The Economics of the European Information Network

(EURONET)

Study on the Cost of
Alternative Network Configuration
and Related Questions

Diebold Deutschland GmbH

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Prepared for the

Commission of the European Communities

by

Diebold Deutschland GmbH

August 1975

PREAMBLE

This study deals with the economic aspects of the European Information Network (EURONET); it centers on cost patterns of alternative network configuration.

Diebold has undertaken this task fully aware that in view of the extremely close deadline, the client's foremost desire was to obtain justifiable analyses and aids to decision-finding.

Diebold feels that on these premises, the findings and recommendations submitted meet this requirement and correspond with the level of decision-making reached by competent bodies within the Commission. Diebold as well as the client recognize the fact that an analysis of network cost patterns covers but one facet of the total problem of "Economics of EURONET". It is deemed necessary to review the aspects of "EURONET Benefits" as well, particularly at user level. If the client confirms this additional approach, a positive attitude toward, and unbiased interpretation of EURONET may safely be expected from those parties who up to now have not given up their skepticism.

Diebold management and staff would like to express their gratitude to all institutions and individuals contacted, particularly to the members of the EFAG Task Force for their courtesy, cooperation and support.

CONTENTS

1. INTRODUCTION

1.1 Goals

The purpose of this survey is to analyze the following alternative approaches to future European information networks:

- Centralized vs. national on-line retrieval systems
- Distributed system or independent star networks
- Leased lines vs. dial-up lines

The study centers on cost aspects of the problem. It is to point out the most reasonable alternative, pragmatical to some extent, but in line with the present level of decision-making; and it is also to determine the extent to which the results are governed by changing environments, such as demand levels.

1.2 Approach

In view of the pragmatical approach requested and of the time limit, subject areas must be narrowed down and clearly defined. Specifically, the following limitations are necessary:

- Only those factors will be considered that significantly affect the solutions under review, and

- analyses will be pursued only to the extent necessary to clearly evaluate diverging cost patterns.

On that basis, Diebold has reviewed the three subject areas. In the course of the investigation, premises developed in cooperation with the EFAG Task Force turned out to be valuable orientation aids. They were, however, amended or elaborated on wherever indicated by an evaluation of interim results. Documents listed in Appendix C, for example, were used to substantiate the assumptions for this study.

2. SYNOPSIS OF RESULTS

2.1 Centralized vs. National On-Line Retrieval Systems

The analysis dealing with this first aspect of cost patterns of alternative EURONET concepts indicates that

annual operating cost of a centralized on-line retrieval system is some ten million DM (or 2.7 million accounting units) lower than that of national on-line retrieval systems. This statement will remain valid even if drastic changes should occur in the basic assumptions pertaining to cost patterns.

Specifically, this cost analysis is based on the following facts, assumptions and conclusions:

- As prescribed by the EFAG Task Force, the figures contained in the November 1974 PA Management Consultants study are applied, but corrected by factors 1/2, 3/8 and 1/10.

- Specifications and characteristics of the "Chemical" (CHEM) sector are used as a model in determining configuration of the data bank and other components of the on-line retrieval system.

- Regional communications networks are omitted from this cost comparison as they are all but equally required by either alternative. Similarly, network concentrators, multiplexers and modems can be neglected.

- Systems development cost is omitted as roughly the same expenditures are incurred in either case. This, however, is on

the assumption that in case of the national solution, standard software would be implemented.

- All factors were omitted from the comparison of alternative solutions that entail roughly the same cost for both or whose impact is too limited to significantly affect results.

2.2 Distributed System vs. Independent Star Networks

The answer to the second aspect of cost patterns of alternative EURONET concepts is as follows:

Annual operating cost of the Distributed System is some 500,000 DM (or 140,000 a.u.) lower than that of the (assumed) three independent star networks. This statement will remain valid; cost difference in favor of the Distributed System further increases coincident with an increasing number of independent networks. This cost pattern results from the fact that while a larger initial investment is required for the Distributed System (system software for network control), line costs are much lower than for independent networks. In addition, future evaluation of such aspects as security, reliability, back-up (thus far neglected) will tend to emphasize the advantage of the Distributed System.

Specifically, this cost analysis is based on the following assumptions:

- As prescribed by the EFAG Task Force, figures of the November 1974 PA study are applied, corrected by factors 1/2, 3/8 and 1/10.

- Calculation is based on three assumed centers with an appropriate combination of sectors: London (AGRI, BIOL, PHYS,

ELEC); Paris (CHEM, GENST, CIVIL, NUC); and Frankfurt (MED, AERO, EARSP). The statement favoring the Distributed System can be derived without modification from any other meaningful combination of sectors or geographical locations.

- For cost comparison, software development cost is estimated at some two million DM (or 550,000 a. u.). Since this is a one-time investment pro-ratable to the useful life of the system (assumption: eight years), this results in some 250,000 DM (or 70,000 a. u.) annual excess cost.

- Computing center equipment is assumed to be almost identical for either type of network. This also applies to line control components (network concentrators, multiplexers etc.). This assumption is derived from the fact that whatever hardware is mandatory for the Distributed System will also be required in independent star networks for efficient network utilization.

2.3 Leased Lines vs. Dial-Up Lines

Break-even analysis for leased vs. dial-up lines revealed that

break-even points for leased vs. dial-up lines, determined for the three (assumed) star networks centered at London, Paris and Frankfurt, range from 100 to 150 hours transmission per month at 2,400 bits per second transmission speed.

Diebold is of the opinion that the decision of selecting leased or dial-up lines has to be made individually for each connection within EURONET so as to insure optimum operation and cost/effectiveness of the datanet. This problem is considered to be of minor impact on the total EURONET cost pattern.

3. RECOMMENDATIONS

In the course of this survey, Diebold has gained the impression that to date, all efforts to review the concept of a European information network have centered on technical and financial problems. At this time, it is desirable to perform an analysis of benefits so as to obtain a sound estimate of the total economics of the system.

On that basis, Diebold recommends these follow-up activities:

(1) Appraisal of EURONET benefits. This requires

- *reassessment and verification of current quantitative premises via alternative cost models (feedback between extent of utilization and cost of the service)*
- *quantification of tangible benefits to individual EURONET users*
- *determination of total benefits to be expected from alternative concepts*

(2) On the basis of detailed findings on EURONET benefits from the above as well as from studies already available dealing with technical feasibility and alternative technical approaches and their cost, cost/benefit analyses can be verified and, if deemed necessary, measures can be initiated to improve cost/effectiveness of the system. This should include further increase of the utilization potential (e. g. by expanding the customer base) as well as selected cost analyses, taking advantage of all technological possibilities.

Any current or subsequent review of technological and user-oriented aspects should only be performed in accordance with the procedure outlined above, with the details of each activity adapted to the level of decision-making reached at the time.

