

Ross School of Business at the University of Michigan

Independent Study Project Report

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TITLE : Kowary Carpet Factory

UNIVERSITY OF MICHIGAN BUSINESS SCHOOL

KOWARY CARPET FACTORY

Mr Markowski, the CEO of Kowary was reviewing the possible strategies that his company could follow. Poland had been going through a lot of changes since the end of communism in 1989, and he knew that many more changes were still to come. Distribution was one of the areas where important decisions had to be taken. These decisions would greatly impact the future and possibly the survival of the company, but it was difficult to predict in which direction things were going to evolve. Among the many decisions that Mr Markowski had to make, two were of strategic importance: Should Kowary invest in a franchise system that its current retailers could join? What should Kowary do with Komfort, a new retail network, which entered the Polish market?

Kowary's history:

The Kowary carpet factory was created in 1854 in the small town of Kowary (today's Southwestern Poland). At that time, the first workers, trained in the town of Izmir (Turkey), famous for carpet manufacturing, started weaving carpets by tying knots on wooden looms. In 1906-1912 new looms were installed which enabled the manufacture of carpets with a maximum number of 64 colors in nap. This helped the factory to compete on the international markets. As early as the 1930s, Kowary started to export carpets to Scandinavia and to both Americas.

When communists took power, after WWII, the company was nationalized and production was managed by the central plan. In 1973, the factory was extended and a new plant was added for the manufacture of synthetic carpets, which were exported, mainly to the Soviet Union. Until the fall of communism in 1989, the Polish economy was facing such a shortage that Kowary had no trouble selling its production. It was not uncommon that customers had to bribe managers of the company to be able to buy carpet. After 1989, Kowary struggled to find new markets when its traditional export markets (the former Soviet Union and Eastern block) collapsed. But despite the economic changes and the increasing share of imports, the factory was still working at full capacity in 1993, and the company was making profit. Kowary was likely to be incorporated in the mass privatization program that the Polish government wanted to launch in the mid 90s.

The floor covering industry:

The floor covering industry in Poland was comprised of multiple products including carpet, rugs, vinyl coverings (PCV), wood panels, laminated wood panels, and ceramic

tiles. Total demand for floor coverings in 1993 was expected to be 78 million m^2 (+ / -25%). Poland had numerous domestic manufacturers of floor coverings that were starting to face intense foreign competition.

- Inputs for almost all floor coverings were commodity items, therefore suppliers had little power in the supply chain.
- Seasonality existed for carpet sales, and there were two peak sales seasons. The largest occurred during the Fall (October and November), and the other occurred just prior to Spring (February and March). As much as 50% of sales could occur during these four months.
- The business-to-business market represented a significant growth opportunity for all manufacturers. Housing construction was expected to double between 1993-2003, and hotel construction was expected to triple in the same period.
- Entry and exit barriers were high due to large investments in production machinery and facilities. In addition, domestic Polish manufacturers were struggling to become competitive with imports because of pro-labor regulations and powerful trade unions that made rationalizing labor very difficult. The high inflation and lack of capital for necessary machine upgrades exacerbated this problem.

The carpet and rug Industry:

The carpet and rug industry represented 50% of the total floor covering category in Poland and was comprised of three major domestic manufacturers and numerous importers of Western European and American products. These companies produced several types of carpets, including polyester-based tufted (printed and non-printed), wool-based carpets like axminster and weltom, and rugs. Carpets were sold by the square meter and ranged in width from 2 m to 5 m (See **Exhibits 1, 2, and 3** for market data)

1993 Market share data for the industry were as follows:

Company	Total Market Share (m 2)
Novita	20%
Kowary	12%
Agnella	8%
Other domestic manufactures	20%
Imports	40%

The growth potential for the carpet market was favorable. Sales to individuals (retail sales) represented 74% of the market and were expected to grow in 1993. Moreover, carpet consumption per capita (0.6 m^2 in Poland) was 25% of the average of Western European countries.

However, the outlook for local producers of carpet was not as favorable. Imports had been steadily gaining market share since import barriers were reduced in 1990. Imports increased from 0% in 1990 to 40% in 1993 and this trend was likely to continue. Imports were purported to have better quality, better designs and lower prices than domestic products.

