

*XIII International Conference on Input-Output Techniques
Macerata, Italy, 21 - 25 August 2000*

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I-O for Management Control
**The Case of a Multinational Pharmaceutical
Company**

Macerata (Italy), August 2000

1. Mission

GlaxoWellcome is a research-based company whose people are committed to fighting disease by bringing innovative medicines and services to patients throughout the world and the health care providers who serve them.

The aim of the Group is to respond adequately to patients' needs and to the far-reaching transformation of modern society.

Alongside traditional issues, the industry now faces new challenges that require necessary changes and adjustments in the attitude of the pharmaceutical industry.

Increased access to knowledge on health-related matters, combined with recent constraints on public health spending, have placed considerable pressure on the pharmaceutical market, resulting in a strong demand for effective, safe and innovative products.

Therefore GlaxoWellcome intends to play an active role promoting "health projects" through partnerships with all social parties engaged in the fight against disease.

The main strength of GlaxoWellcome is its novelty, for doctors as well as patients, in searching for the most effective answer to a growing demand for health in contemporary society.

2. GlaxoWellcome in Italy and in the world

GlaxoWellcome began its activities in 1995 with the merger of the two English multinationals, Glaxo and Wellcome ¹. Today, it is considered to be one of the major international pharmaceutical groups, with subsidiaries in 85 countries and active on 150 markets by means of 76 local companies with almost 60,000 employees.

The GlaxoWellcome Group controls 9 Centres of Research and Development scattered across four continents, and 55 productive plants situated in 33 countries.

¹ The present study deliberately takes no account of the merger project, which in fact is in progress between GlaxoWellcome and SmithKline Beecham.

In 1998, GlaxoWellcome recorded a consolidated world turnover of £7,983 million, equivalent to about Eu12 billion.

The sales breakdown by geographical areas is illustrated in Fig. 2.1

GlaxoWellcome's investments in Research and Development for the year 1998 totalled approx. £1,170 million, which places the Group first among all international pharmaceutical groups with a priority commitment to research.

GlaxoWellcome is recognised as a world leader in the development of new cures against viral diseases, such as HIV, and against diseases of the respiratory and the central nervous systems.

Sales by geographical region

	1998	1997	1996
	GBP mln	GBP mln	GBP mln
North America	3565	3589	3683
Europe, Africa & Middle East	2968	2849	3087
Asia Pacific	558	624	646
Japan	476	538	598
Latin America	416	380	327
Total	7983	7980	8341

Fig. 2.1

It is also involved in the search for more effective drugs in categories such as anti-infections, gastrointestinal medications, and of cardiovascular and metabolic pathologies.

In Italy, too, where its full-cycle organisational structure employs 2,147 peoples (Fig. 2.2), GlaxoWellcome has strengthened its leadership, recording for 1998 a turnover of Lit. 1,444 billion (Fig. 2.3), and reaching fifth position in the Group for its contribution to total sales revenues.

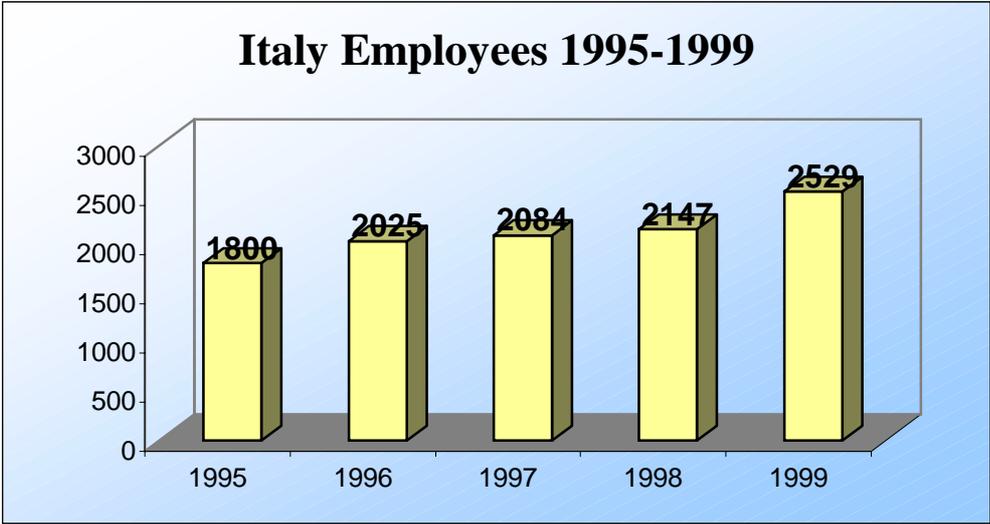


Fig. 2.2



Fig. 2.3

The main stages in the growth of GlaxoWellcome Italy have been reported in the following Fig. 2.4.

The stages of development in Italy

1905	Borroughs Wellcome Italy opens its head office in Milan
1932	S.A. Italiana Nathan Bompiani opens its head office in Verona
1936	S.A. Glaxo Laboratories are set up
1948	The company changes its name to Glaxo SpA
1955	Wellcome Italy SpA is created, with head office in Rome
1967	Glaxo's new head office and the new plant are inaugurated
1984	The Parma factory is acquired
1990	The new Research Centre is founded in Verona
1995	Glaxo plc and Wellcome plc merge. GlaxoWellcome SpA sets up in Italy with headquarters in Verona
1998	The Research Centre of Verona is designated as a <i>Drug Discovery Centre</i>

Fig. 2.4

In 1998, GlaxoWellcome Italy further established its leading role within the Group thanks to the successful results achieved by the Research Centre of Verona (one of three strategic R&D Centres in the world (*Drug Discovery Centre*)), but also on account of the excellent standards of quality and production attained by the Verona and the Parma plants.

3. The organisation

The competitive power GlaxoWellcome Italy enjoys within the Group and on the Italian pharmaceutical market is based essentially on its capacity to control the industrial processes using a strongly integrated approach. As a matter of fact, GlaxoWellcome Italy's structure is organised in such a way as to encompass fully the constitutive stages in the production of a medicine: from first conception of the molecular design to the clinical elaboration and testing, from the pharmaceutical formulation to the marketing and distribution of the product to the patients.

The system of internal and external relations at GlaxoWellcome Italy is shown in

Fig. 3.1.