4. ANALYSIS OF AREAS UNDER REVIEW

4.1 Centralized vs. National On-Line Retrieval Systems

4.1.1 Premises

Evaluation of centralized vs. national on-line retrieval systems

- refers to cost comparison
- was performed within one selected sector (CHEM)
- is to illustrate the dependence of the cost situation from changing environments

This comparison is based on the following premises:

- Data bank specifications: 360,000 records p.a.; 3,000 characters per record; five-year storage interval
- Figures as per the November 1974 PA study, but with reduced 1980 demand levels (D) which are considered too high

Reduction Factor R = 3/8 is determined as follows:

R = (Demand Level "D" plus SDI Add-On Factor) x Correction Factor
= (1 plus 1/2) x 1/4
= 3/8

(SDI Add-On Factor: see PA Study)

Other correction or reduction factors are 1/2 and 1/10

Reduced Demand Level D_R is determined as follows:

D_R = Demand Level x Reduction Factor = D x R

- Centralized System center to be located at Frankfurt

In addition, the following assumptions are made by Diebold which simplify the analysis without significantly affecting its evidential value:

- Regional networks are neglected as they are equally required by either alternative.
- System development costs are neglected as roughly the same expenditures are incurred in either case. It is assumed that in case of the national solution, standard basic software would be used.
- Network concentrators, multiplexers and modems are neglected as mandatory for either version. It is assumed that whatever concentrators and multiplexers are required for the centralized solution would be implemented, in part, as front-end processors under the national concept. In either case, the operating expenses are roughly the same.
- Network loads for data entry into the system are neglected as they are roughly 200 times lower than those of the output load.

The objective is to eliminate from the comparison any parameters that apply to either solution, plus any of those factors that entail roughly the same expenditure for both, as well as those that have no significant impact on the results.

4.1.2 Basic Reference Tables

The following network references were used in the comparison:

Table 4/1 - USES estimate for 1980

Table 4/2 - Network load estimate for 1980 by number of messages

Table 4/3 - Network load estimate for 1980 by number of Bits

Table 4/4 - Estimate of transmission times for 1980 in relation to line speeds

While these tables are largely self-explanatory, attention is invited to the following:

- all figures are based on the November 1974 PA study
- one year is considered to have 250 days
- rounding of figures results in negligible deviations in sum totals

The following computer cost references were used in the comparison:

Table 4/5 - Estimates of computer size and cost re: "European Center"

Table 4/6 - Estimates of computer size and cost re: "Regional Centers"

These tables are self-explanatory; they are contained in Appendix A. Figures 4/1 and 4/2 (Appendix B) illustrate the network architecture of the CHEM sector with various load factors. In addition, Figures 4/3 and 4/4 reflect two examples of national on-line retrieval systems, also with different load factors.

4.1.3 Network Alternatives

On the basis of network loads as per Table 4/4, the following alternatives alternatives are derived for the (assumed) model sector CHEM:

Factor	Cost per Annum (Cost Basis: See Appendix C)	Line Identification: see Figure No.
3/8	approx. 764,000 DM 208,700 a.u.	4/1
1/10	approx. 634,000 DM 173,000 a.u.	4/2

It should be noted that

- The comparatively small deviation between the approaches by factors 3/8 and 1/10 indicates that network costs for workloads in the volumes assumed are almost fixed. Significant changes could occur only if, for example, conversion to wide-band lines were to become necessary. This, however, does not apply under the premises of this study.
- For further simplification, the cost estimates following hereafter are based on the higher standard (factor 3/8, rounded off to DM 800,000 or 220,000 a.u.).

4.1.4 Computer System Alternatives

There are two alternatives for the centralized solution (see Table 4/5):

Factor	Cost per Annum	Basis for further Computation
3/8	3.55 - 4.35 million DM	4 million DM approx. 1.1 million a.u.
1/10	2.50 - 3.05 million DM	2.8 million DM approx. 0.765 million a.u.

Assuming that not all of the regional centers are to be equipped with computers of their own, there are two alternatives for the national solution (see Table 4/6 and Figures 4/3 and 4/4):

Factor	Location	Equipment Level	Cost per Annum
3/8	Amsterdam	B	As per Table 4/6:
	Brussels	B	14.0 - 17.3 million DM
	Copenhagen	(Amsterdam)	Basis for further
	Dublin	(London)	Computation:
	Frankfurt	A	15.0 million DM
	London	A	(without line cost)
	Luxembourg	(Brussels)	
	Paris	A	
	Rome	A	approx. 4.2 million a.u.
1/10	Amsterdam	B	As per Table 4/6:
	Brussels	(Paris)	11.5 - 14.25 million DM
	Copenhagen	(Amsterdam)	Basis for further
	Dublin	(London)	Computation:
	Frankfurt	A	12.5 million DM
	London	A	(without line cost)
	Luxembourg	(Paris)	
	Paris	A	
	Rome	B	approx. 3.4 million a.u.

4.1.5 Cost Comparison

Based on cost estimates set forth below, cost patterns for the two alternatives are as follows (one a.u. = DM 3.66):

Factor 3/8	Centralized Solution million DM	Centralized Solution million a.u.	National Solution million DM	National Solution million a.u.
Network	0.8	0.22	-	-
Central Computer	4.0	1.10	-	-
Regional Computers	-	-	15.5	4.2
Total	4.8	1.32	15.5	4.2
Factor 1/10				
Network	0.8	0.220	-	-
Central Computer	2.8	0.765	-	-
Regional Computers	-	-	12.5	3.4
Total	3.6	0.985	12.5	3.4

The foregoing breakdown reveals some ten million DM (2.7 million a.u.) difference between the centralized and national solutions. This is also proven by the comparison

- of approximately 800,000 DM (approx. 220,000 a.u.) for the network
- with some ten million DM (2.7 million a.u.) for the additional computer operations within individual regions.

From the cost aspect, the extent of these differences points to the obvious advantage of the centralized version. This statement remains valid even if the premises were to be drastically changed:

- In case of twice the network cost together with half the cost of national computer operations, the difference is still over four million DM or 1.1 million a.u.
- In case of twice the cost of the network and the central computer, the difference with factor 3/8 is still six million DM or 1.6 million a.u.; with factor 1/10, 5.4 million DM or 1.5 million a.u.

Consequently, a shift of these cost patterns in favor of the national solution can only be expected to occur under conditions that are beyond the scope of the premises considered realistic in this study.

4.2 Distributed System vs. Independent Star Networks

4.2.1 Premises

Comparison of the distributed-system concept with that of several independent star networks

- refers to cost
- was performed for a meaningful combination of three to four sectors each, within three centers
- is to illustrate the dependence of the cost patterns from changing environments (e. g. demand level)

The comparison is on the premise of the November 1974 PA study figures, corrected by factors 1/2; 3/8 and 1/10 as appropriate.

