

LACQUER Case

QUESTION

Considering market analysis and investment capacities, you are required to propose the appropriate production plan development. Justify and argue selected options.

Introduction

Created more than a half century ago, the S.A. Paints Company manufactures and distributes products for the Decoration market, where it realizes annual business figures of 700 million €. Particularly more present in the "Large Public" sector of which it is the national leader, it realizes 3.5 percent of its business figures from exports.

Its national market share is between 15 and 18 percent but is tending to increase, despite strong competition, thanks to its policy of innovation and the quality of its products and services. In parallel, its profitability has tended to improve since its refocus on traditional trades, where it occupies the dominant place in the market.

The last fiscal year shows operating profits of 7.5 percent.

The S.A. Paints Company is run by a president general director, and a Direction Committee of seven members, six directors, as well as a person in charge of management control, who reports directly to the president.

The paints commercialized by the S.A. Paints Company in the Decorations market can be divided into three large families:

- glycerin-based, or solvent paints
- emulsion, or water-based paints
- specialty paints (refinishing paints, for floors, wood, etc.)

For these different product types, we find distinctions in terms of the characteristics and quality of the product.

Globally, we can consider that 60 percent of the company's volumes are realized by solvent paints, 30 percent by emulsion paints, and 10 percent by specialty paints.

The "China Lacquer" product line in which we are interested here belongs to the category of glycerin-based paints and constitutes one of the company's oldest product lines. It is a top-of-the-line product whose distribution is reserved for specialized markets such as pottery and customers of traditional chemists.

The shades of this line comprise 44 colors, a portion of which are revised every year in collaboration with a stylist in order to follow the aesthetic trends of the Decorations market.

Marketed at a base price of 50 € per kg, China Lacquer achieved a sales volume of 1,400 tons in 2003, for a significant annual business figure of 63 million € (18% of business figures realized in the Decoration market), up 12 percent the preceding year.

Table 1 allows us to follow the evolution of the line over the course of the last ten fiscal years in volumes sold, market share, and the relation between the product's average sale price and that of the average market price.

The product's evolution over the last ten fiscal years has shown a consistent increase in sales volume with a more accentuated increase in 1998, which is considered to be the direct result of a rejuvenation in packaging (a more modern image, the cover displaying the color of the paint, instructions enhanced with pictures).

The pricing policy adopted for this product line has always positioned it above the average market price but never by more than 10 percent. This policy is only justified by the product's positioning as a top-of-the-line product. The increase in the average sale price over the last three fiscal years, higher than any registered to date, corresponds to the necessary repercussions from an increase in the cost of raw materials, followed by modifications of the formulation introduced in 1991 in order to abide by changes in legislation.

Production Machinery and the Characteristics of the Process

The production line for this product is located at the heart of the company's Decoration production factory. It consists of a specialized homogeneous production line solely dedicated to this product line. Its average production volume is 6 tons per day in 1998, for an average factory production total of 50 tons.

Of a very recent design, this factory allows for the assembly line production of products, without a break in loading, or at the least without a "discontinuous" transfer of the product from one line to another.

Some facts about the manufacture of paints follow:

Composition

The following components are found in all paints:

The binding Resin or emulsifier, which will give the agent: finished product the vast majority of its physical/chemical characteristics, such as hardness, suppleness, weather resistance, etc. This is always a liquid product, more or less viscous.

Evolution of the China Lacquer Product				Line	
<i>Year</i>	<i>Sales in Tons</i>	<i>Average Net Sales Price €</i>	<i>Net Business Figures (in million Euros)</i>	<i>Estimated Market Share</i>	<i>Average Market Price €</i>
1993	850	27	22.95	17.70%	25.00
1994	1000	28	28.00	17.85%	25.50
1995	1050	29	30.45	18.42%	26.70
1996	1100	31	34.10	18.50%	28.50
1997	1150	32	36.80	9.00%	30.40
1998	1250	33	41.25	20.50%	31.40
1999	1260	35	44.10	20.00%	31.85
2000	1270	36	45.72	19.80%	34.20
2001	1300	38	49.40	20.00%	35.00
2002	1340	42	56.28	20.30%	37.80
2003	1400	45	63.00	20.90%	42.75

The pigment : Solid, colored particle, of mineral or synthetic origin, which will give the finished product its color and coverage ability.

The coating agents : Less troublesome than the pigments, they give coverage ability to the product.

