of valves and customer satisfaction on this specific item.

Besides, all employees were encouraged to set up quality control teams spontaneously. Monetary and spiritual awards would have been awarded to quality control team achievements, i.e.: bonuses and wage increases, public praise and "yearly star employees" nomination.[68]

Furthermore, to encourage more and more employees to exert their wisdom and potentials, Shanghai Wam enacted the "Innovation award" policy: 10% of the cost saved or profits made out of the said innovation within one year after the innovation was proved and adopted would be awarded to the innovator, and administrative praise would be recorded in the employee's file.[69]

As a result, In May 2004 Shanghai Wam received the Uni-En-Iso 9000:2000 quality certification by the German Authentication Institute Tüv.[70]

But, above all, to conquer the leadership of the Chinese market Shanghai Wam had to invest in its sales and marketing organization. To upgrade the professionalism of the sales force the company

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[63] On the contrary, work on three shifts was prohibited by both the Italian and the US legislation.
[64] Fantini, Interview, 30 April 2004.
[65] Marchesini, *Fare impresa*.
[66] Grass, Interview, 30 April 2004.
[67] *Wam Shanghai Quarterly Journal* 1 (2003) (1): 2.
[68] *Wam Shanghai Quarterly Journal* 2 (2004) (1): 4.
[69] Ibid.: 6.
[70] *Wam Shanghai Quarterly Journal* 2 (2004) (2): 4.

organized several training courses for its sales staff in cooperation with Cegos, the largest enterprise management consulting company in Europe.[71]

To promote its products Shanghai Wam started since 2002 to regularly participate at the "International Powder/Bulk Conference & Exhibition" held in Shanghai, the most influential event in this sector in China. The technical department and communication center of Wam's headquarters in Italy backed up the Shanghai Wam to prepare and manage its showcase at this trade fair.[72]

Besides, to better serve the regions of China that are far away from Shanghai, in 2003 the company opened up sales offices in Chengdu, Guang-Zhou and Beijing.[73]

13. Conclusions

This article has shown that at the basis of Wam's success there was the competitive advantage that the company acquired in the late 1970s through the re-design and re-engineering of the cement screw conveyor. As a result, the screw conveyor was transformed from a custom-built product to a product constituted by several standardized modules that could be combined in many different ways. In such a way, product customization was maintained but, at the same time, module standardization enabled the company to realize economies of scale that gave it a decisive competitive advantage over its competitors.

Successive growth has occurred by pursuing a "deep niche" strategy typical of many small firms that have succeeded in becoming international players: that is, by finding and creating new markets where there were no large rivals so that such firms could become leaders while remaining relatively "small" in size.[74] Thus, Wam applied the modular product design originally conceived for the cement screw conveyor to other bulk solids handling and processing equipment and dust filters, thereby realizing economies of scope as well as economies of scale.

The growth of the company was made possible by the Chandlerian three-pronged investment in production facilities large enough to exploit a technology's potential economies of scale and scope, in a national and international marketing and distribution network, and in management.[75] Eventually, it was the latter – the investment in organizational capabilities – that turned out to be the more important, by enabling the company to manage and coordinate a network of nearly 30 commercial and manufacturing affiliates – using mainly proprietary technology – spanned across

[71] *Wam Shanghai Quarterly Journal* 2 (2004) (1): 5.
[72] *Wam Shanghai Quarterly Journal* 2 (2004) (4): 8.
[73] *Wam Shanghai Quarterly Journal* 1 (2003) (1): 2.
[74] T.O. Kohn, "Small Firms as International Players", *Small Business Economics* 7 (1997): 45-51.
[75] Ibid., p. 8.

four continents. These are supported by the R&D and engineering departments located at Wam's headquarters in Modena.

A comparison between Wam's factories in Italy, China and the United States has shown that these produce the same goods (screw conveyors and dust filters) but differ each from the other as regards both their level of vertical integration and the type of production equipment installed. Such a circumstance seems to confirm that there is not only one way – or a one best way – to organize a production process. The same product can be made in many different ways. And which of these will be preferred does not depend on qualities that are intrinsic in technology, but on other factors, such as the size of the market, customers' preferences with regard to the quality-price ratio, the level of competition, the existence of a network of qualified sub-sucontractors, the role of institutions, and the relative prices of factors of production.[76]

A prominent scholar has observed that by going abroad a company does not simply finance an affiliate in a foreign country but transfers over borders an entire business package that includes products, processes, experience, reputation, knowledge of where and how to find financing, marketing know-how and networks, trade marks, technology, research and development background, information, and managerial expertise. Moreover, the establishment of a foreign affiliate triggers "spill-over" effects in the host country that must be considered as well. These include the development of supplier and dealer networks that are not internalized within the multinational enterprise as well as the training of employees that leave the multinational enterprise to go to other firms, thus disseminating skills. A spill-over effect occurs also when a multinational introduces a new product in a country: domestic businesses see possibilities in copying and producing the same products.[77]

This article has shown that Wam's internationalization process triggered many of these effects. This was particularly the case in the United States and China, where the company established not only a commercial subsidiary, but also its own production facilities. In both countries Wam created subcontracting networks that in many respects resembled those typical of its Italian ID of origin. Wam transferred to its American and Chinese subcontractors its technical knowledge to enhance the quality of their products so that they could meet Wam's standards. Moreover, Wam's headquarters in Italy backed up its US and Chinese subsidiaries by training their personnel and transferring to them its technology, trade-marks, sales and marketing know-how, organizational procedures, and managerial expertise. By doing so Wam developed some of those "new pragmatic disciplines" of "learning by monitoring" which transform tacit knowledge into "pidgin formalizations" and facilitate cooperation and information exchange across organizational and geographical boundaries.