Other assumptions originally intended are obviated by the following conclusion which simplifies the overall analysis:

- The Distributed System alternative merely entails software development or adaptation cost that is higher than that of several independent star networks. This is due to the comparative novelty of the distributed-system concept and consequently, suitable software is not generally available. To be on the safe side, excess cost is estimated at around two million DM (550,000 a. u.). Further assuming an eight-year depreciation period for this software investment, annual cost is calculated at some 250,000 DM (70,000 a. u.). This total does not affect the trend statement favoring the Distributed System.

4.2.2 Basic References

Contrary to the originally intended five network centers, the following comparison refers to only three. This was considered appropriate for better transparence of the statements derived. The following references were used:

Table 4/7 - 1980 network load estimate re: AGRI, BIOL, PHYS, ELEC sectors
Assumed location of network center: London

Table 4/8 - 1980 network load estimate re: CHEM, GENST, CIVIL, NUC sectors
Assumed location of network center: Paris

Table 4/9 - 1980 network load estimate re: MED, AERO, EARSP sectors
Assumed location of network center: Frankfurt

All tables are contained in Appendix A. In addition, Figures 4/3 to 4/5 and 4/9 to 4/11 (Appendix B) reflect network architecture on the basis of the above tables for load factors 3/8 and 1/10, including annual operating cost.

4.2.3 Computation of Annual Cost for three Centralized Star Networks

The following line fees were determined for two alternatives:

Network Center	Load Factor 3/8		Load Factor 1/10	
	Annual Line Cost DM	See Figure No.	Annual Line Cost DM	See Figure No.
London	674,300	4/5	393,350	4/9
Paris	889,800	4/6	503,350	4/10
Frankfurt	1,047,000	4/7	569,200	4/11
Total	2,611,100		1,465,900	
	(713,400 a.u.)		(400,520 a.u.)	

4.2.4 Computation of Annual Cost for the Distributed System

4.2.4.1 Workload Factor 3/8

(See Appendix B, Figure 4/8)

a) Leased Lines 2400^{+}/4800 bps; Four-Wire; M 102

Line No. (Appendix B)	Workload Hours per Day	Number of Lines	Rental Fee per Annum DM
1	10.0	1	132,000
2	16.0	2	228,000
3	33.0	3	255,000
4	30.0	3	252,000
5	7.7	1^{+}	72,000
6	6.4	1	42,000
7	10.0	1	96,000
8	8.6	1^{+}	108,000
9	31.0	3	324,000
10	35.0	3	363,000
11	3.6	1^{+}	18,000
12	4.5	1^{+}	84,000
13	2.7	1^{+}	114,000
Subtotal			2,088,000 DM (570,491 a.u.)

b) Dial-Up Lines 1200^{+}/ 2400 bps

1	0.3	1^{+}	4,600
2	0.3	1^{+}	4,900
3	0.2	1^{+}	2,800
Subtotal			12,300 DM (3,360 a.u.)
Total Cost per Annum		approx.	2,100,000 DM (574,000 a.u.)

4.2.4.2 Workload Factor 1/10

(See Appendix B, Figure 4/12)

a) Leased Lines 2400/4800^{+} bps; Four-Wire; M 102

Line No. (Appendix B)	Workload Hours per Day	Number of Lines	Rental Fee per Annum DM
1	5.0	1	132,000
2	8.5	1	114,000
3	9.4	1^{+}	85,000
4	7.7	1^{+}	84,000
5	2.0	1	72,000
6	3.4	1	42,000
7	4.9	1	96,000
8	5.0	1	108,000
9	8.0	1^{+}	108,000
10	9.0	1^{+}	121,000
11	2.0	1	18,000
Subtotal			980,000 DM (267,760 a.u.)

b) Dial-Up Lines 1200^{+}/ 2400 bps

12	2.4	1^{+}	36,000
13	1.4	1^{+}	27,300
1	0.1	1^{+}	1,500
2	0.3	1^{+}	4,900
3	0.1	1^{+}	1,400
Subtotal			71,100 DM (19,430 a.u.)
Total Cost per Annum		approx.	1,050,000 DM (287,000 a.u.)

4.2.5 Cost Comparison

Line cost for the two alternative solutions is as follows:

Workload Factor	Type of Network	Line Cost per Annum DM	Line Cost per Annum a.u.	Difference DM	Difference a.u.
3/8	Star	2,610,000	713,000	500,000	137,000
	Distributed	2,100,000	574,000		
1/10	Star	1,500,000	410,000	450,000	123,000
	Distributed	1,050,000	287,000		

The above breakdown reveals that regardless of assumed network loads, the absolute cost advantage of the Distributed vs. the centralized version remains the same. In addition, line costs decrease overproportionately with increasing workloads: if the workload increases from 1/10 to 3/8 of the assumed volume (i.e., 3.75 times) line fees are only two times higher. (See Figure 4/13 on page 18).

Computation of Distributed System line fees with workload factors 3/8 vs. 1/10 reveals an absolute total difference of some one million DM (287,000 a.u.) per annum.

In the comparison of star networks vs. the Distributed System, it is important to note that higher cost of software development indicates a disadvantage of the Distributed System. However, the above differences of some 500,000 DM (137,000 a.u.) reveal that due to better line utilization within the Distributed System, excess software development investments can be depreciated within a few years.