The solvents: They allow for the regulation of the product's viscosity according to its usage. Generally composed of hydrocarbons for solvent paints, alcohol, ammonia, and water for water-based paints.

The adjuvants: Involves those products introduced during the course of production either to facilitate the process (anti-foaming agents, dispersion agents, etc.), or to improve the final qualities of the paint (anti-skin), or to guarantee its usage (quick drying agents).

The Production Process

All fabrication can be broken down into four distinct phases. ...

Dispersion: During the course of this operation, we assure the mixture of the solid particles, pigments, and/or the coating agents into one part binding agent and one part solvent, and when the situation calls for it, with several adjuvants as well. Here we utilize dispersers and this phase lasts about 1.5 hours for 6,000 liters of product.

Grinding: Its role is two-fold. On one hand it allows the dispersion process to complete, by assuring a higher or lower degree of fineness in relation to the desired finish (high gloss, matte, or satin) and, on the other hand it will allow the color to develop by increasing the specific surface of the pigment particles. We use continuous, horizontal grinders and this phase lasts between one and two hours depending on the product.

Dilution: This essential phase encompasses all of the operations that produce the product's final characteristics.

In certain cases, this phase will furthermore permit the fixation of the product's color when the color is produced with the help of tinting pastes from an initial solution, which is more or less colorless. The dilution process is accomplished in 6,000-liter, 12,000-liter, or 24,000-liter vats, which are in fact used from the beginning of the dispersion process to the end of the packaging process, encompassing therefore the times for inspection, color fixation, and dilution.

Packaging: Specific to this product line, the packaging line allows for the packaging of cans containing between 0.125 and 5 liters of product.

The production line assigned to this product is composed of a disperser, two grinders, seven dilution vats (1 x 24,000 liters; 2 x 12,000 liters; 4 x 6,000 liters) and one packaging line.

Batch is the way 24 000 l

Equivalence is about 11 = 1,4 kgs

Dispersion	Grinding	Dilution and Control	Packaging
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Production cycle

Delay for cleaning	Production operation Dispersion, grinding, dilution, control	Adjustment of the line	Packaging
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Fixed time	Fixed time	Fixed time	Variable time relative to volume of the speed of the line and the characteristics of the product viscosity, elasticity, plasticity
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Even though certain phases of the process are variable, we consider the production time for this cycle to be fixed; that is, independant from the size of the lot produced, taking into account the preponderance of fixed production times during this portion of the cycle

- Dilution vat holds product
- Product is on packaging line –

This process has been diagrammed across the four production stages: the delay for cleaning of the vats; production time, which covers the total of the process described above with the exception of packaging; the delay for regulating the packaging line; and finally, the packaging. The first three phases correspond to fixed times for each batch; the packaging time is directly related to the size of the batch.

Organization of Production

The products of the Decoration product lines are basically "convenience products," that is, those that are for general usage and which are not perishable. They can be utilized in steps subsequent to the production process or sold right away. As a result, there is always an inventory of these products.

The production administration uses an annual sales forecast for each product line, and within the product line, coefficients for each color, allowing them to determine the demand for each product. From this data, and keeping in mind the constraints of inventory and ability, the production administration defines a standard batch size for each product that will be put in effect according to precise rules of planning.

The available inventory is evaluated in terms of rate of coverage on the basis of sales forecasts. It is compared to the trigger point expressed by the number of days of sales that are covered by the security inventory and by production delays.

The security inventory on hand has been designated to absorb the gaps between the theoretical data and the reported actuals (gaps in sales forecasts, gaps in the production cycles) and to assure total product availability. The base inventory is three days' worth for whites and five days' worth for colors. Nevertheless, the level is tied directly to the rate of use of the equipment and increased whenever the rate of use of the equipment is less than 85 percent.

Additionally, an analysis of the production cycles over the past two fiscal years has allowed us to characterize each one of the components in the following manner:

profits	2 701	4 073	4 563	4 876	5 336	6 954	4 612	4 476	4 750	6 559	6 460
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Requirements for											
operating profits	7 737	7 904	9 840	9 321	11 132	11 703	12 104	12 709	13 594	15 533	15 647
Inventory	7 049	6 994	8 698	7 957	9 476	9 743	9 788	10 195	10 630	11 734	11 080
Debit account	3 672	4 550	5 024	5 712	6 256	7 116	7 718	8 115	8 892	10 271	11 655
Credit account	2 984	3 640	3 882	4 348	4 600	5 156	5 402	5 601	5 928	6 472	7 088
Variation of											
operating profits											
requirement		167	1 936	519	1 811	571	401	605	885	1 939	114
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Fixed assets	10 163	9 655	9 172	8 714	8 278	7 864	7 471	7 097	6 742	6 405	6 085
Depreciation	508	483	459	436	414	393	374	355	337	320	304
Invested capital		100	100	250	250	1 500	1 000	750	750	1 000	500
Invested capital											
(average Francs)		103	106	278	278	1 770	1 250	960	1 013	1 420	730
Cumulative of											
invested capital		103	209	487	487	2 545	3 795	4 755	5 768	7 188	7 918
Depreciation of											
invested capital		5	10	24	24	127	190	238	288	359	396
Cumulative of											
depreciations		5	15	39	39	205	395	633	921	1 280	1 676
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China Lacquer Financial Results (cont.)

Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003
Fixed assets on		98	194	448	448	2 340	3 400	4 122	4 847	5 908	6 242
invested capital	10 163	9 753	9 366	9 162	9 162	10 204	10 871	11 219	11 589	12 313	12 327
New fixed assets											
Cash flow before	4 292		2 991	5 557	5 557	5 134	3 524	3 502	3 478	3 880	6 315
taxes											
Profit	22.91%		24.76%	25.88%	25.88%	33.11%	20.55%	19.09%	19.34%	24.74%	23.15%

Commercial Strategy for the China Lacquer Product Line for the Years 2004 to 2010

The commercial director of the S.A. Paints Company has established four scenarios for the development of this product line. Each scenario is defined by data in terms of the volume and the mix produced, and aims its objectives at a specific segment of the market.

The following pages outline each of the four scenarios presented by the commercial director during the last direction committee meeting.

Scenario #1: Objective 2010-1,000 Tons/25% market share

In this hypothesis, we simply envision a progression of the current product line, the evolution of which we will assure by way of an important technical modification of the product, without engendering the launch of a new product line or an extension of the current product line.

Supported by the product's reputation and a modification of the package image, we can use the same line of colors and packaging to introduce significant technical innovations to improve the conditions of product usage. Thanks to the current development of new resins, we can envision the development of a product whose odor has been significantly reduced or even eliminated, as well as the possibility of being able to clean brushes and rollers with only water.

The advantage of such a product is certainly ecological, and in the current context where consumer legal pressures are moving more and more toward hygiene and safety, this benefit is far from negligible and could engender, with a fair-sized marketing push, a new penetration of this market.

Nevertheless, this product is not ready today and with the current state of affairs we cannot realistically expect to have it available before 2006, which leaves us with two years without a sizable opportunity to distinguish ourselves from the competition.

The data for this scenario can be outlined as follows:

<i>Year</i>	<i>Market Volume</i>	<i>China Lacquer Volume</i>	<i>Goal of Market Share</i>	<i>Average Price of Market Sales</i> €	<i>Average Price of Company Sales</i> €	<i>Net Business Figures in Million €</i>
2003	6700 T	1400 T	20.90%	42.75	45.00	63.00
2004	6800 T	1430 T	21.03%	43.60	45.30	64.80
2005	6900 T	1450 T	21.01%	44.40	45.60	66.10
2006	7000 T	1700 T	24.28%	45.30	48.50	82.45
2007	7200 T	1750 T	24.30%	46.00	49.00	85.75
2008	7250 T	1780 T	24.55%	47.00	49.30	87.75
2009	7350 T	1820 T	24.76%	48.00	49.60	90.30
2010	7400 T	1850 T	25.00%	49.00	50.00	92.50

If we expect a mean progression equal to the inflation of direct production costs (material and manufacturing), in the year 2010, we should obtain a gross profit of 22.75 € against 20.79 €/kg, for a total sales volume of 42.08 million €.

Scenario #2: Objective 2010—2,000 Tons/27% market share

The basis of this scenario maintains the hypothesis of scenario #1. But from 2004 on, we engage an aggressive policy with respect to the white paints by the creation of new packaging targeted at the market of professional products, thereby increasing the sales totals of these products.

In this hypothesis, we estimate that we can obtain a goal of 2,000 tons (+ 150 tons in relation to the preceding hypothesis, or an 8% increase), without too strong a deterioration of our average sales price and of our profits.