Three manufacturers dominated the domestic production. The leading carpet manufacturer in Poland was called Novita. It produced 2 and 3 meter wide tufted carpet. The quality of Novita carpet was supposed to be lower than that of imports and

its product line was not very wide. Agnella, the third largest domestic producer, decided to focus only on rugs. It had relatively lower costs than the other two Polish producers. Its strategy was to copy the hot selling products of Western European manufacturers and sell them in Poland at a lower price.

Kowary's Product Line:

Kowary produced two types of carpets: axminster and tufting. Axminster carpets were high quality products made of thick wool. Kowary had a strong competitive advantage on this type of product. It was the only domestic manufacturer of axminster and had lower production costs than foreign manufacturers. Kowary carpets were the only axminster products sold on the Polish market, but because of its high price, axminster was a small segment of the Polish market and was sold primarily to hotels and corporate offices.

35% of Kowary's axminster production was sold on the Polish market. The other 65% were exported, mostly to the United Kingdom. The UK was a peculiar market because axminster was the standard for high-end carpets. Customers were aware of the axminster technology and were willing to pay a premium price for it. Kowary had a 10% share on the British market and was selling its products through four networks of independent retailers. Those networks provided their own designs and only subcontracted production to Kowary. Kowary was also selling these designs on the Polish market but few of them really fitted the tastes of Polish customers (See **Exhibit 4** for Kowary's sales breakdown). With the strong British Pound, Kowary was able to make good margins on axminster exports while maintaining a price that was 8% lower than that of British producers. However, because of its old machinery, Kowary had trouble providing a consistent quality. Kowary's management believed that if the company increased its axminster production capacity, it would not have any problem selling the incremental output on the British market.

The picture was different in tufted carpets where Kowary faced strong competition from Western Europe. Manufacturers from Belgium and the Netherlands had followed a low costs/high volume strategy and dominated the European tufting market. Their margins were below 10% but they had little overheads and these overheads were spread over much higher volume than that of Kowary. Because of the low productivity of its labor force and the age of its equipment, Kowary's tufted products were not cost competitive. In order to offer competitive prices, retailers had to reduce their margins to 18-25% on Kowary carpets versus 30-50% on imported carpets. This margin differential was even higher for printed carpet. The only reason why imports did not gain a higher than 40% share was that many small retailers did not have access to imported products. They were supplied by small wholesalers, which could not order the minimum quantity required by importers. In order to carry Belgian carpets, theses wholesalers would themselves have to go through an additional middle man, thus reducing the price benefit of imported products.

Another problem was that Kowary could only produce three meter wide printed carpet and three and four meter wide non-printed carpet. However, the market was slowly shifting to four and five meters as new homes had larger rooms. Imports, which were four and five meter wide, had dramatically increased over the past few years and now represented 40% of the market. Kowary's domestic market share dropped from 20% in 1990 to 12% in 1993.

No new investment had been made in the production lines since the new tufting plant in 1973, and some machines were up to 30 years old. If Kowary wanted to acquire the

same equipment as its Belgian competitors, it would have to invest 25 million zl. The capacity of one of these machines was 20 million m², which would represent a considerable increase over Kowary's current capacity. Mr. Markowski was concerned about the ability of Kowary to sell such a volume. Besides, investing in a new technology did not guarantee that Kowary would be cost competitive with European manufacturers. Very little labor was needed with these new machines, while cheap labor cost was the major competitive advantage of Polish manufacturers. Finally, Kowary would probably have to lay off half of the 400 employees working on the tufting line. Because of the public concern about rising unemployment, it was very likely that the powerful unions would go on strike in such a case, threatening the survival of the company.

Aside from cost, Kowary also faced problems with its product offer. Because in the 70s and 80s production could easily be sold, the company had never focused on customer needs. Kowary produced carpets of different thickness, colors and designs, but the product lines had always been organized according to technical characteristics. Beata Pitkowska, Kowary's Marketing Director, wanted to entirely reorganize the product lines. Ultimately, she wanted Kowary to offer three lines of business-to-business products (high, medium, and low-end) that met governmental standards (inflammability, electrostatic, etc.). For individuals, she wanted products designed for each specific home usage: bedrooms, bathrooms, living rooms, children's bedrooms, etc. She believed that this reorganization would take two to three years to complete because the internal design department could only produce a limited number of new designs each year.