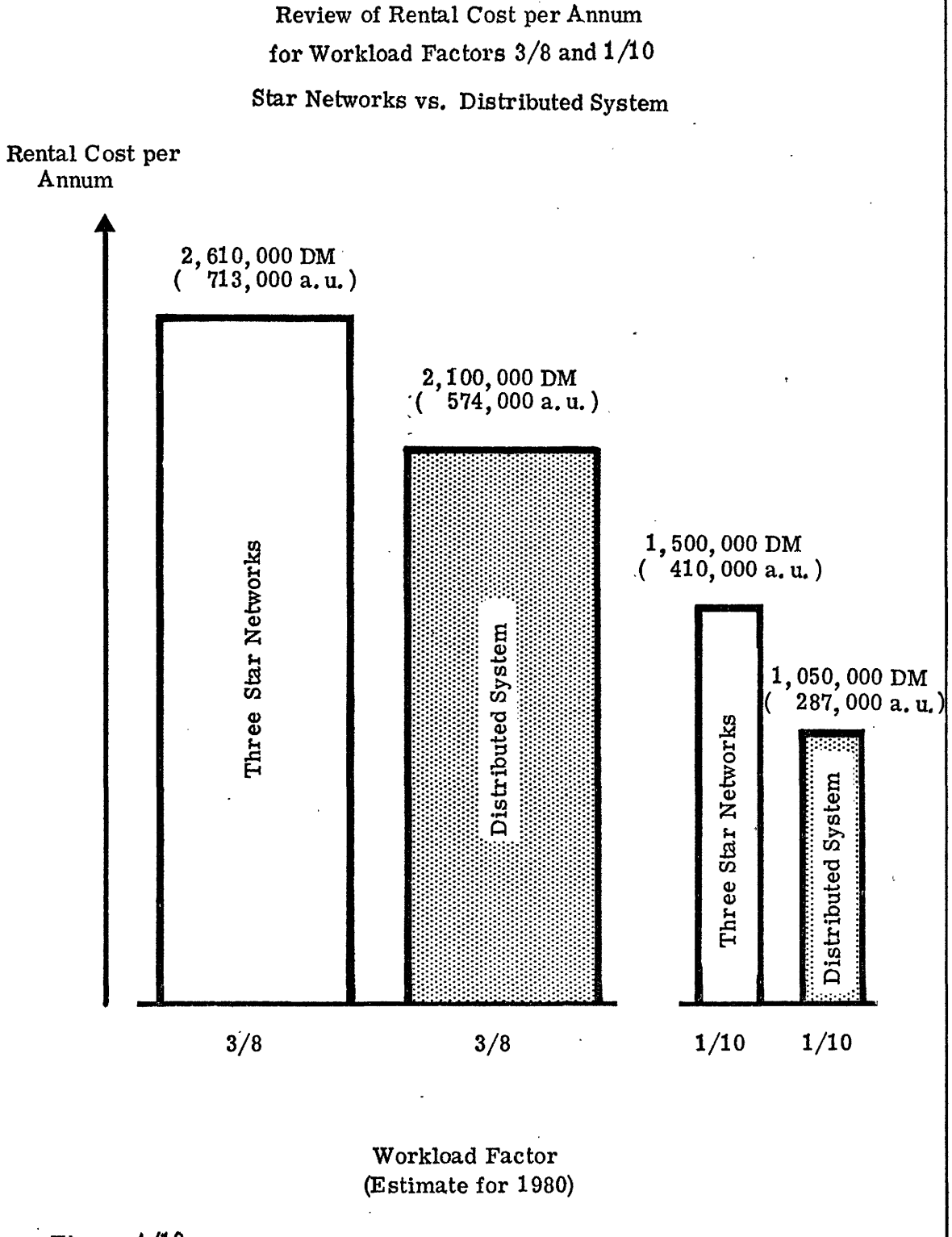

Review of Rental Cost per Annum
for Workload Factors 3/8 and 1/10
Star Networks vs. Distributed System
Rental Cost per Annum
2,610,000 DM
(713,000 a.u.)
2,100,000 DM
(574,000 a.u.)
1,500,000 DM
(410,000 a.u.)
1,050,000 DM
(287,000 a.u.)
Three Star Networks
Distributed System
Three Star Networks
Distributed System
3/8
3/8
1/10
1/10
Workload Factor
(Estimate for 1980)

Figure 4/13

4.3 Leased Lines vs. Dial-Up Lines

Rental fees should not be the sole deciding factor in selecting leased or dial-up lines; the following additional aspects must be carefully reviewed:

- Nature and volume of data to be transmitted
- Required turn-around times
- Reliability and security of transmission lines
- Available terminals and data processing systems
- Type of network required (e.g. distributed vs. star)

Dial-up lines should be preferred whenever

- No exceptional demands are made on turn-around times
- Volume of data to be transmitted is low
- Subscribers require dial-up service (e.g., for access to several independent networks)

Conversely, leased lines are more advantageous in case of complex networks with high-volume data exchange and extensive utilization periods, particularly for direct computer-to-computer connections.

Graphs on pages 22 to 24 show break-even points for connection of the (assumed) London, Paris and Frankfurt star network centers with other EC countries.

Taking the London - Paris connection as an example, the graph on page 22 reveals that regardless of network architecture, monthly utilization should be well below 129 hours for dial-up to be more advantageous than lease-line connection.

If utilization rates are close to the break-even point, however, leased lines are advisable as they feature several user-oriented advantages

over dial-up lines. This is indicated by the shaded areas in the graphs; the critical range is between 20 and 30% throughout. Since significant improvements in international telephone/data traffic may safely be expected by 1980 (e. g. dial-up lines to become more reliable), the critical area will shrink.

Break-even points were determined on the basis of the 1975 fee structures. The following example illustrates how to compute the cost of a Paris - London connection:

- Determine annual rental for the leased line from Appendix C, Enclosure A, referring to plane "a" of the coordinates:
  = DM 85,200 (23,280 a. u.)
- Determine dial-up line fee for 250-hours-per-annum utilization (i. e., 20. 83 hours per month) from Appendix C, Enclosure A, referring to plane "b" of the coordinates:
  = DM 13,750 DM (3,800 a. u.)
- Compute break-even in hours:

$$\frac{\text{Leased Line Rental}}{\text{Dial-Up Transmission Fee}} \times 20.83 \text{ hours per month}$$

$$= \frac{85,200 \text{ DM}}{13,750 \text{ DM}} \times 20.83 \text{ hours per month} = 129 \text{ hours per month}$$