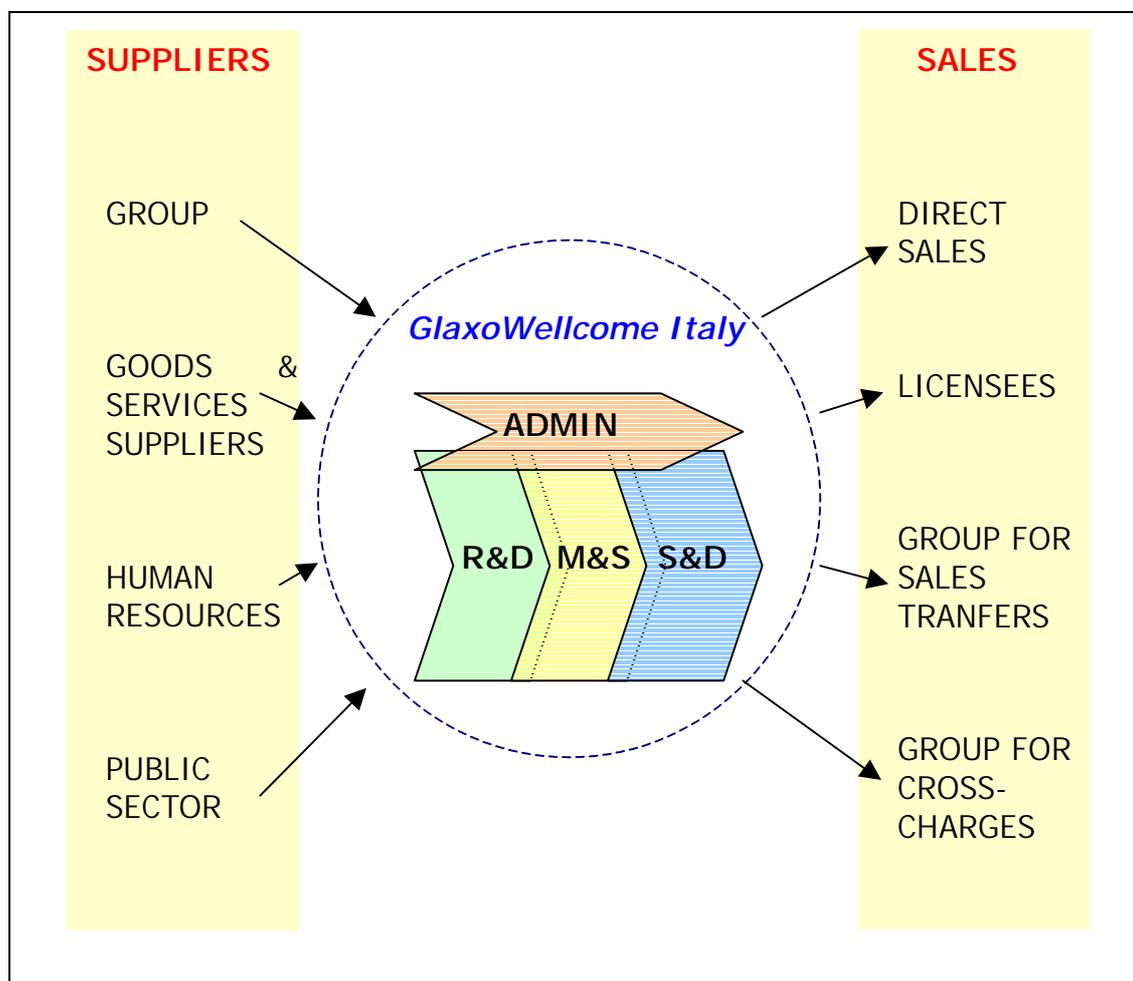


Fig. 3.1

For the purchase of products and services, the company depends on other sister companies within the Group for the supply of active ingredients, of semi-finished materials and of consulting services (*Group*); it depends on external suppliers of goods and services for production and consumption materials (*Goods & Services Suppliers*), and it finds in the local and national community a pool of human resources for the company development (*Human Resources*); and finally it turns to the public sector for a whole series of authorising and certifying activities (*Public Sector*).

To sell its products, it has built relations with a large variety of ‘third-party’ customers (*Direct Sales*: hospitals, wholesalers, private hospitals, pharmacies, ...), of “licensee” customers (*Licensees*: Menarini, Angelini, Sigma Tau, etc.) as well as of internal customers, i.e. the Group’s subsidiaries (*Transfers* and *Cross-*

Charges).

In addition to its connections with the world outside the firm, the GlaxoWellcome Italy system is criss-crossed by a tight web of interdependencies between the internal functions, known as *strategic business and support areas* (SBSAs).

Because the time it takes to patent new products is much shorter now, and because of the huge investments needed to develop new molecules, pharmaceutical companies have no choice but to drastically reduce the *time to market*. In particular, if in the past it took between 15 and 20 years to move from first conception to the end product (the medicine), the interval nowadays is hardly more than 5 to 8 years.

Hence the need to integrate the various SBSAs into a system of interdependence in order to promote and optimise the development flows of the new products.

The company's structure is based on three *strategic business areas* and one *support area*. The three *strategic business areas* are: *Research & Development* (R&D), *Manufacturing & Supply* (M&S) and *Selling & Distribution* (S&D). The *support area* is known as *Administration* (Admin), and essentially is there to assist and support the other areas (Financial, Institutional authorities, Human Resources Management, Strategic Planning, and so on).

As Fig. 3.1 shows, the three *strategic business areas* are integrated in one single chain that links the molecule to the final drug; they are assisted by *Administration* at all stages of the production process.

One gets a sense of the size of the four SBSAs from the diagram in Fig. 3.2, which shows the number of employees per area.

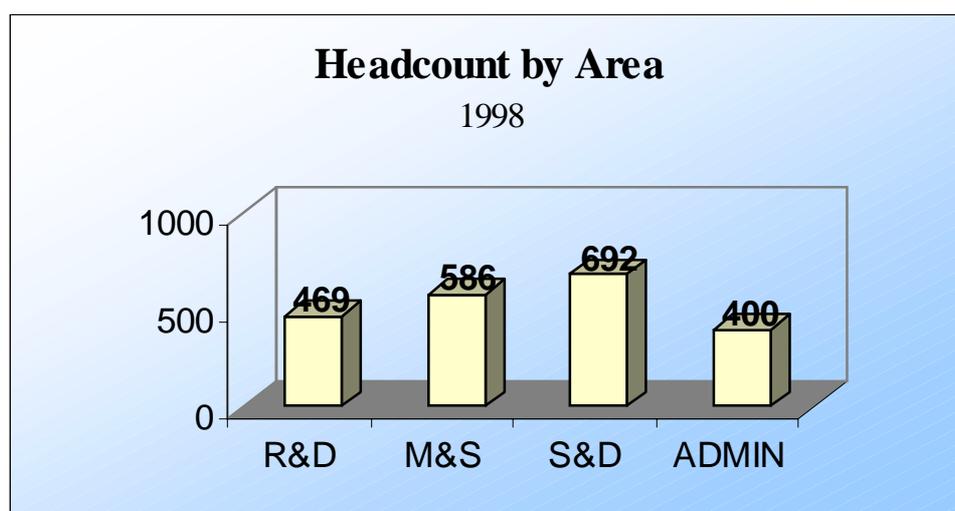


Fig. 3.2

3.1 *Research and Development (R&D)*

It is on scientific research that the GlaxoWellcome Group has built its history, its international prestige, its economic success, and its strategies for future expansion. Internationally, GlaxoWellcome employs more than 9,000 researchers and with an annual expenditure of £1.2 billion it is the first pharmaceutical Group in the world for investments in research. Thanks to this type of investment, today it spearheads all third-generation R&D, based on genetics, on the utilisation of the most advanced technologies of computational chemistry, combinatorial chemistry, robotics screening and computerised biology.