<i>Year</i>	<i>Sales Volume of "China Lacquer"</i>			<i>Market Share</i>	<i>Average Sales Price</i>		<i>Business Figures in Million €</i>
	<i>Colors</i>	<i>White</i>	<i>Total</i>		<i>Colors</i> €	<i>White</i> €	
2003	890 T	510 T	1,400T	20.90%	45.00	45.00	63.00
2004	910 T	640 T	1,550T	22.80%	45.30	43.00	68.70
2005	920 T	780 T	1,700T	24.60%	45.60	43.30	75.70

2006	1,080 T	720 T	1,8007	25.70%	48.50	46.00	85.50
2007	1,110 T	740 T	1,850 T	25.70%	49.00	46.60	88.90
2008	1,130 T	770 T	1,9007	26.20%	49.30	46.80	91.70
2009	1,155 T	795 T	1,9507	26.50%	49.60	47.10	94.50
2010	1.175 T	825 T	2.000T	27.00%	50.00	47.50	98.00

If we apply a sale price that is 5 percent less than that of the colored paints, and keeping in mind the average increase in production costs, the increase obtained by this hypothesis would be 21.93 €/kg or -3.6 percent and would produce for this year's sales 43.85 million €, or +4.22% in relation to scenario #1.

Scenario #3: Objective 2010—2,100 Tons/28.60% market share

The basis of this hypothesis is to aggressively attack the market beginning in fiscal year 2004. In order to do this, we can offer today a new product for which consumer tests are extremely positive. We will speak of this product henceforth under the code name "PAGODA."

The "PAGODA" project involves a completely new and innovative product line. Without being definitive, we have the idea that this new product line could be called "China Lacquer Cream." This new product will be characterized by its exceptional finish qualities—high gloss, garnishing, coverage ability; but its most important quality resides in its structure, which will give it a property so it will not run during application. Nevertheless, this product could only be applied by brush, and therefore it is uniquely a finishing product.

As a result, we have limited the packaging to a single size of 0.75 liter and we will use a new packaging especially designed for this product. We will come back to this project, after we analyze the impact that we expect from this product.

The product would be considered top of the line and as a result, marketed at a price higher than that of traditional products. We can in effect consider that it will be sold on the basis of 50 € per 0.75 liter can, or 55.50 €/kg.

We estimate that 30 colors will make up this line. It will be launched in 2004 with a sales goal of 300 tons the first year, but will have a "bundling" impact on the China Lacquer product line of 100 tons.

Under these conditions, the preceding table becomes:

<i>Market Evolution</i>	<i>Market Volume</i>	<i>Evolution of Sales of "China Lacquer"</i>	<i>Evolution of "Cream"</i>	<i>Total Volume</i>	<i>Market Share (%)</i>	<i>Average Sales Price 1 €</i>	<i>Average Sales Price 2</i>	<i>Business Figures (net)</i>
2003	6,700 T	1,400T	—	1,400T	20.9%	45.00	—	63.00
2004	6,800 T	1,300T	300T	1,600T	23.5%	45.50	55.00	75.65
2005	6,900 T	1,350 T	300T	1,650T	23.9%	46.00	55.75	79.40
2006	7,000 T	1,400T	350T	1,750T	25.0%	47.00	60.50	87.00
2007	7,200 T	1,500T	350 T	1,850 T	25.7%	47.50	63.50	93.50
2008	7,250 T	1,550T	400T	1,950T	26.9%	48.00	66.50	101.00
2009	7,350 T	1,600T	450T	2,050 T	27.9%	49.00	69.50	109.70
2010	7,400 T	1,600T	500T	2,100T	28.4%	50.00	73.00	116.50

Keeping in mind an increase of 23.09 € for the "Lacquer" family, and a 40.27 € increase for the China Lacquer "Cream" family, in 2010 we can expect for accumulated gross profit of 57.06 million € or a 35.6% increase in relation to the first scenario.

Scenario #4: Objective 2010—2,250 Tons/30% market share

The final scenario that we have envisioned constitutes, in fact, the optimum of the scenarios previously presented, namely:

- Concerning the current "China Lacquer" product line, beginning this year, we plan to launch professional products and to continue, as we have discussed, with a complete re-launch of this line through modifications in both formula and packaging.

- Beginning in 2004 we launch a new line, "China Lacquer Cream," with significant public support.

Under this hypothesis, we believe we can optimize the totality of the product's positioning and optimize our market share with these product lines.