Changes in Poland during the 90s:

After the fall of communism in 1989, the Polish government opted for the so-called "shock therapy". Tariffs on most imported products were lowered overnight to force Polish producers to adapt to the market economy. Every day, thousands of Polish entrepreneurs were crossing the border with Germany bringing back Western products that they were selling on the street. For carpets, tariffs on imports from the European Union were lowered to only 4% and were not believed to be a significant barrier to entry.

State-owned companies quickly had to adapt to the rules of market economy and many of them went bankrupt. Between 1989 and 1993, the GDP fell by approximately 15% and unemployment peaked at 16%. However, GDP was forecasted to start growing again in the next few years and personal real income was forecasted to grow even faster. At the same time, inflation, which was around 35%, was forecasted to decrease gradually.

Distribution:

Floor covering products were sold in three different types of stores, floor covering specialists, do-it-yourself/home improvement stores and all-in-one stores.

• Floor specialists were primarily selling PCV, carpet and rugs. Some of them were also selling accessories, wallpaper or blinds. There were approximately 1,000 of these stores around the country. Their size greatly varied, some were as small as 80 m², while others were larger than 1,000 m². However, the median size was probably below 200 m². These outlets were "mom-and-pop" stores run by independent entrepreneurs. Most of these stores (except for the largest ones) had a limited choice and were only carrying domestic products. A few regional networks had started to appear, but these networks were still the exception. They were

- usually operating between two and ten stores. These networks carried both domestic and imported products.
- Do-it-yourself/home improvement stores were selling all type of construction materials: cement, bricks, or paint. They were usually selling floor covering items such as PCV and ceramic tiles, but rarely carpet. There was no reliable data on the number of such stores. Kowary estimated them to be less numerous than floor specialists.
- All-in-one stores were found in smaller towns and villages. They were selling a wide variety of products such as light bulbs, paint, wallpaper, silverware, hammers, etc. Many of them were selling a limited range of PCVs (usually five to ten designs). There was no reliable data on the number of such stores. Kowary estimated there were up to 20,000 such stores.

These stores were supplied by hundreds of wholesalers. After the fall of communism, thousands of Polish entrepreneurs became wholesalers. They usually started by using their basement as a warehouse and their personal car for shipments. Even though the business had rationalized, most wholesalers were still relatively small with only one or two vans and a small number of customers. Kowary was selling on an occasional basis to more than 150 floor-covering wholesalers and estimated that these wholesalers were not supplying other stores than the 1,000 floor-covering stores. Aside from diseconomies of scale, this system was not very efficient because relationships were often based on personal connections rather than on economic rationality or geographic proximity. A wholesaler could serve stores all across the country and incur high transportation costs. The fact that a large part of these stores' and wholesalers' activity was not reported to the taxation authorities made trust between the wholesaler and the retailer very important and long lasting relationships were difficult to break.

In the past, manufacturers, such as Kowary, viewed their objective as selling as much volume to as many wholesalers as they could. The burden of selling products to retailers was left to the wholesaler, and the burden of selling products to final customers was left to the retailers. With the arrival of foreign competitors, Kowary was starting to realize that it could not rely exclusively on wholesalers to promote its products and that it was important to establish direct relationships with the retailers.

However, wholesalers were reluctant to cooperate and share information on their stores. They were afraid that Kowary would communicate information to other wholesalers or start supplying stores directly. The wholesalers were acting like a wall between the manufacturers and the retailers. Kowary did not know precisely how many stores were selling its products, how much shelf space was devoted to them, and how they were positioned compared to imports. It did not have formal information channels to receive feedback from retailers on the quality of its products, the hot selling colors and designs, and the customer remarks. Nevertheless, it had to cooperate with the wholesalers because few of the stores were large enough to order directly.

Kowary was wondering what it should do with wholesalers. The current system was not efficient and there was a lot that could be done to rationalize it. Kowary was not cost competitive with foreign manufacturers and distribution was an area where costs could be reduced significantly (See **Exhibit** 5 for data on distribution costs). However, rationalization was a difficult and risky task. Kowary did not know whether it should supply stores directly or continue working with wholesalers. If it decided to work with wholesalers, it would probably have to reduce their number. However, it was not clear how these wholesalers should be selected, and whether they would be financially strong enough to serve more stores. Another issue was whether stores would be willing to switch to a designated wholesaler or whether they would just stop carrying Kowary products.