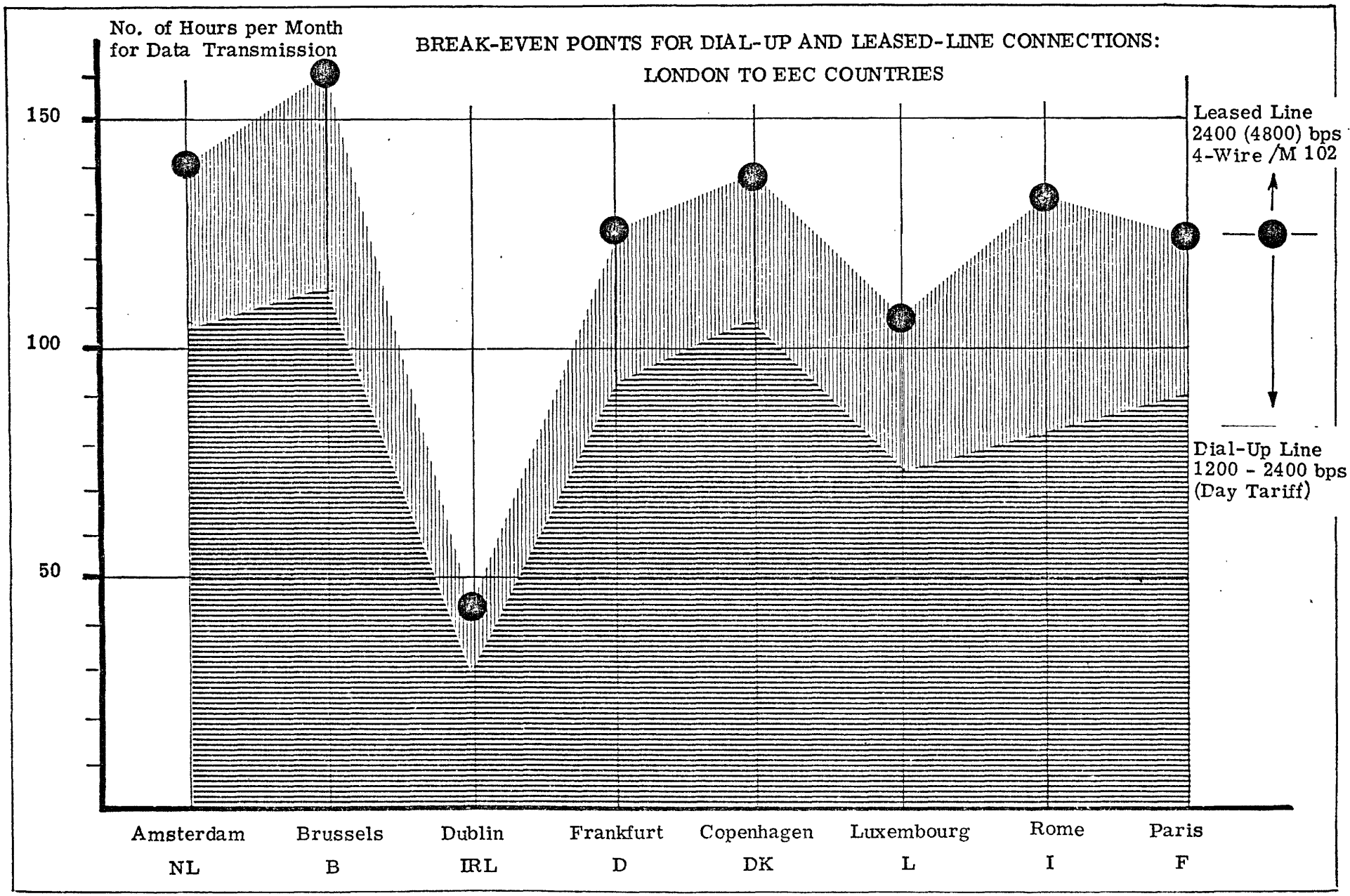
The rates reflected in Enclosure A are arithmetic means as line fees are subject to national PTT policy and therefore vary according to the originating country's tariffs. This applies to lease and dial-up lines alike. This chart should therefore serve as an orientation aid rather than for precise computation of network cost. The objective is to determine dimensions of expenditures to be expected; it would be unreasonable to try and predict exact line fees for 1980.

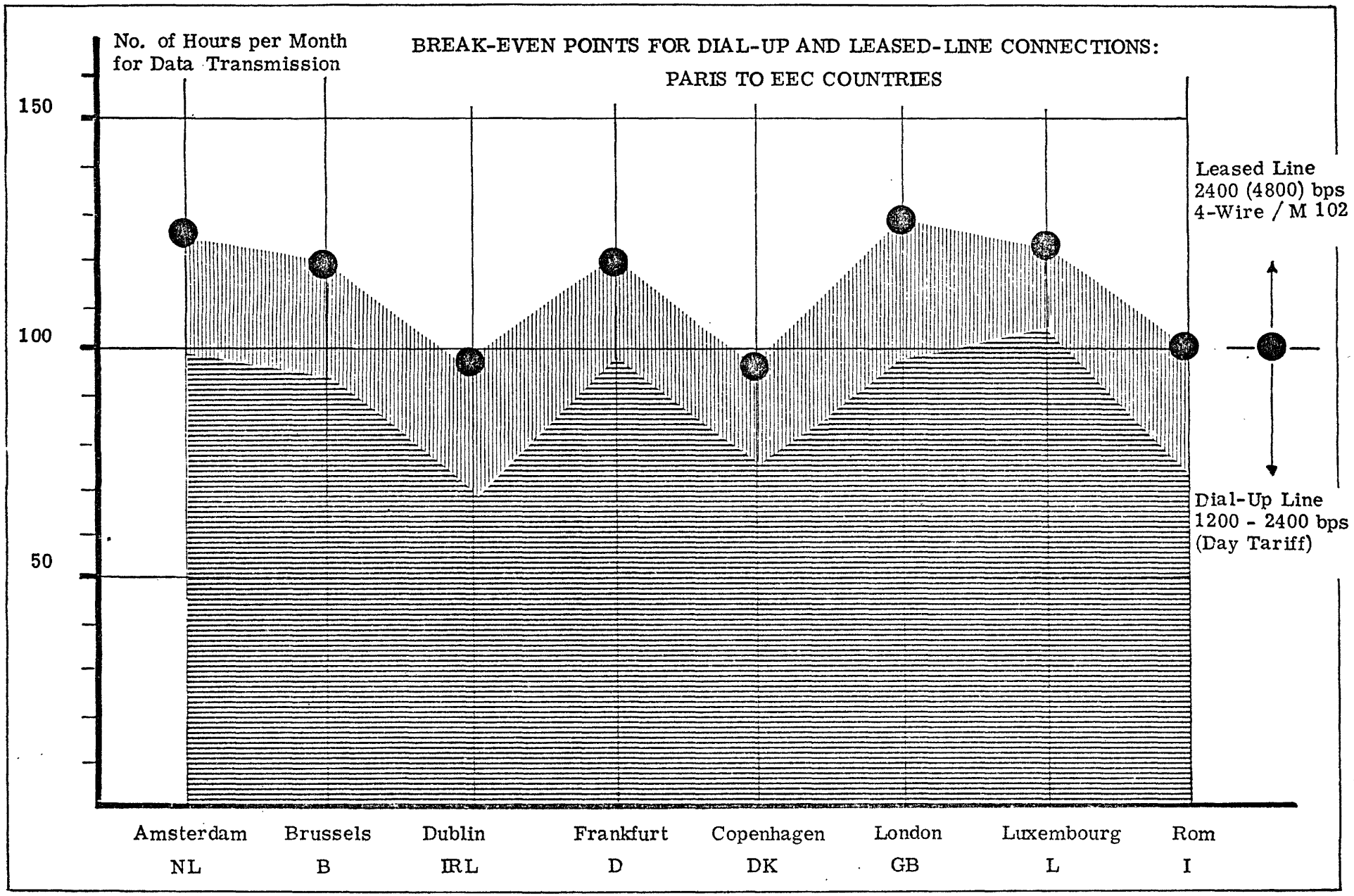
Basis for computation of dial-up transmission fees is an assumed one-hour