Its R&D activity is conducted in 9 centres, 3 of which, named *Drug Discovery Centres*, are located in England, in the United States, and in Italy. These Centres clearly play a strategic role, if we bear in mind that they are responsible for every single stage in the research and development of new medicines in the therapy area they specialise in.

In this context, GlaxoWellcome Italy occupies an especially relevant and significant position within the Group thanks to the Research Centre of Verona, a centre of competence and excellence world-wide in the field of anti-infection medicines and medicines for the central nervous system, equipped with state-of-the-art technology as an aid to research.

The Verona Research Centre co-operates with some 40 Universities in Italy and abroad and interacts with over 1,000 clinical centres on the implementation of projects; thus it plays a central part in therapeutic-pharmacological research in Italy, which thereby will find its way into the wider network of international scientific know-how.

The Research Centre of Verona ranks third in the world in terms of invested capital (over 100 billion lire in 1998), and in terms of staff numbers: from an initial 403 researchers in 1996 to 469 at the end of 1998, with a target figure of 568 by the end of 2000.

3.2 *Manufacturing and Supply (M&S)*

GlaxoWellcome Italy owns two production plants: one in Verona and one in San Polo di Torrile, in the province of Parma.

The plants at Verona and Parma play a central role in all the productive activities of the GlaxoWellcome Group. Indeed, not only are they able to assure remarkable quality standards, but they are also highly flexible in producing and personalising products to respond to the target market demand.

At these two works, whose activity is authorised by the world's major health

authorities, such as the American Food and Drug Administration (FDA), approx. 102 million packs are produced every year, 55.4% of which are exported to 49 countries. In 1998, the Verona plant, reputedly one of (only) two strategic centres in the world in the production of cephalosporin, exported medicines to 40 countries, producing packages written in 31 different languages.

The Parma plant, which became operational in 1985, produces tablets, vials, syringes and nasal sprays, which in 1998 were exported to 38 countries with packages bearing writing in 28 different languages.

The production of the Italian plants divides into foreign and internal markets according to the proportions shown in Fig. 3.3.

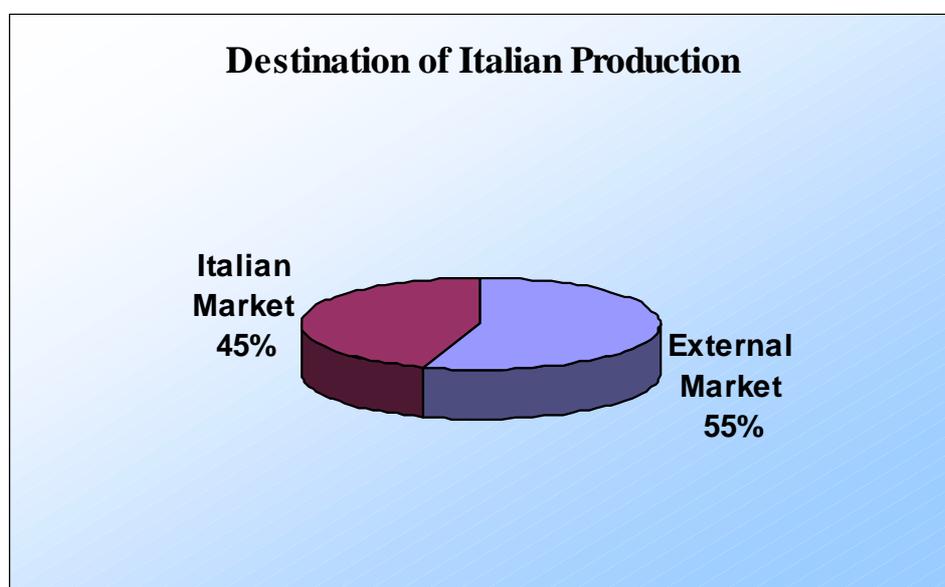


Fig. 3.3

3.3 *Selling & Distribution (S&D)*

Seven of the 50 ethical medicines that are regularly sold in the world belong to the GlaxoWellcome portfolio.

The GlaxoWellcome Group concentrates 80% of its turnover on 5 areas of therapeutic intervention: 27% is represented by respiratory-diseases medicines, 17% by anti-viral medicines, 16% by medicines for disorders of the central nervous system, 11% by anti bacterial medicines, 9% by gastrointestinal-diseases medicines. Fig. 3.4 shows the distribution of the turnover of GlaxoWellcome Italy by therapeutic areas.

In the near future, GlaxoWellcome is set to devote its efforts to launching on the Italian market 9 new medicines and 17 *line extensions*, together with another 14 new products and further line extensions in the pipeline for the period 2001-2003. This is a commitment that obviously relies on GlaxoWellcome Italy's continuing to invest significantly in the professional training of its over 600 representatives, who are a crucial link between the company and the medico-scientific community. To improve and strengthen the quality and the efficacy of the service offered to institutions and health operators alike, GlaxoWellcome Italy has adopted a policy of regionalisation of its commercial structure and identified new organisational strategies.