We can outline this hypothesis by way of the following table:

<i>Volume Evolution</i>						<i>Business Figures in Million €</i>
<i>Year</i>	<i>Colored China Lacquer</i>	<i>White China Lacquer</i>	<i>China Lacquer "Cream "</i>	<i>Tbtal</i>	<i>Market Share</i>	
2003	890T/45.00 €	510T/45.00€	—	1400T	20.90%	63.00
2004	890T/45.30 €	615T/43.00€	300T/55.00€	1805T	26.50%	83.30
2005	895T/45.60€	755T/43.30€	315T/57.75€	1965T	28.50%	91.70
2006	975T/48.50€	695T/46.10€	330T/60.50€	2000T	28.60%	99.20
2007	975T/49.00€	715T/46.60€	345T/63.50€	2035T	28.30%	103.0
2008	990T/49.30€	745T/46.80€	360T/66.50€	2095T	28.90%	107.60
2009	990T/49.60€	770T/47.10€	375T/69.50€	2135T	29.00%	111.40
2010	1050T/50.00€	800T/47.50€	400T/73.00€	2250T	30.40%	119.70

On this basis, our strategy will bring us to practically double our annual business figures. According to this increase, if we always calculate the base average sales price in the year 2010 as 26.91 € for the China Lacquer family and as 32.73 € for the China Lacquer "Cream" family, our annual business figures would increase to 57.2 million €, or a 35.9 percent increase in relation to our first hypothesis.

There you have it, esteemed colleagues, said the commercial director, a quick outline of the different hypotheses that we could apply to our solvent and high-gloss paints strategies.

Bearing in mind the data just presented, we have decided, if the president agrees, to develop scenario #4. In effect, it is the one that will allow us to obtain all the advantages of a leader's position and will open up the most future opportunities. With a 30 percent market share and the first steps toward a professional line, we can hope to rapidly develop this line by complementing it with other products in our catalog.

At this point, the direction committee becomes animated and a debate quickly ensues. Let us therefore consider the point of view of each of the protagonists, but first, that of the president general director.

President General Director

Mr. Commercial Director, I thank you for your brilliant intervention. I must admit to being very impressed by the perspectives that you present, especially when I consider that you estimate it is possible for us to double our annual business figures in just several years. You have presented us with what each of your different scenarios would engender, but I assume that all of these will require investments, if even only for advertising, or you have been very discreet about this particular point.

Commercial Director

Mr. President, it is clear that these different hypotheses all support themselves with modified communications policies. In the case of the first two scenarios, we have considered that the advertising and promotional budgets will represent approximately 10 percent of the annual business figures. In effect, there is not much of a change, and our advertising will be designated exclusively to China Lacquer. In the case of scenarios 3 and 4, this investment would represent 12 percent of the annual business figures, dividing itself to give one-third to China Lacquer and two-thirds to China Lacquer "Cream."

President General Director

All of this gives us a vastly different landscape to consider, for our profit margin after advertising becomes with each of these different hypotheses: 32.8 million € for scenario #1, 34 million € for scenario #2, 43 million € for scenario #3, and 42.8 million € for scenario #4, which significantly reduces the profitability gap between each of these different scenarios.

Commercial Director

That's exactly right, Mr. President, but do not lose sight of the fact that we win some 5 percentage points of market share with this strategy, and therefore win a dominant market position, which will guarantee us a higher profitability in the medium term.

President General Director

We will admit that; but how will the competition react? I don't suppose that it will remain without reaction.

Commercial Director

Our strategy in this regard consists in innovating and investing in advertising to force them into a profit loss in the hypothesis that they will attempt to imitate us. In effect, bearing in mind their lower average market price, they will be forced into a smaller range of choices due to the fear of not quickly being able to follow our innovations. In all events, we have counted on the significant investment represented by our adherence to the legislation in order to preserve the technical lead acquired with China Lacquer "Cream" and to break through the market with this product.

President General Director

Yes, but let us not underestimate, colleagues, it can very well be that the competition also has a plan that has already been finalized.

Industrial Director

Well, I must say that I am still a little bit concerned when faced with this presentation. In effect, you are proposing, for a progression in volume of 850 tons, or more than 60 percent, to increase our fiscal year numbers by 60 percent in going from 44 to 74, but without telling us what that means in terms of production; for in any case, we will have to invest in production machinery.

Director of Logistics

And in distribution, for it seems inevitable to me that we will be required to review and come to terms with the problem of inventory space, as much with the increase in volumes as with the number of references to stock, and also on the level of raw materials and packaging as well as finished product.