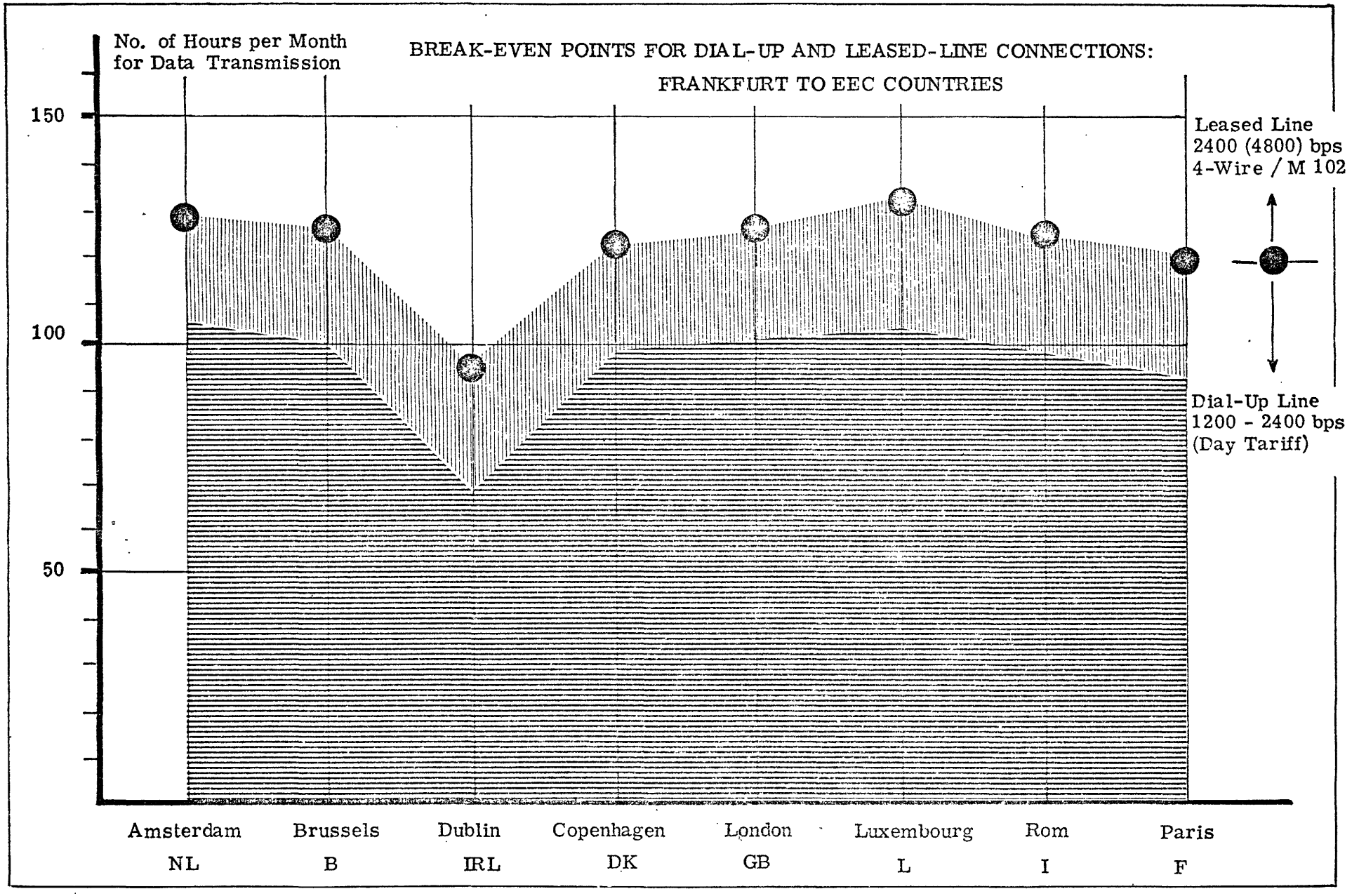
daily transmission rate (or 250 hours per annum).

Determination of break-even points is based on the following assumptions:

	Leased Line	Dial-Up Line
Transmission Speed	2400 / 4800 bps	1200 / 2400 bps
Reliability	Excellent (M 102)	Normal
Type of Line	Four-Wire	Two-Wire
Operating Cost	See Chart of Line Fees, Appendix C, Encl. A	
Critical Area	20 - 30 %	
Connections between EC Countries and Centers	London, Paris, Frankfurt	


No. of Hours per Month
for Data Transmission
BREAK-EVEN POINTS FOR DIAL-UP AND LEASED-LINE CONNECTIONS:
LONDON TO EEC COUNTRIES
150
100
50
Leased Line
2400 (4800) bps
4-Wire /M 102
Dial-Up Line
1200 - 2400 bps
(Day Tariff)
Amsterdam
NL
Brussels
B
Dublin
IRL
Frankfurt
D
Copenhagen
DK
Luxembourg
L
Rome
I
Paris
F


No. of Hours per Month
for Data Transmission
BREAK-EVEN POINTS FOR DIAL-UP AND LEASED-LINE CONNECTIONS:
PARIS TO EEC COUNTRIES
150
100
50
Leased Line
2400 (4800) bps
4-Wire / M 102
Dial-Up Line
1200 - 2400 bps
(Day Tariff)
Amsterdam
NL
Brussels
B
Dublin
IRL
Frankfurt
D
Copenhagen
DK
London
GB
Luxembourg
L
Rom
I


No. of Hours per Month
for Data Transmission
BREAK-EVEN POINTS FOR DIAL-UP AND LEASED-LINE CONNECTIONS:
FRANKFURT TO EEC COUNTRIES
150
100
50
Leased Line
2400 (4800) bps
4-Wire / M 102
Dial-Up Line
1200 - 2400 bps
(Day Tariff)
Amsterdam NL
Brussels B
Dublin IRL
Copenhagen DK
London GB
Luxembourg L
Rom I
Paris F

APPENDIX A

TABLES

TABLE 4/1	SECTOR: CHEM				ESTIMATE OF USES					
ITEM / REGION/ COUNTRY	USES 1980				USES IN 1980 PER DAY				INTENSITY FACTOR (D = 100)	%
	ORIG.	x 3/8	x 1/2	x 1/10	ORIG.	x 3/8	x 1/2	x 1/10		
B	10.000	3.790	5.050	1.010	40	15,0	20,0	4,0	15,0	4,0
DK	5.600	2.100	2.800	560	22	8,0	11,0	2,2	8,4	2,0
F	58.000	21.750	29.000	5.800	232	87,0	116,0	23,0	87,0	23,0
D	67.000	25.125	33.500	6.700	268	100,0	134,0	26,0	100,0	26,0
IRL	1.970	740	985	197	8	3,0	4,0	0,8	2,9	1,0
I	35.600	13.350	17.800	3.560	142	53,0	71,0	14,0	53,0	14,0
L	295	111	148	30	1	0,4	0,5	0,1	0,4	0,1
NL	17.900	6.713	8.950	1.790	71	27,0	35,0	7,0	26,7	7,0
GB	57.000	21.375	28.500	5.700	228	86,0	114,0	23,0	85,0	23,0
TOTAL	253.465	95.054	126.733	25.347	1.012	379,0	510,0	101,0	--	100,0