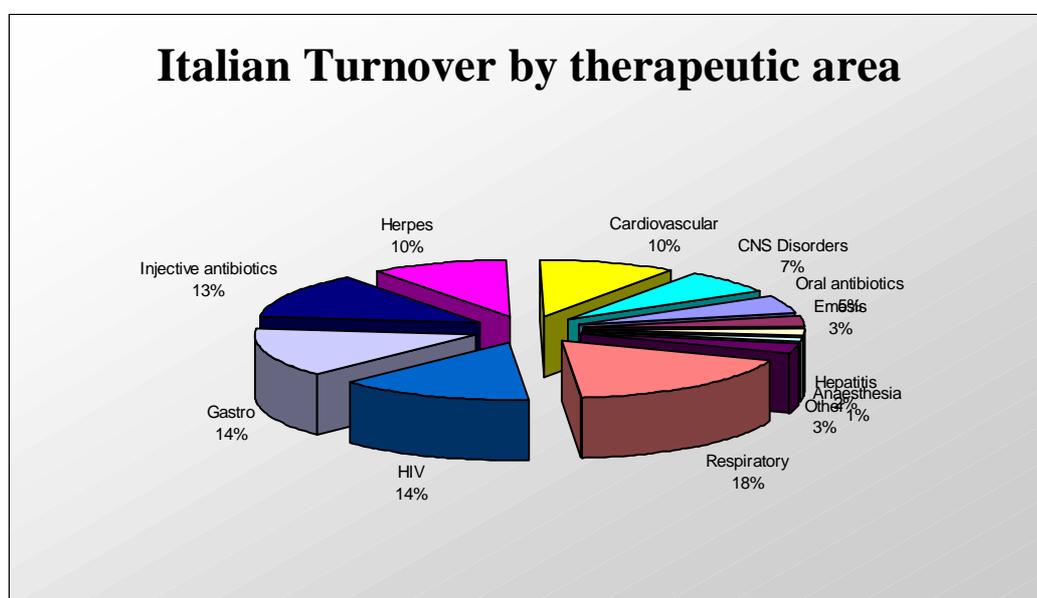


Fig. 3.4

3.4 Administration (*Admin*)

Covering all activities of support to business, the *Administration* area consists of the Institutional Organs, External Relations, Strategic Planning, the Finance and Accounts Office, and Human Resources.

This section employs 400 people, i.e. 18.6% of the whole company's personnel. The principal objective of *Admin*, besides guaranteeing an institutional cover for the positions of the President, of the General Manager and of the Institutional Relationships, is to assure the other *strategic business areas* the necessary assistance in the day-to-day running of all scientific and business activities.

4. Internal Shared Services

We have already mentioned that GlaxoWellcome Italy is characterised by a close web of interrelations and interdependencies between the different SBSAs.

The organisation's structure, based on three *strategic business areas* and a *support area*, generates a remarkable exchange of resources between one another in the form of "*internal shared services*".

The *Admin* area is by nature a supporting structure, with the sole objective, besides the one of guaranteeing the firm's institutional structure, to assist the other areas of the company in terms of financial consultancy, organisational choices or directions, selection, training and development of the employees, strategic planning, safety, etc. Therefore *Admin* is the producer and the supplier of services for all the three *strategic business areas*.

The *Manufacturing & Supply* area, which is responsible for the *core* production activity, is organised on the basis of a Service Department, a Procurement Department and a Department for International Demand & Supply Management. The Service Department is responsible, for the entire company, for supplying services such as repairs and maintenance, environment, cafeteria, communications, transports, etc. The Procurement Department is responsible for the management of all purchases for the entire company. The Department for International Demand & Supply Management manages purchases and sales to and from the Group (*Transfers*). It is quite obvious that M&S supplies its services to all other areas of the company.

The *Research & Development* area generates services of consultancy on behalf of the commercial area. In particular, the Medical Department provides research and support services with regard to the study and the analysis of markets of different pathologies. R&D supplies also marginal services to *Admin*.

The *Selling & Distribution* area, which looks after the commercial interests of the company, offers its services mainly to the M&S area.

The inter-area service flows, excepting those commercial services which S&D assures to M&S, are open to economic monitoring/measurements by the Management Control Department. The quantification of these flows is necessary to determine the effective cost of every individual SBSA. This determination is fundamental for the calculation of the unit prices of the products, of the total costs of the research projects, of advertising and launch costs, for budgeting and planning, and furthermore for a critical analysis of the Profit & Loss account.

The cost of each single SBSA is therefore the result of the algebraic sum of structural costs (wages, other costs and depreciation), IN services, OUT services and other residual items.

The dynamics of the internal services is represented in Fig. 4.1.