Management Controller

Yes, I completely share the views of my two colleagues I fear that the profitability that you have presented will be somewhat compromised by the amount of investments that will be necessary to obtain it, and that, in fact, the final results of each hypothesis are not substantially different from the image that you give us once we factor in the total costs.

Commercial Director

Sirs, I will not deny the fact that it is necessary to invest in order to have adequate abilities at our disposal in order to meet this demand, but I fear that we will not have another avenue if we desire to remain on the market and to strengthen our presence.

Management Controller

Additionally, I must insist that we return to a particularly important point, the weight of inventory on our results. With a volume of close to 19 percent of the business figures, inventory represents a heavier expense to support every year, and which, in time, will compromise not only our results, but our capacity for investment as well. I believe it therefore urgent to implement an inventory reduction plan.

Director of Logistics

To do this we do not have to neglect our capacities and in no case we can work with a base utilization rate greater than 85 percent, which already constitutes a dangerous limit.

Management Controller

I don't understand this last point very well. I have always heard it said that in order to reduce our production costs, we should on the contrary use the production machinery at 100 percent of its capacity.

Director of Logistics

Well, I think that you better resign yourself to that idea. Personally, I share the point of view of those who consider that a factory in which all of the positions are continually occupied at 100 percent of their capacity is a globally inefficient factory.

How can we effectively confront risks such as a sudden variation in sales, materials that are not sufficiently reliable, delays in the delivery from a supplier that halts a production cycle, and finally, a production problem that abnormally elongates the delay in production for the product?

To address this issue, we can adopt the following plan.

Our very simple approach begins with our existing capacity and attempts to saturate it with the shortest possible production series that will allow us to reduce inventory, while satisfying the integrity of the demand.

Our decisions should therefore rest on the respective quantities of each product that must be manufactured. For that, we must find the best balance between the three components of demand, inventory, and production capacity.

President General Director

Sirs, I have listened with great interest to you all, but I must say that in fact, I find myself without any concrete element to position myself in relation to our starting point: to know which of the scenarios we should choose for the years to come, with regard to our high-gloss paints and especially how to obtain the optimal profitability in each case. How do you therefore think we should respond to this particular problem?

Director of Logistics

I believe that our only possible route is to support ourselves with the forecasts of the commercial director and establish for each scenario the different production policies that can be envisioned. Understandably, it would be in our best interest to determine for each one the profits that we anticipate, but equally the investments that will be necessary, both in production equipment and in inventory, in order to evaluate the real impact on economic profitability. In this fashion, I believe that we will have the best possible understanding and will be able to determine which scenario to adopt.

President General Director

This seems totally reasonable and I propose that we return to this subject as the order of the day at our next direction committee meeting in fifteen days.

Having been seduced by your approach, which is based on economic profitability, and I hope that it will be according to this criterion that you will evaluate the impact of each scenario.

I await your recommendations.

The dossier that follows was given to each of the members of the direction committee. This dossier contains the following elements:

- The technical characteristics of the two product lines
- The policy concerning safety stock inventory
- The actions of type just-in-time, which we can envision in order to increase the flexibility of the factory while reducing the level of inventory in progress
- The different levels of production capacity and the total fixed costs introduced by these different levels
- Investment possibilities to argue for the production capacity
- A presentation of the China Lacquer product line and the percentage of sales represented by each color in the line in relation to the total sales

Policy of Safety Stock Inventory

In "normal" operation—that is to say, with an average maximum production usage rate < 85 percent (capacity of the vats or capacity of the packaging line)—the security inventories are at three days for white paints and five days for colored paints.

Technical Characteristics of the Two Product Lines. Results include various anomalies that can affect the production cycle and generate an additional consumption of production capacity.

	<i>China Lacquer</i>		<i>China Lacquer</i>	<i>Cream</i>
	<i>Standard</i>	<i>Average result/ 1998</i>	<i>Estimated</i>	
Delay in production				
White	2 days	3.5 days	2 days	
Colors	5 days	6 days	4 days	

Delay for cleaning				
White	1 day	1 day	1 day	1 day
Colors	2 days	2 days	2 days	2 days
Adjustment of packaging line	2 hours	2 hours	2 hours	4 hours
Speed/rate of packaging	1.250 liters/hour	1.250 liters/hour	1.250 liters/hour	1.00 liters/hour

Beyond a production capacity usage rate of 85 percent, each 1 percent of additional capacity translates into a 1/4 day increase in inventory for whites and a half-day increase for colors, and beyond 90 percent an additional half-day for whites and one day for colors.