Komfort:

Komfort was a floor covering specialist selling carpets, rugs, PCV, wood panels, wall paper and accessories. The company was created in 1992 by four Polish wholesalers with 19 stores but it was planning on opening ten additional stores in 1993. These stores were located in downtown areas and but were larger than most independent stores (400 m² on average). Komfort was trying to pursue the same strategy as Western European networks: low prices, wide product selection, and a complete range of services. For example, Komfort was offering free transportation within a twenty kilometers radius. The low price claim was backed up by the reimbursement of twice the difference if a customer found the same carpet at a lower price in another store. For that reason, Komfort asked its suppliers to produce exclusive designs and all these products carried the Komfort brand name. Because Polish producers had high costs, 80% to 85% of the products sold in Komfort stores were imports. Komfort was only carrying Kowary's axminster and 3 meter tufted carpet, and Kowary estimated that its products only represented 2% of Komfort's sales.

Because it was wholesaler and retailer at the same time, Komfort was generating economies on logistics. All the stores were supplied from a central warehouse located in Lodz, in Central Poland. Komfort was also purchasing directly from European manufacturers cutting the importer's margins that other retailers had to pay. This efficient logistic system was probably the principal reason why Komfort was able to offer low prices while maintaining its margins at a higher level than other stores.

Future changes in distribution:

Some Western European retail companies were considering moving into Poland. They were either do-it-yourself networks or floor covering specialists (**Exhibit 6** provides detailed information about these networks). In Western Europe, do-it-yourself stores were usually located in suburban areas, next to hypermarkets or other large specialized stores (i.e. Ikea). They were much larger (5,000 m² to 10,000 m²) and offered very competitive prices. Floor covering products represented 5% to 10% of their offer. These networks had very high requirements on price, quality, terms of payments that Polish suppliers would probably not be able or not be willing to meet. Therefore, it was likely that these networks would carry products manufactured by the same suppliers as their Western European stores.

Specialized floor covering networks also, were considering entering the Polish market. The size of their stores ranged from $1,500~\text{m}^2$ to $2,500~\text{m}^2$ and consequently their offer was extremely wide. Aside from low prices, their strength resided in well-trained salespersons and services, such as warranty, transportation, and installation.

When moving into a new country, these networks usually opened a couple of stores in one of the major cities. During the first two or three years, they tried to understand the local market and adapt their offer of products and services. Ikea, for example, found out that they had to offer free bus service to transport to their stores the 75% of Polish customers who did not own a car. After this test period, they decided to either withdraw from that country or move in on a larger scale.

Mass merchandisers had first developed in France and Germany. When their markets became saturated, these networks started to expand to Spain, Italy, smaller European countries, and eventually to Asia and South America. In almost all Western European countries, mass distribution had driven independent stores out of business, especially in price sensitive commodity markets, such as floor covering and home improvement.

The only country that did not follow this pattern was the United Kingdom. In the UK, independent floor-covering retailers had been able to compete against mass merchandisers. Early on, they organized into buying groups or national networks to apply the tools of modern distribution to their business while remaining independent. By organizing, they had been able to negotiate larger discounts with manufacturers, improve the efficiency of their logistic system, and advertise their brand name nationally.

Kowary was wondering whether mass merchandisers would be successful in Poland or whether Poland could evolve like the UK did. There were many differences between Poland and the countries were mass merchandisers operated. First of all, Poland was a rural country with more than 40% of the population living in small towns that were too small to support these large stores. Secondly, only 25% of Poles owned a vehicle and these cars were usually too small to carry floor covering products on long distances. Finally infrastructures in Poland were far from being as good as in Western Europe. There were almost no highways in Poland. Traffic on small roads was slow due to tractors, truck or horse carriages. The average speed on long distances did not exceed 50 km/hour. Traffic in major cities was becoming very congested and driving to the outskirts could take a long time. All these factors considerably reduced the "attraction radius" of such stores (Exhibit 7 provides information about Polish consumers shopping habits).