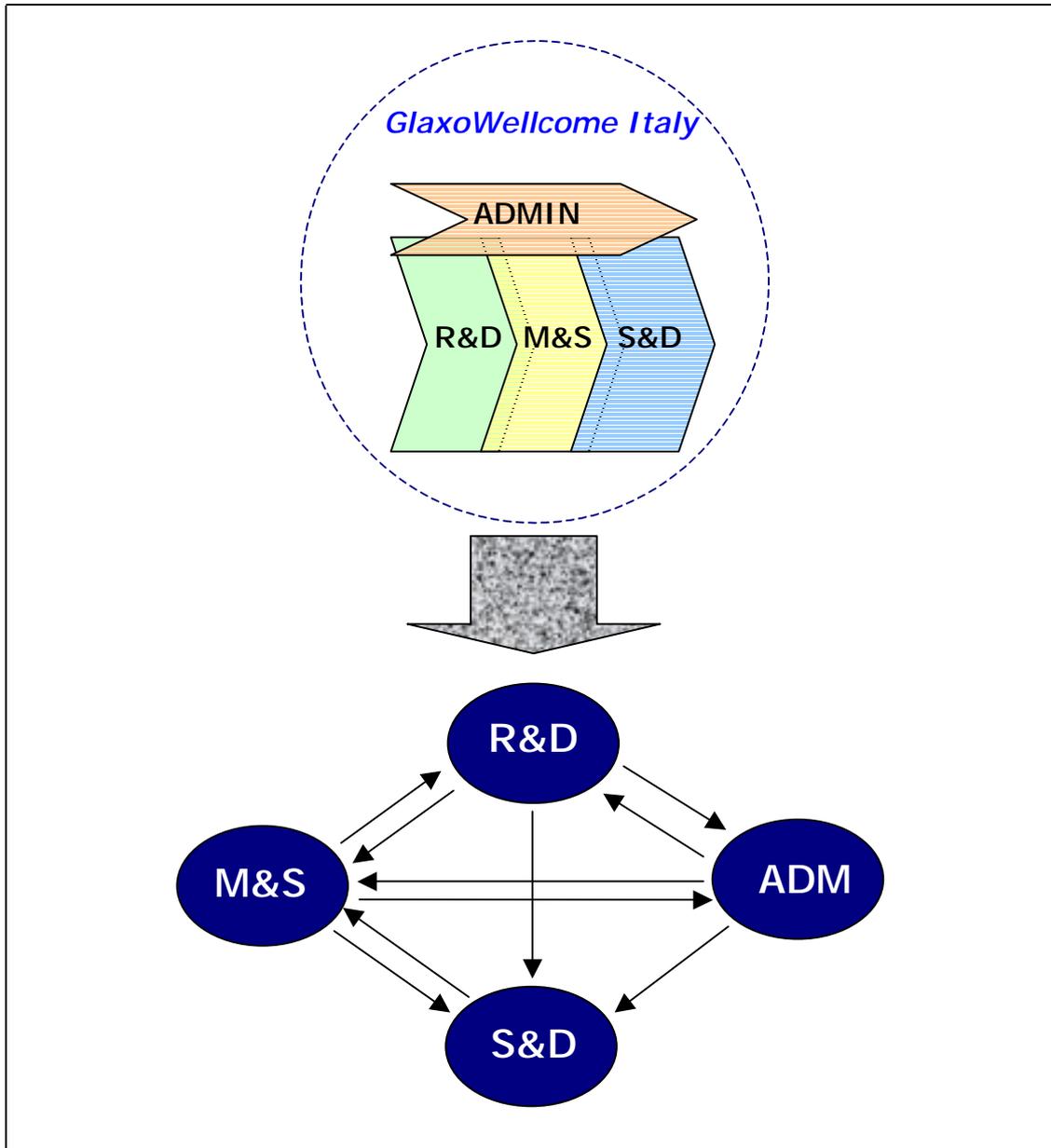


Fig. 4.1

The financial management of the shared services raises a few problems.

1. It is difficult to draw up a qualitative and quantitative picture of the complex flow of interdependencies between the different SBSAs applying the traditional forms of reporting currently used.
2. It is hard to reach a precise and reasonable estimate of the value of the services

run by one area for another. The methodology applied consists in identifying a representative *driver* of costs. The determination of a representative *driver* for each of the approximately 70 cost centres that provide services is a very complex and time-consuming operation: the risk is that the relevance and immediacy of the resulting information may fade in the process.

3. The existence of a network of interrelations makes the financial planning procedure extremely difficult, not only for the 5-year planning, but also whenever one may, without delay, want or need to have a sensitivity analysis of the entire Profit & Loss account of the company.

5. An I-O model for Management Control and Financial Planning: theory

If the problems of representation and planning of the interdependencies between all the SBSAs are difficult to solve with the traditional approach, we suggest that the instruments of input-output analysis may provide an immediate and efficient solution.

The inter-area flow of services may be represented by means of a square matrix (4 x 4) whose rows and columns are named according to each of the four SBSAs (Fig. 5.1). We will call it *matrix of the shared services* and indicate by an **S**.

	<i>S & D</i>	<i>M & S</i>	<i>R & D</i>	<i>ADM</i>
<i>S & D</i>	s_{11}	s_{12}	s_{13}	s_{14}
<i>M & S</i>	s_{21}	s_{22}	s_{23}	s_{24}
<i>R & D</i>	s_{31}	s_{32}	s_{33}	s_{34}
<i>ADM</i>	s_{41}	s_{42}	s_{43}	s_{44}

Fig. 5.1

The columns show the services that every individual area acquires from the other SBSAs, while the rows show the services that each area sells to all the other SBSAs. Thus, the matrix represents the internal dynamics of GlaxoWellcome Italy. The external relations are registered as costs and revenues in some vectors, which complete the matrix of the shared services.

The total sales of products of GlaxoWellcome Italy are registered in the column vector **d** of the *final market demand*:

$$\mathbf{d} = \begin{pmatrix} d_1 \\ d_2 \\ d_3 \\ d_4 \end{pmatrix}.$$

The values d_i derive from the sum of the three different types of sales that characterise the company:

1. Group Transfers
2. Licensees
3. Direct sales.

The *value of the total production* of area i , indicated by x_i , is the sum of the internal and external sales of the area itself and it is equal to:

$$x_i = s_{i1} + s_{i2} + s_{i3} + s_{i4} + d_i.$$

The column vector \mathbf{x} of the values of the total productions is given by:

$$\mathbf{x} = \begin{pmatrix} x_1 \\ x_2 \\ x_3 \\ x_4 \end{pmatrix}.$$

So the following relation is valid:

$$\mathbf{S}\mathbf{i} + \mathbf{d} = \mathbf{x}$$

where \mathbf{i} is a column vector (4 x 1) whose elements are equal to 1.

The values of the total productions may be also obtained starting from the columns of matrix \mathbf{S} . As a matter of fact the values of the production obtained from an area, in terms of internal and external sales, must be exactly equal to the value of the internal and external resources utilised.

Every individual area is a purchaser not only of internal services but also of different products and services that come directly from the outside. It is necessary to distinguish between *external costs* and *value added*. Under *external costs* we include the raw materials and the products purchased from the Group (*Group Charges*), the products and services purchased from third-party suppliers (*Cost of Sales*), the direct costs running the structures, besides other costs labelled extraordinary and sundry.

The components of the *value added* are wages, depreciation, revenues coming from financial activities, taxation and profits.

The *external costs* are represented by a row vector (1 x 4), \mathbf{C}' , whose elements are the sum of the external costs for every individual area:

$$\mathbf{C}' = (C_1 \quad C_2 \quad C_3 \quad C_4).$$

The total value added is also represented by a row vector (1 x 4), \mathbf{V}' , whose elements are the sum of those activities that form the value added of every individual area:

$$\mathbf{V}' = (V_1 \quad V_2 \quad V_3 \quad V_4).$$

The column sum of the internal services that have been purchased, of the external costs and of the value added again determines the value of the total production per area. So the following relation is valid:

$$\mathbf{i}'\mathbf{S} + \mathbf{C}' + \mathbf{V}' = \mathbf{x}'.$$

Starting from the total flows it is possible to determine the technical coefficients of service (a_{ij}), the external cost coefficients (c_j) and the value added coefficients (v_j):

$$a_{ij} = \frac{s_{ij}}{x_j} \qquad c_j = \frac{C_j}{x_j} \qquad v_j = \frac{V_j}{x_j}.$$

And then the company's Profit & Loss account may be organised into the simple input-output model:

$$\mathbf{x} - \mathbf{Ax} = \mathbf{d}$$

with the following solution:

$$\mathbf{x} = (\mathbf{I} - \mathbf{A})^{-1} \mathbf{d}$$

The model lends itself well to analysis and forecasting.

From the point of view of analysis, one may gain a better understanding of the company's structure, and thus determine the values of the multipliers for every individual area.