Additionally, we will consider that in the case of a creation of a new product line, the additional lock-up of stock would be equivalent to five days of safety stock inventory for the whites in the China Lacquer product line. Finally, with regard to the China Lacquer Cream product line, a maturation delay of five days is considered necessary before the product is put on the market.

Safety Stock Inventory Policy

	<i>China Lacquer</i>			<i>China Lacquer Cream</i>		
	<i>Without professional line</i>			<i>With professional line</i>		
<i>Maximum usage rate/ packaging line or vat</i>	<i>White</i>	<i>Colors</i>	<i>White</i>	<i>Colors</i>	<i>White</i>	<i>Colors</i>
<85%	3 days	5 days	8 days	5 days	8 days	10 days
86%	3.25 days	5.5 days	8.25 days	5.5 days	8.25 days	10.5 days
90%	4.25 days	7.5 days	9.25 days	7.5 days	9.25 days	12.5 days
95%	6.75 days	12.5 days	11.75 days	12.5 days	11.75 days	17.5 days
100%	9.25 days	17.5 days	14.25 days	17.5 days	14.25 days	22.5 days

'Additionally, we estimate the lock-up for warehoused inventory (at the distribution point) to be the equivalent of twelve days for whites and fifteen days for colors, which are added to the preceding data.

Just-In-Time (JIT) Action

The directors of production and logistics have evaluated a certain number of actions of a JIT approach within the production organization. You will find here the list of the actions considered, their costs, and their anticipated benefits.

<i>Action</i>	<i>Cost</i>	<i>Effect</i>
Increase in control staff + 2 person s/position cycle for colors	+450 K€	One-day reduction in the production
Investment in an automatic vat cleaning system of 0.0625 day €/year	Investment of 500 K€ and operations	Maximum cleaning delay for whites and colors
Increase in maintenance and polyvalence with packaging adjustment personnel + 1 person/position	+ 200 K€	Packaging adjustment time of 0.3 hour for China Lacquer and 0.5 hour for China Lacquer Cream

Production Capacity and Fixed Production Costs

Production capacity is defined by the maximum number of batches that can be produced by production without taking into account packaging. It is therefore possible that for a certain volume, even if the number of produced lots is inferior to the number indicated below, the packaging capacity may be insufficient. Under that assumption we will refer to the table of investments or to the work of a partial team.

<i>Number of positions</i>	1 in production	2 in production	3 in production
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	1 in packaging	1 in packaging	1 in packaging
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<i>Maximum capacity</i>	250 batches	400 batches	550 batches
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<i>Fixed production costs</i>	4.500 K€'	8.500 K€	12.700 K€'
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<i>Number of positions</i>	1 in production	2 in production	1 in production
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	1 in packaging	2 in packaging	3 in packaging
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<i>Maximum capacity</i>	250 batches	250 batches	250 batches
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<i>Fixed production costs</i>	4.500 KF	6.790 K€	8.900 K€
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<i>Number expositions</i>	1 in production	1 in production	1 in production
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	1 in packaging	2 in packaging	3 in packaging
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<i>Maximum capacity</i>	250 batches	250 batches	400 batches
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<i>Fixed production costs</i>	4.500 K€	'6.790 K€'	9.700 K€
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**The costs indicated are based on the euro in 2003- We will apply the inflation rate according to the information specified in the financial table to determine the value of this production cost for a given year.*

Investment Possibilities

The investments presented here correspond to an increase in the capacity of the production factory. We will consider that all investments made in year N will be realized and paid in year N but will only translate into an increase in production capacity for year $N + 1$.

All costs are given at the value of the Euro in 2003.

Increase in the dilution capacity .

Without major equipment, the current platform allows for the receipt of three new dilution vats each with a volume of 6,000 liters. The cost of one vat is 100 K€, and in the hypothetical increase to 10 vats (+3 x 6,000 liters), the repercussions for production costs is 200 K€ per production position.

Every additional augmentation in dilution capacity requires:

A platform extension costing 400 K€ and pipes costing 150 K€ for each section of four vats.

The per unit cost for the vats is:

24,000 liters 200 K€

12,000 liters 150 K€

6,000 liters 100 K€

Above and beyond ten vats, we consider that operational costs are increased by 600 K€ per production position for the four vats installed.