[76] M.J. Piore and C.F. Sabel, *The Second Industrial Divide* (New York, 1984).
[77] Mira Wilkins, "Comparative Hosts", *Business History* 36 (1994): 18-50.

As recent scholarship has observed, these make IDs less self-contained and more integrated into global supply chains and knowledge exchange networks and have been one of the most important evolutions in successful IDs.[78]

Conversely, the Modena plant saw since the late 1970s a progressive increase in the level of vertical integration which made it less dependent on its traditional manufacturing subcontractors located inside the Modena mechanical-engineering ID. At the same time – and especially since the 1990s – Wam developed new asset-augmenting relations with a web of other actors operating within its Italian ID of origin, which over the course of time became more and more important to the whole Wam group's success, such as specialized subcontractors that manufacture customized and short-run components, suppliers of automatic machinery and sophisticated production equipment, software houses, real service centres, vocational training centres, and local universities.

[78] Charles F. Sabel, "Diversity, Not Specialization: The Ties that Bind the (New) Industrial Districts", in *Complexity and Industrial Clusters – Dynamics, Models, National Cases*, ed. Alberto Quadrio Curzio and Marco Fortis (Heidelberg-New York, 2002), 108-9; Jonathan Zeitlin, "Industrial Districts and Regional Clusters", in *The Oxford Handbook of Business History*, ed. Geoffrey Jones and Jonathan Zeitlin (Oxford, 2007), 233-34.

TABLES

Table 1 – Wam's market shares in some selected countries

	Cement screw conveyors							Circular dust filters						
	Italy	France	Germany	UK	Usa	Japan	China	Italy	France	Germany	UK	Usa	Japan	China
1981	40%	40%	20%	40%	-	-	-	20%	10%	5%	-	-	-	-
1991	60%	60%	50%	60%	-	-	-	40%	30%	10%	10%	-	-	-
2000	50%	70%	70%	60%	10%	-	-	50%	50%	20%	10%	10%	3%	-
2003	55%	70%	70%	60%	40%	-	40%	60%	60%	20%	20%	10%	3%	20%

Source: Data provided by William Fantini (Wam's General Manager) on 30 April 2004.

Table 2 – Employees at Wam

	Wam Compnay	Wam group
1968	3	-
1973	7	-
1978	27	-
1980	59	-
1981	68	-
1982	66	-
1983	69	-
1984	72	-
1985	70	-
1986	76	-
1987	87	-
1988	82	-
1989	104	-
1990	108	-
1991	120	-
1992	137	-
1993	135	-
1994	166	-
1995	179	-
1996	210	-
1997	220	-
1998	224	343
1999	218	444
2000	257	558
2001	282	552
2002	302	799
2003	332	967

Source: Archivio Wam, Relazioni del Consiglio di Amministrazione e dei Sindaci (1980-2003).

Table 3 – Wam Company's selected balance sheet indexes

	Turnover (1)	Roe (2)	Roi (3)	Debt/equity Ratio (4)	Financial expenses/ Turnover (%)
1981	13,917	8.2	13.7	3.9	10.7
1982	12,717	2.0	12.4	3.5	12.1
1983	10,781	1.3	10.1	4.3	12.1
1984	9,943	1.5	9.1	4.4	10.6
1985	10,540	1.7	13.9	4.4	9.9
1986	11,398	1.2	10.8	5.0	7.0
1987	12,423	0.9	9.8	5.1	8.9
1988	15,077	0.2	10.0	7.6	7.6
1989	20,041	11.5	9.7	7.7	6.7
1990	16,506	15.6	12.1	6.2	6.7
1991	18,424	7.2	10.9	4.5	6.2
1992	21,335	1.7	11.4	5.5	5.8
1993	20,420	6.0	5.8	5.3	6.7
1994	23,141	27.4	8.3	4.7	4.6
1995	30,578	26.0	11.5	5.3	4.9
1996	31,206	19.8	14.0	4.7	4.8
1997	33,861	19.2	11.0	4.9	3.9
1998	34,598	8.7	12.0	3.9	4.7
1999	36,637	10.4	7.7	3.8	2.9
2000	41,233	10.8	6.7	3.2	2.4
2001	48,854	15.3	11.1	3.1	2.6
2002	52,374	11.6	13,4	3.2	2.6
2003	51,292	11.6	6,3	3.0	2.3

Source: Archivio Wam, Bilanci annuali (1980-2003).
(1) Thousands of euro (2003)
(2) Net profit / capital owned x 100
(3) Operating profit / invested capital x 100
(4) Invested capital / shareholder's equity

Table 4 – Wam group's selected balance sheet indexes

	Turnover (1)	Roe (2)	Roi (3)	Debt/equity Ratio (4)	Financial expenses/ Turnover (%)
1997	58,869	25.4	10.4	6.0	3.7
1998	61,847	21.3	10.1	4.7	3.8
1999	68,728	22.8	10.8	4.0	2.1
2000	82,637	16.2	7.7	3.9	1.9
2001	94,986	18.4	10.7	3.7	2.3
2002	92,717	24.0	8.5	3.6	3.1
2003	96,906	11.3	5.2	3.2	3.2

Source: Archivio Wam, Bilanci consolidati (1997-2003).
(1) Thousands of euro (2003)
(2) Net profit / capital owned x 100
(3) Operating profit / invested capital x 100
(4) Invested capital / shareholder's equity

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