Mr. Markowski believed that independents could organize before the arrival of mass merchandisers, like they had done in the United Kingdom. He also believed that Kowary could create its own distribution network and have a better position for its products in these stores. However, it was not clear whether Polish retailers would be willing to join such a network as they did not feel the threat of Komfort and foreign networks yet.

CARPET AND RUG MARKET IN POLAND - 1993 Exhibit 1:

SMALL RUGS 4 mln m^2 10 mln m^2 RUGS LARGE RUGS 6 mln m^2 TOTAL MARKET 28 mln m^2 BUSINESS to BUSINESS 4 mln m^2 $18 \, \mathrm{mln} \, \mathrm{m}^2$ CARPET 14 mln m^2 HOME

CARPET MARKET MIX

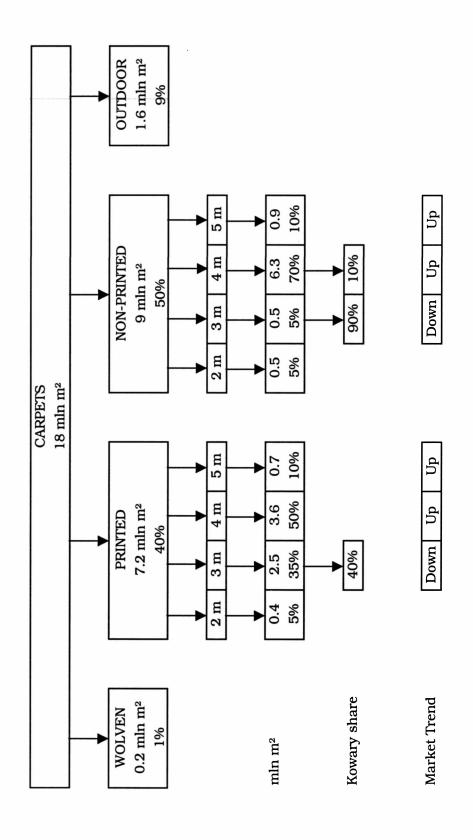


Exhibit 3:

LARGE RUGS MARKET MIX

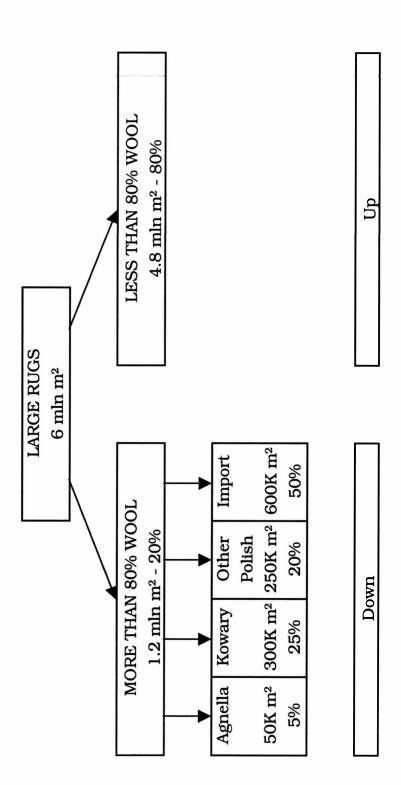
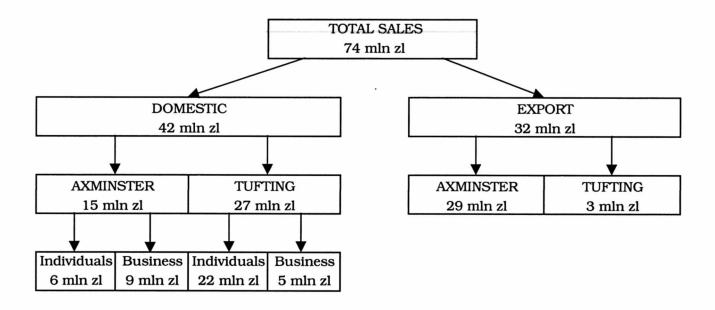


Exhibit 4:

KOWARY SALES BREAK-DOWN - 1993



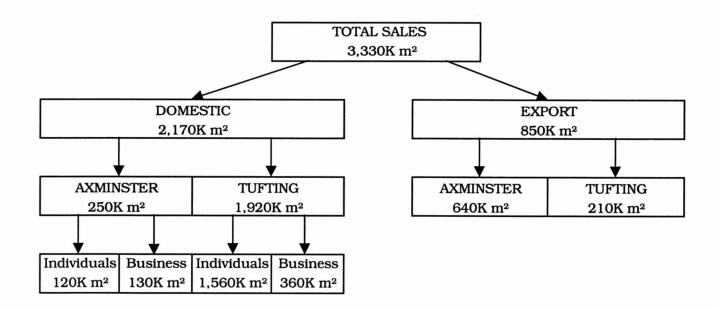


Exhibit 5: Economics of distribution

Supply chain of a typical independent store:

	Kowary carpet	Imported carpet
Factory price	11.75 zl	8.00 zl
less Discount	1.18 zl (10%)	0.32 zl (4%)
Importer Purchase Price		7.52 zl
plus Transportation		0.30 zl
plus 4% Duties		0.31 zl
plus Importer Margin		0.75 zl (10%)
Wholesaler Purchase price	10.57 zl	8.88 zl
plus Wholesaler Margin	1.06 zl (10%)	0.89 zl
Retailer Purchase Price	11.63 zl	9.77 zl
plus Retailer Margin	4.76 zl (41%)	6.62 zl (68%)
Retail Price before Tax	16.39 zl	16.39 zl
plus VAT 22%	3.61 zl	3.61 zl
Retail Price VAT included	20 zl	20 zl

Supply chain of a Komfort store:

	Kowary carpet	Imported carpet
Factory price	11.75 zl	8 z1
less Discount	1.41 zl (12%)	0.48 zl (6%)
plus Transportation		0.18 zl
plus 4% Duties		0.31 zl
Komfort Purchase price	10.34 zl	8.01 zl
plus Warehousing Costs	0.21 zl (2%)*	0.16 zl (2%)*
plus Transportation Costs	0.21 zl (2%)*	0.16 zl (2%)*
Retailer Purchase Price	10.76 zl	8.33 zl
plus Retailer Margin	5.63 zl (52%)	8.08 zl (97%)
Retail Price before Tax	16.39 zl	16.39 zl
plus VAT 22%	3.61 zl	3.61 zl
Retail Price VAT included	20 zl	20 zl

^{*} estimates of Komfort's costs

Exhibit 6: Mass merchandiser networks

Leroy-Merlin:

• Leroy-Merlin was a subsidiary of Auchan, one of the major mass merchandiser networks in France. It had worldwide sales of 15 billion FF (\$2.5 billion). Less than 10% of its sales came from international activities but due to new French regulations making it almost impossible to open new stores, the company was looking for international growth opportunities. Spain, Italy and Poland were the three target countries. Leroy Merlin was looking at opening its first 8,000 m2 store in Warsaw in the mid 1990s, 5% to 10% of the surface would probably be devoted to floor coverings.

Castorama:

• Castorama was a public company listed on the Paris stock Exchange and specialized in housing equipment retailing. It had worldwide sales of 20 billion FF (\$3.5 billion). Less than 5% of its sales came from international activities but in France, it was facing the same regulation issue as Leroy-Merlin. A first 10,000 m2 store was projected to open in Warsaw in the mid 90s.

Stinnes:

• Stinnes BM was a retailing chain specialized in housing equipment. It was part of the Stinnes AG company, which had sales of 25 billion DM (\$12 billion). A typical Stinnes store offered nine ranges of products including floor coverings, ceramic tiles, wallpaper and paints. Polandwais presented as a strategic market for Stinnes. The company was planing to open two stores in Warsaw and Krakow in the coming years.

Nomi:

• Nomi was a Polish network specialized in housing and gardening that was started in 1993. Its stores were between 1,500 and 3,000 m2 and carried 12,000 SKUs in ten ranges of products. These stores were all supplied by a central warehouse. The company wanted to reach 40 stores by the year 2000 with an average size increasing to 2,000 to 4,000 m2. Nomi was targeting mid-size cities where it would not face competition from foreign networks.

World of Carpets:

 World of Carpets was a large Danish floor covering retail network operating in several Western European countries. The average size of its stores was 1,500 m2. These stores were exclusively selling carpets, rugs, vinyl floor floor covering, and wood panels. Stores were usually located on the outskirts of large cities next to other hypermarkets. World of Carpets was planing to open its first Polish store in Warsaw in the coming years.