Additionally, above and beyond fourteen vats, an additional investment would be necessary to assure the dispersion and grinding capacity, at a cost of 1,250 K€ to which is added 400 K€ per production position.

Increase in packaging capacity Two options can be envisioned.

1. Traditional packaging line

Packaging only

- Rate for China Lacquer of 1,250 liters/hour, adjustment time two hours, China Lacquer Cream 1,000 liters/hour, adjustment time four hours

- Cost 500 K€

- Operations cost/packaging position 1,000 K€

Packaging plus peripheral equipment, same rate as above

- Cost 2,000 K€

- Operations costs 400 K€

Peripheral equipment of the existing line without modifying the parameters for packaging rate and adjustment would represent a cost of 1,500 K€ and an operations gain of 600 K€.

2. Rapid packaging line

Packaging plus peripheral equipment

- Rate for China Lacquer of 2,500 liters/hour, adjustment time four hours, China Lacquer Cream 2,200 liters/hour, adjustment time five hours

- Cost 2,800 K€

- Operations cost 400 K€

China Lacquer Product Line

<i>Colors</i>	<i>% Family</i>	<i>% Family Outside of White and White-On-White</i>	<i>% White and White-On-White</i>
White-on-white	4.09%		11.19%
Raw silk	1.00%	1.58%	
Silver	0.11%	0.17%	
Black	3.68%	5.80%	
Off white	7.04%	11.09%	
Snow white	32.43%		88.81%
Pastel gray	2.52%	3.97%	
Pure gray	2.15%	3.39%	
Ivory	2.20%	3.37%	
Tortoise shell	1.68%	2.65%	

Lemmish gray	0.99%	1.56%	
Pebble	0.99%	1.56%	
Sky blue	1.83%	2.88%	
Radiant blue	1.47%	2.32%	
Marine blue	0.42%	0.66%	
Sand	0.99%	1.56%	
Pastel green	1.20%	1.89%	
Springtime green	0.74%	1.17%	
Lutece green	0.95%	1.50%	
Lapis lazuli	0.58%	0.91%	
Josephine green	1.47%	2.32%	
Sea green	1.63%	2.57%	
Carriage green	1.52%	2.39%	
Peach	1.05%	1.65%	
Primavera	0.23%	0.36%	
Narcissus	0.23%	0.36%	
Almond	0.21%	0.33%	
Ecru beige	0.95%	1.50%	
Pastel cream	1.58%	2.49%	
Brilliant yellow	1.37%	2.16%	
Eggshell	3.47%	5.47%	
Azalea	0.74%	1.17%	
Water lily	0.22%	0.35%	
Hazelnut	1.62%	2.55%	
Dark chestnut brown	2.84%	4.47%	
Cork	1.37%	2.16%	
Flanders leather	2.04%	3.21%	
Wood tone	3.31%	5.21%	
Van Dyck brown	1.79%	2.82%	
Willow	0.63%	0.99%	
Magnolia	0.95%	1.50%	

Paprika	0.42%	0.66%	
Madras red	1.83%	2.88%	
Basque red	1.47%	2.32%	
44 Products	100.00%	100.00%	100.00%

China Lacquer

Each color is packaged in three or four different packaging types. All of the products were sold in .5 liter and 2.5 liter packages. Certain colors are also available in .125 liter packages.

China Lacquer Cream This product is packaged in .75 Liter only.

<i>Colors</i>	<i>% Family</i>
Alabaster cream	3.79%
Tradewind cream	1.79%
White-on-white cream	33.44%
Opal cream	2.91%
Tawny beige cream	1.51%
Caramel cream	1.97%
Gallic blue cream	1.92%
Midnite blue cream	2.30%
Black cream	4.20%
Bronze cream	1.26%
Coffee cream	1.73%

<i>Colors</i>	<i>% Family</i>
Hawthorn cream	2.76%
Chestnut cream	2.11%
Poppy cream	1.11%
Seashell cream	3.20%
Sand dune cream	2.12%
Emerald cream	1.44%
Wisteria cream	1.71%
Garnet cream	2.76%
Storm gray cream	2.91%

Havana cream	1.41%
Ivory cream	3.26%
Honey cream	1.23%
Mother of pearl cream	3.60%
Pacific blue cream	2.22%
Spice bread cream	0.85%
Sun cream	2.10%
Forest green cream	1.74%
Hawaiian cream	2.83%
Off white cream	3.82%
30 Products	100.00%