From the point of view of planning, it is possible to obtain new economic

company accounts based on the forecast performance of the sale activity. In particular, it is possible to estimate the sensitivity of the Profit & Loss account with respect to the variations of the final market demand (direct sales, licensees and transfers). As a matter of fact, given the sale forecasts for a time t , \mathbf{d}^t , it is possible to forecast the values of the goods and of the services produced by the various SBSAs in the time t , as shown in the following equation:

$$\mathbf{x}^t = (\mathbf{I} - \mathbf{A})^{-1} \mathbf{d}^t$$

Applying this method, and applying the values of \mathbf{x}^t to the technical coefficients which were previously determined, it is possible to obtain the current values of \mathbf{S}^t , \mathbf{C}^t and \mathbf{V}^t ; consequently, it is now possible to evaluate the Profit & Loss account expected for the time t , which also takes into consideration the interdependencies between the different SBSAs and the interdependencies with the external world.

6. An I-O model for Management Control and Financial Planning: application 1998-2004

The application that follows has been run on the official consolidated data of GlaxoWellcome Italy for 1998.

With regard to the Profit & Loss account, the entries have been respected throughout so as to match the facts and to guarantee consistency and significance in the results obtained by implementing the model.

To achieve an accurate representation of the internal interdependencies between the different areas, where the present management accounting instruments are considered insufficient, a number of assumptions have been necessary.

In particular:

1. We suppose that the S&D area supplies a commercial service to the M&S area supporting the Group (*Transfers*) and the direct sales (*Direct Sales*);
2. In any event, the S&D area remains the manager of the sales to licensees (*Licensees*);
3. That share of research activity (R&D) that is not handed over to the Group as *Transfers*, therefore directly posted to local research, is granted to M&S, which will benefit from any discoveries that may be made precisely because of its position as an integrated development centre belonging to Glaxo Wellcome Italy;
4. The costs of *Admin* are entirely dealt out among all the other strategic business areas.

INPUT-OUTPUT MODEL for GLAXO WELLCOME Management Control

ACTUAL 1998 -P&L Account

	S&D	M&S	R&D	ADM IN	TOTAL SOLD SERVICES	GROUP TRANSFERS	LICENCEES	DIRECT SALES	TOTAL FINAL DEMAND	TOTAL PRODUCTION VALUE
S&D		85.715			85.715		187.694		187.694	273.409
M&S	2.638		8.693	4.072	15.403	366.469		892.757	1.259.226	1.274.629
R&D	10.451	114.700		1.386	126.537	56.571			56.571	183.108
ADM IN	32.807	22.205	22.727		77.738				-	77.738
TOTAL BOUGHT SERVICES	45.896	222.619	31.420	5.458	305.392	423.040	187.694	892.757	1.503.491	1.808.883
GROUP CHARGES		327.690	68.328		396.018					
COST OF SALES		405.578			405.578					
PROMOTDN	53.308				53.308					
OTHER DIRECT COSTS	27.823	22.816	15.353	28.109	94.101					
SUNDRY	21.896			2.654	24.550					
EXTRAORDINARY ITEMS	2.941	- 927	9.134	5.351	16.499					
TOTAL EXTERNAL COSTS	105.968	755.157	92.815	36.114	990.054					
W AGES AND OTHER	98.082	43.733	41.661	37.049	220.525					
DEPRECIATIONS AND AMORT.	143	17.331	17.212	4.591	39.277					
INTEREST PAID				- 5.474	5.474					
TAXATION	10.835	109.559			120.394					
PROFIT	12.484	126.231			138.715					
VALUE ADDED	121.545	296.853	58.873	36.166	513.437					
TOTAL PRODUCTION VALUE	273.409	1.274.629	183.108	77.738	1.808.883					

Fig. 6.1

On the basis of these assumptions, and utilising both the 1998 balance sheet date and the company's current management accounting analysis, it is possible to build the table shown in Fig. 6.1.

The square matrix at the top left-hand side is the shared-services matrix, **S**. The adjacent column vectors specify the various components of the final market demand and the row vectors record in detail the external-costs and the value-added components.

This simple scheme allows us immediately to solve one of the main problems of the present internal reporting activity of the company, which we have already mentioned: the difficulty of achieving an adequate qualitative and quantitative picture of the complex flow of internal and external interdependencies between the areas.

This type of model encapsulates in a single logical system the complete structure of the company's profits and losses through a graphic and numerical representation that is both efficient and explanatory.

The importance of the single SBSAs in that complex system of internal interdependencies may be studied critically by using a simple analysis of the multiplier effects that a variation of the final market demand produces on the internal shared services.

This type of analysis may be carried out simply by analysing the Leontief inverse of the matrix of the service coefficients shown in Fig. 6.2.

Leontief Inverse				
ACTUAL 1998				
$(\mathbf{I} - \mathbf{A})^{-1}$	S&D	M&S	R&D	ADMIN
S&D	1.00123	0.06772	0.00366	0.00361
M&S	0.01825	1.00707	0.05448	0.05372
R&D	0.04215	0.09388	1.00730	0.02288
ADMIN	0.12569	0.03732	0.12641	1.00421
MULTIPLIER EFFECT	1.18732	1.20598	1.19185	1.08442