TABLE 4/2	SECTOR: CHEM				ESTIMATE OF TRAFFIC 1980											
ITEM / REGION/ COUNTRY	INPUT PER YEAR (Messages x 1.000)				OUTPUT PER YEAR (Messages x 1.000)				INPUT PER DAY (Messages)				OUTPUT PER DAY (Messages)			
	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10
B	1.070	401	535	107	4.520	1.695	2.260	452	4.280	1.605	2.140	428	18.080	6.780	9.040	1.808
DK	600	225	300	60	2.520	945	1.260	252	2.400	900	1.200	240	10.080	3.780	5.040	1.008
F	6.200	2.325	3.100	620	26.100	9.787	13.050	2.610	24.800	9.300	12.400	2.480	104.400	39.150	50.220	10.440
D	7.200	2.700	3.600	720	30.200	11.325	15.100	3.020	28.800	10.800	14.400	2.880	120.800	45.300	60.400	12.080
IRL	209	78	105	21	880	330	440	88	836	312	418	84	3.520	1.320	1.760	352
I	3.790	1.421	1.895	379	15.900	5.963	7.950	1.590	15.160	5.685	7.800	1.516	63.600	23.850	31.800	6.360
L	31	12	15	3	132	49	66	13	124	45	62	12	528	198	264	53
NL	1.910	716	955	191	8.000	2.400	4.000	800	7.640	2.865	3.820	764	32.000	12.000	16.000	3.200
GB	6.000	2.250	3.000	600	25.300	9.478	12.650	2.530	24.000	9.000	12.000	2.400	101.200	37.950	50.600	10.120
TOTAL	27.000	10.128	13.500	2.700	114.000	42.750	57.000	11.400	108.040	40.515	54.020	10.804	454.208	170.328	227.104	45.420

TABLE 4/3	SECTOR: CHEM				ESTIMATE OF TRAFFIC 1980											
ITEM / REGION/ COUNTRY	INPUT PER YEAR (Megabits)				OUTPUT PER YEAR (Megabits)				INPUT PER DAY (Kilobits)				OUTPUT PER DAY (Kilobits)			
	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10
B	89	33,00	45,0	9,0	19.700	7.386	9.850	1.970	356	133,0	178	36,0	78.800	29.550	39.400	7.880
DK	49	18,00	25,0	5,0	11.000	4.125	5.500	1.100	196	73,0	98	20,0	44.000	16.500	22.000	4.400
F	510	189,00	255,0	51,0	114.000	42.750	57.000	11.400	2.040	765,0	1.020	204,0	456.000	171.000	228.000	45.600
D	590	219,00	295,0	59,0	132.000	49.500	66.000	13.200	2.360	885,0	1.180	236,0	528.000	198.000	264.000	52.800
IRL	17	6,00	9,0	2,0	3.850	1.443	1.925	385	68	25,0	34	7,0	15.400	5.775	7.700	1.540
I	313	117,00	157,0	31,0	70.000	26.250	35.000	7.000	1.252	469,0	626	125,0	280.000	105.000	140.000	28.000
L	3	1,11	1,5	0,3	580	216	290	58	12	4,5	6	1,2	2.320	870	1.160	232
NL	158	59,00	79,0	16,0	35.100	13.161	17.550	3.510	632	237,0	316	63,0	140.400	52.650	70.200	14.040
GB	497	186,00	249,0	50,0	111.000	41.625	55.500	11.100	1.988	745,0	994	199,0	444.000	166.500	222.000	44.400
TOTAL	2.230	836,00	1,115,0	223,0	496.000	186.000	248.000	49.600	8.904	3.339,0	4.452	890,0	1.988.920	745.845	994.460	198.892

TABLE 4/4	SECTOR: CHEM				ESTIMATE OF TRANSFER TIME 1980															
ITEM / REGION/ COUNTRY	INPUT MINUTES PER WORKLOAD DAILY (1.000 bit/s)*				OUTPUT HOURS PER WORKLOAD DAILY (1.000 bit/s)*				INPUT MINUTES PER WORKLOAD DAILY (2.000 bit/s)*				OUTPUT HOURS PER WORKLOAD DAILY (2.000 bit/s)*				OUTPUT HOURS PER WORKLOAD DAILY (4.000 bit/s)*			
	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10
B	5,9	2,21	2,95	0,5	21,8	8,2	10,9	2,18	3,0	1,1	1,5	0,3	11,0	4,1	5,5	1,1	5,5	2,1	2,8	0,6
DK	3,3	1,24	1,65	0,3	12,0	4,5	6,0	1,2	1,7	0,7	0,9	0,2	6,0	2,3	3,0	0,6	3,0	1,1	1,5	0,3
F	34,0	13,0	17,0	3,4	126,0	47,2	63,0	12,6	17,0	6,4	8,5	1,7	63,0	24,0	31,5	6,3	31,0	11,6	15,5	3,1
D	39,0	15,0	19,5	3,9	146,0	55,0	73,0	14,6	20,0	7,5	10,0	2,0	73,0	27,0	36,5	7,3	36,0	13,5	18,0	3,6
IRL	1,1	0,41	0,55	0,11	4,2	1,6	2,1	0,42	0,6	0,23	0,3	0,06	2,1	0,8	1,05	0,21	1,05	0,4	0,5	0,1
I	21,0	8,0	10,5	2,1	78,0	29,0	39,0	7,8	11,0	4,1	5,5	1,1	39,0	15,0	19,5	3,9	19,0	7,1	9,5	2,0
L	0,2	0,1	0,1	0,1	0,6	0,2	0,3	0,1	0,1	0,04	0,05	0,01	0,3	0,11	0,15	0,03	0,15	0,05	0,08	0,02
NL	11,0	4,1	5,5	1,1	39,0	15,0	19,5	3,9	6,0	2,3	3,0	0,6	20,0	7,5	10,0	2,0	10,0	3,8	5,0	1,0
GB	33,0	12,4	16,5	3,3	123,0	46,0	61,5	12,3	17,0	6,4	8,5	1,7	62,0	23,0	31,0	6,2	31,0	11,6	15,5	3,1

* effective transfer rate

Table 4/5	Sector: CHEM		Computer Building Blocks, European Center (Estimate for 1980)	
Demand / Module	Characteristics		Annual Costs (1.000,DM)	
	Level A (P.A. x 3/8)	Level B (P.A. x 1/10)	Level A (P.A. x 3/8)	Level B (P.A. x 1/10)
Central Processor	2 - 3 MB Min 2 MIPS (Million Instructions per Second)	1 - 1,5 MB Min. 1 MIPS	900 - 1,200	600 - 800
On-line Storage	Based on: 360.000 records a year 3.000 characters per record Five years backlog That means: Min. 6.000 million of characters, reasonable access time (10^{-3} to 10^{-2})		800	600
Other Components	Unit record equipment Tape drives Consoles etc.		400 - 500	300 - 400
Communications Features	Communications Controller (Front-end Computer) Line adapters, etc.		250 - 350	200 - 250
Operations and Overhead	Operating Supplies etc.		1,200 - 1,500	800 - 1,000
TOTAL	--	--	3,550 - 4,350 (970 - 1,189 u.a.)	2,500 - 3,050 (683 - 833 a.u.)