Exhibit 7: Results of focus groups

Please list the 3 most important factors while making a purchase decision of carpets:

Color	65%
Price	43%
Pattern	39%
Durability	22%
Material	13%

All other less than 10% (special note: brand - 3%)

Which features are important in the purchase decision?

Height of the loop	67%
Attests	47%
Underlining	46%
Warranty	22%
Prizes	15%
Contests	9%

Which features not important in the purchase decision?

Brand

Technology of production

Although brand was not important several respondents mentioned spontaneously Kowary as a carpet manufacturer.

What are the sources of information?

Magazines Inserts and catalogs Friends and neighbors Salespeople

Who makes the decision?

Wife without husband	31%
Husband without wife	12%
Both husband and wife	24%
Other cases (non spouse related)	33%

Carpet purchase decision is mostly made by the wife or by both spouses with the help of sales assistants. Experts play a very small role. This feminine decision making model is valid in almost all families, independent of age. In general, the purchase of Kowary carpet was planned by the 45 years old and above.

What is the buying process?

Decision to buy a rug is considered to be important (high price) and consists of several stages:

The first stage consists in determining the need at home: carpet size, color, design, material, highest acceptable price.

The second stage consists in visiting stores. Respondents visit several stores before final decision. In stores, they compare color, designs, quality, price, etc, touch the different carpets and inquire about ways to clean the carpet and amount and frequency of customer complaints. Customers have a negative opinion on salespeople and expect bad service. However, the salespeople's advice is very important.

The last stage of the buying process is marked by the participation of the husband. His role is to accept the decision (and therefore bare the responsibility), and transport the carpet home.

Which features should the ideal store have?

Wide range of carpets Good service and advice Well organized displays Transportation and installation solutions Installation accessories Store should be big and well lit

Which features should the Ideal carpet manufacturer have?

Be attentive to customer needs Sell in its own company outlets Respond positively to customer complaints

According to respondents, no manufacturer provides a warranty. A company providing a warranty would be perceived as more credible. A warranty would increase a likelihood of purchase.

Ideal carpet producer should offer sales promotions, advertise in magazines and inform customers about addresses of stores.

Opinion of Kowary:

Associated with production of rugs Traditionally Polish Goodwill Export manufacturer Credible

Younger respondents opinion of Kowary:

Old, not fashionable designs Medium quality carpets

Axminster name associations: never heard it before, negative.

Tufted carpet: synthetic, low quality

Opinion of rug manufacturers:

Brand awareness was very low among respondents. Due to the following reasons: Brand is not important when making purchasing decision There are no manufacturers' store displays and no company stores There are no TV commercials for rugs

In order to identify customers' perception of different carpet and rug brands, respondents were asked to describe the type of room each brand reminded them of (brands: Agnella, Dywilan, and Kowary).

- Agnella Room: bright, somewhat gray, empty, practical, many people, average people.
- Dywilan Room: room for work, cold, contrasting colors, modern, creative, however chaotic atmosphere, young people, people from the office, busy people, average.
- Kowary room: atmosphere, cozy, warm, elegant, home, calm, relaxation, colors, serious, dark red, red, equipment, stylish, antiques, classic, gdanski furniture, people, elderly, good taste, calm, good manners, well dressed (suit).

Which features should the Ideal rug manufacturer have?

High quality
Wide range of colors, patterns, sizes, materials, prices
Customized offer (rugs on order)
Warranty
Fashionable
Successful abroad
Advertising (TV commercials: someone who advertise on TV must offer a good product, rich, successful company)
Company stores (associated with wide offer and low prices, no middlemen)

Instructor Comments: M 750 Research Project

Laurent Laffineur's research project involved the investigation of the strategic moves of a Polish carpet manufacture in a highly competitive international market. The format of the research was the development of a case study highlighting the competitive issues confronting the management.

Evaluation: Laurent has done an excellent job of researching the economic setting, competitive environment and management issues confronting Kowary carpet. The case study will be used as the bases for a International Simulation research project by the instructor. Laurent has build the case study consistent with the broader research needs of the simulation and prepared several supporting concepts for the design phase.

James R. Taylor

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