Fig. 6.2

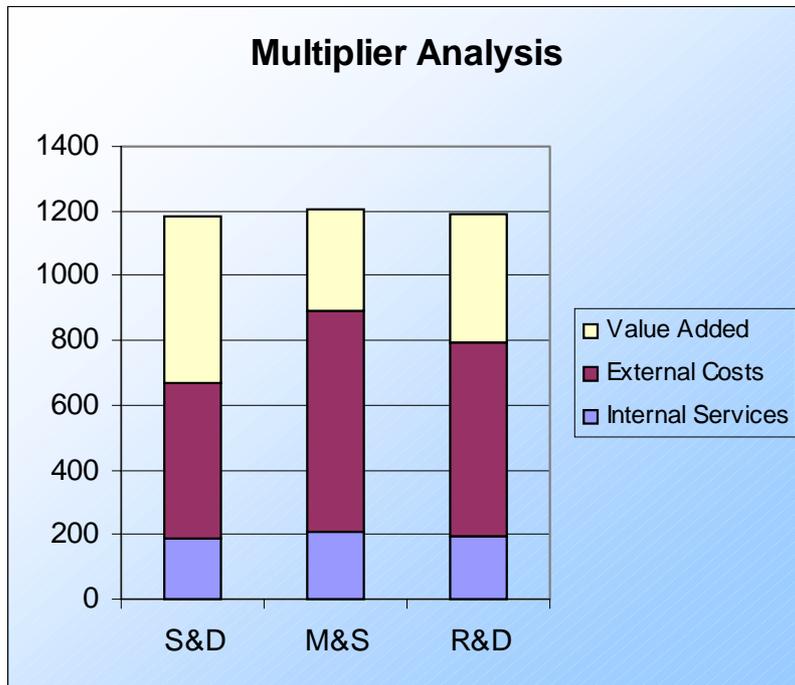


Fig. 6.3

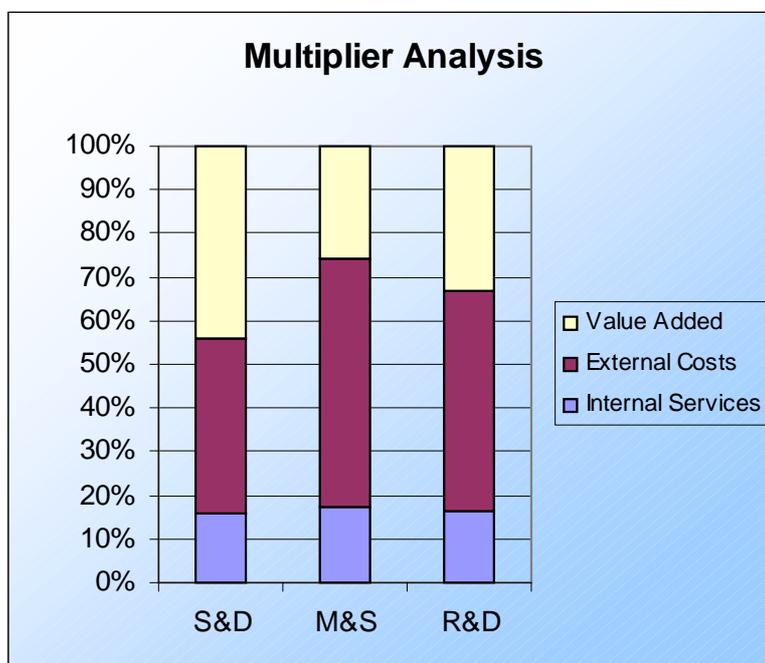


Fig. 6.4

As is well known, the column sums of the Leontief inverse highlight the multiplier effects on the total production determined by a variation of the final unitary market demand. Thus, an increase of Lit. 1 million in the licensee sales, managed exclusively by the S&D area, ends up increasing the total production by approx. 1.187 million. If the increase concerned the *Direct sales* or the *Transfers* of the M&S area, the value of the total production would rise by 1.206 million. Finally, should the Group put the R&D area in charge of new researches, and investing Lit. 1 million to this end, the total production value would go up by 1.192 million. The multiplier effect may be analysed further by dividing it, area per area, into its different input components, just as illustrated in Fig. 6.3 and 6.4. The following application is designed to analyse the impact of the estimated variations of the final market demand on the production of services provided by the four SBSAs.

The data used are the market demand data forecast supplied by the Financial Planning Department and by the Management Control Department for the 1998-2004 period. Occasionally, these Departments draw up also estimates on the variation of the goods and services produced; and so, in certain cases, it will be possible to compare the forecasts made using traditional methods with the forecasts elaborated with the input-output model and with the actual final balances.

The sale forecasts for the years 1998-2004 are reported in Fig. 6.5.

Sales Forecast – GlaxoWellcome Italy 1998-2004 (ITL billion)

	1998	1999	2000	2001	2002	2003	2004
Direct Sales	892.757	1000.449	1147.652	1285.423	1435.301	1568.300	1638.521
Licencees	187.694	184.400	167.834	148.126	132.223	137.794	133.381
Transfers (*)	364.103	383.879	389.062	418.440	421.732	425.650	431.129

(*) net of the Group activities

Fig.6.5

One of the problems with Glaxo Wellcome Italy's present planning system consists in its ability (or not) to determine fast the value of the services shared between the areas when sales vary, without activating the complicated procedure by means of *drivers*.

The input-output model allows an immediate determination of these values simply by reconstructing the new values of matrix **S** starting from matrix of coefficients **A** and from the new vectors of the total production **x**. The result of this analysis is reported in Figures 6.6, 6.7, 6.8, 6.9. Tables and graphs show the total values of the services sold and bought by each area for all the years of the financial plan.

A quick determination of the values of the shared services represents a remarkable result, considering the enormous amount of resources necessary for a traditional planning approach to evaluate the internal services. We should emphasise the fact that the validity of the results obtained by the traditional, complex methods is at least debatable.

The input-output model allows us likewise to draw up fast planning estimates for any other entry of the Profit & Loss account depending on the variations of the final market demand.

In the following application we have estimated the dynamics of GlaxoWellcome Italy's profits according to sales fluctuations. Using available data we have been able to compare the estimates obtained by the traditional methodology with those obtained from the input-output model and test their compatibility. We have also been able to compare the estimates for 1998, 1999 and 2000 with the actual final balance values. For the year 2000, the balance sheet values have been calculated through a projection of data available up to the end of June. All the results are recorded in Fig. 6.10 and 6.11.

From the graphic representation of the results we infer a higher stability of the input-output model compared with the traditional one.

The estimate resulting from the application of input-output analysis instruments is undoubtedly interesting, especially if compared with the values of the profit balance. No one can deny that the estimate of expected profits by means of the input-output model yields more accurate and more realistic figures than the traditional methodology could have do.

Total Sold Services (ITL billion)

	1998	1999	2000	2001	2002	2003	2004
S&D	85.715	94.343	104.643	115.938	126.292	135.571	140.692
M&S	15.403	16.243	17.018	17.839	18.631	19.700	20.154
R&D	126.537	138.364	151.971	166.832	180.540	193.628	200.549
ADM	77.738	82.081	85.686	89.447	93.165	98.975	101.246

Fig. 6.6

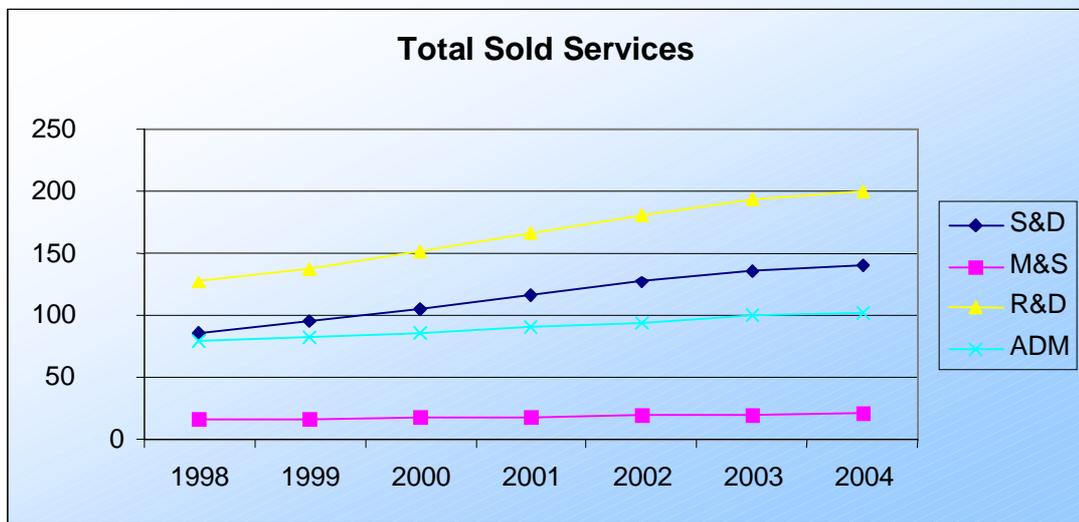


Fig. 6.7

Total Bought Services (ITL billion)

	1998	1999	2000	2001	2002	2003	2004
S&D	45.896	46.791	45.740	44.327	43.396	45.889	46.007
M&S	222.619	245.028	271.778	301.115	328.005	352.105	365.406
R&D	31.420	33.449	35.784	38.334	40.686	42.932	44.119
ADM	5.458	5.763	6.016	6.280	6.541	6.949	7.108

Fig. 6.8

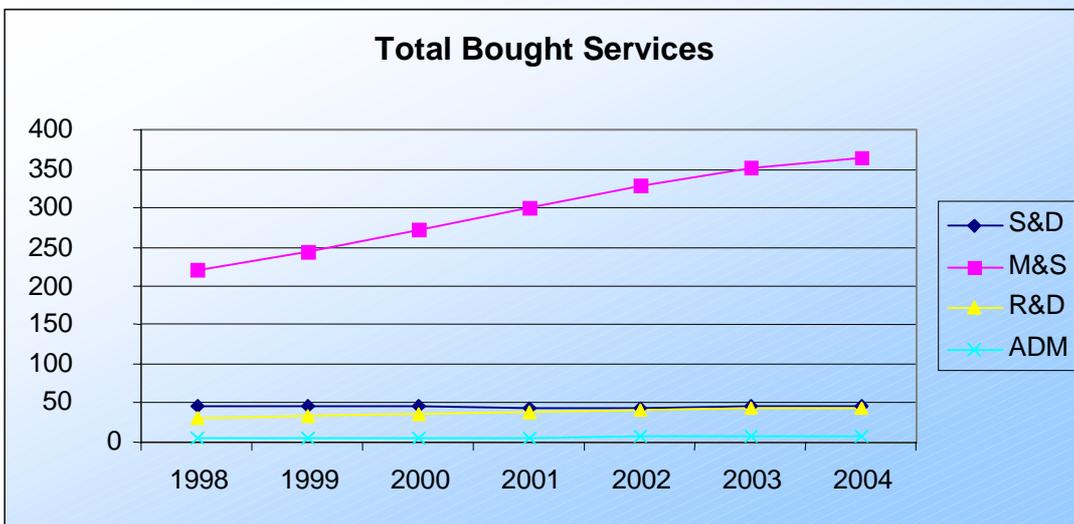


Fig. 6.9

Profit (ITL billion)

	1998	1999	2000	2001	2002	2003	2004
Profit	138.715	124.836	107.518	138.701	201.236	239.426	245.159
Profit I/O	138.715	151.655	166.547	182.798	197.792	212.135	219.709
Actual	138.715	135.200	(*)157.800				

(*) Forecast

Fig. 6.10

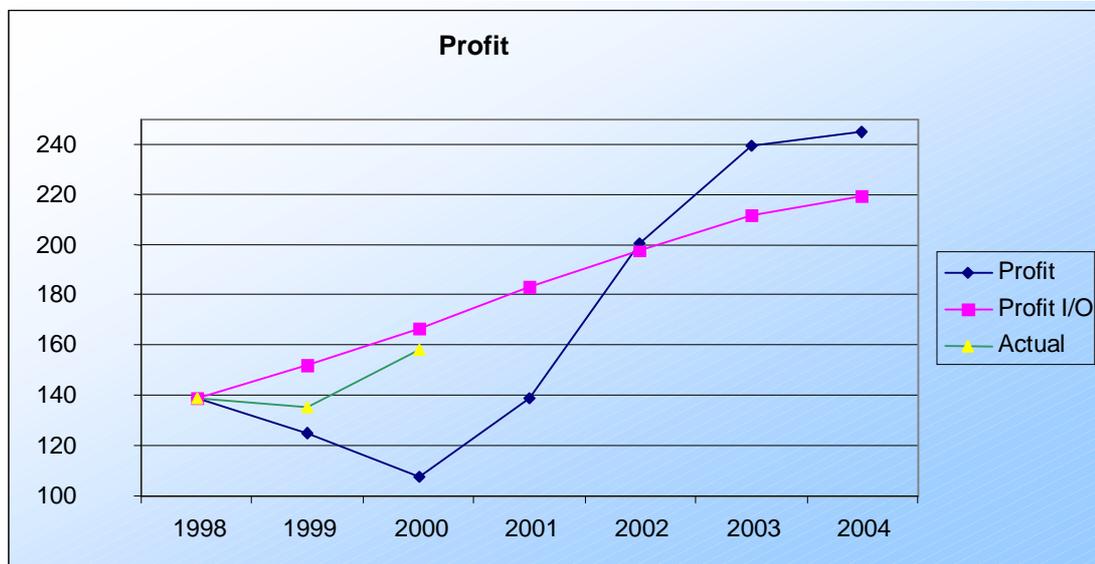


Fig. 6.11

Having thus tested the model's efficacy and the reliability of the results, we have good grounds to believe that this paper may be extended at some future point to the formulation of other hypotheses.

One of the first extensions concerns a possible disaggregation of the model. In GlaxoWellcome Italy each SBSA is divided into a substantial number of profit centres, for which the data relative to services sold and bought are (or may be) available. If so, we would be operating with an extremely disaggregated model (over 100 profit centres, which means micro-areas), which would produce an extraordinary in-depth analysis of the company's activity.

Moreover, the input-output model might likewise be applied to study the financial dynamics of the Group. The GlaxoWellcome Group's structure world-wide is organised according to a multiplicity of relations in terms of supply, sales and inter-company financial loan, which could be 'translated' into a matrix of interdependencies. An international model, designed to study the interdependencies between the different local companies, would have advantages such as the provision of fast and accurate information on the Group Net Financial Position, with the consequent possibility of optimising and saving in terms of financial costs.