Table: 4/6	Sector: CHEM	Computer Building Blocks, Regional Centers (Estimate for 1980)		
Demand / Module	Characteristics		Annual Cost (1.000/DM)	
	Level A (High Demand)	Level B (High Demand)	Level A (High Demand)	Level B (High Demand)
Central Processor	1 - 1,5 MB Min. 1 MIPS	750 KB - 1 MB 1 MIPS	600 - 800	500 - 700
On-Line Storage	Based on : 360.000 records a year 3.000 characters per record five years backlog That means: Min. 6.000 mill. of characters reasonable access Time (10^{-3} to 10^{-2})		600	500
Other Components	Unit record equipment Tape drives Consoles etc.		300 - 400	250 - 350
Communications Features	Communications Controller (Front-end Computers) Line adapters etc.		200 - 250	150 - 200
Operations and Overhead	Operating Supplies etc.		800 - 1.000	600 - 800
Total	———	———	2.500 - 3.050 (683 - 833 a.u.)	2.000 - 2.550 (546 - 697 a.u.)

TABLE 4/7	SECTOR: AGRI, BIOL, PHYS, ELEC				ESTIMATE OF TRANSFER TIME 1980															
ITEM / REGION/COUNTRY	INPUT MINUTES PER DAILY WORKLOAD (1.000 bit/sec.)*				OUTPUT HOURS PER DAILY WORKLOAD (1.000 bit/sec.)*				INPUT MINUTES PER DAILY WORKLOAD (2.000 bit/sec.)*				OUTPUT HOURS PER DAILY WORKLOAD (2.000 bit/sec.)*				OURPUT HOURS PER DAILY WORKLOAD (4.000 bit/sec.)*			
	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10
B	5,6	2,1	2,8	0,6	18,0	6,8	9,0	1,8	2,8	1,1	1,4	0,3	9,0	3,4	4,5	0,9	4,5	1,7	2,3	0,5
DK	2,8	1,0	1,4	0,3	9,0	3,4	4,5	0,9	1,4	0,5	0,7	0,1	4,5	1,7	2,3	0,5	2,3	0,9	1,2	0,2
F	32,0	12,0	16,0	3,2	105,5	39,0	53,0	11,0	16,0	6,0	8,0	1,6	53,0	20,0	27,0	5,3	27,0	10,0	14,0	2,7
D	36,0	14,0	18,0	3,6	119,0	45,0	60,0	12,0	18,0	7,0	9,0	1,8	60,0	23,0	30,0	6,0	30,0	12,0	15,0	3,0
IRL	1,4	0,5	0,7	0,2	4,6	1,7	2,3	0,5	0,7	0,3	0,4	0,1	2,3	0,9	1,2	0,2	1,2	0,5	0,6	0,1
I	20,0	7,5	10,0	2,0	64,0	24,0	32,0	6,4	10,0	3,8	5,0	1,0	32,0	12,0	16,0	3,2	16,0	6,0	8,0	1,6
L	0,1	0,1	0,1	0,1	0,5	0,2	0,3	0,1	0,1	0,1	0,1	0,1	0,3	0,1	0,2	0,1	0,2	0,1	0,1	0,1
NL	10,0	3,8	5,0	1,0	32,0	12,0	16,0	3,2	5,0	1,9	2,5	0,5	16,0	6,0	8,0	1,6	8,0	3,0	4,0	0,8
GB	32,0	12,0	16,0	3,0	105,0	40,0	63,0	11,0	16,0	6,0	8,0	1,6	53,0	20,0	27,0	5,3	27,0	10,0	14,0	2,7

* effective transfer rate

TABLE 4/8	SECTOR: CHEM, GENST, CIVIL, NUC				ESTIMATE OF TRANSFER TIME 1980															
ITEM / REGION/ COUNTRY	INPUT MINUTES PER DAILY WORKLOAD (1.000 bit/sec.)*				OUTPUT HOURS PER DAILY WORKLOAD (1.000 bit/sec.)*				INPUT MINUTES PER DAILY WORKLOAD (2.000 bit/sec.)*				OUTPUT HOURS PER DAILY WORKLOAD (2.000 bit/sec.)*				OUTPUT HOURS PER DAILY WORKLOAD (4.000 bit/sec.)*			
	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10
B	9,2	3,5	4,6	0,9	30,0	11,0	15,0	3,0	4,6	1,8	2,3	0,5	15,0	5,5	7,5	1,5	7,5	2,8	3,8	0,8
DK	4,6	1,7	2,3	0,5	15,0	5,6	8,0	1,5	2,3	0,9	1,2	0,2	8,0	2,8	4,0	0,8	4,0	1,4	2,0	0,4
F	53,0	20,0	27,0	5,3	172,0	65,0	86,0	17,0	27,0	10,0	14,0	2,7	86,0	33,0	43,0	8,6	43,0	17,0	22,0	4,3
D	60,0	23,0	30,0	6,0	195,0	73,0	98,0	20,0	30,0	12,0	15,0	3,0	98,0	37,0	49,0	9,8	49,0	19,0	25,0	4,9
IRL	2,3	0,9	1,2	0,2	7,5	2,8	4,0	0,8	1,2	0,5	0,6	0,1	4,0	1,4	2,0	0,4	2,0	0,7	1,0	0,2
I	32,0	12,0	16,0	3,2	105,0	39,0	53,0	11,0	16,0	6,0	8,0	1,6	53,0	20,0	27,0	5,3	27,0	10,0	14,0	2,7
L	0,2	0,1	0,1	0,1	0,8	0,3	0,4	0,1	0,1	0,1	0,1	0,1	0,4	0,2	0,2	0,1	0,2	0,1	0,1	0,1
NL	16,0	6,0	8,0	1,6	52,0	20,0	26,0	5,2	8,0	3,0	4,0	0,8	26,0	10,0	13,0	2,6	13,0	5,0	7,0	1,3
GB	53,0	20,0	27,0	5,3	172,0	65,0	86,0	17,0	27,0	10,0	14,0	2,7	86,0	33,0	43,0	8,6	43,0	17,0	22,0	4,3

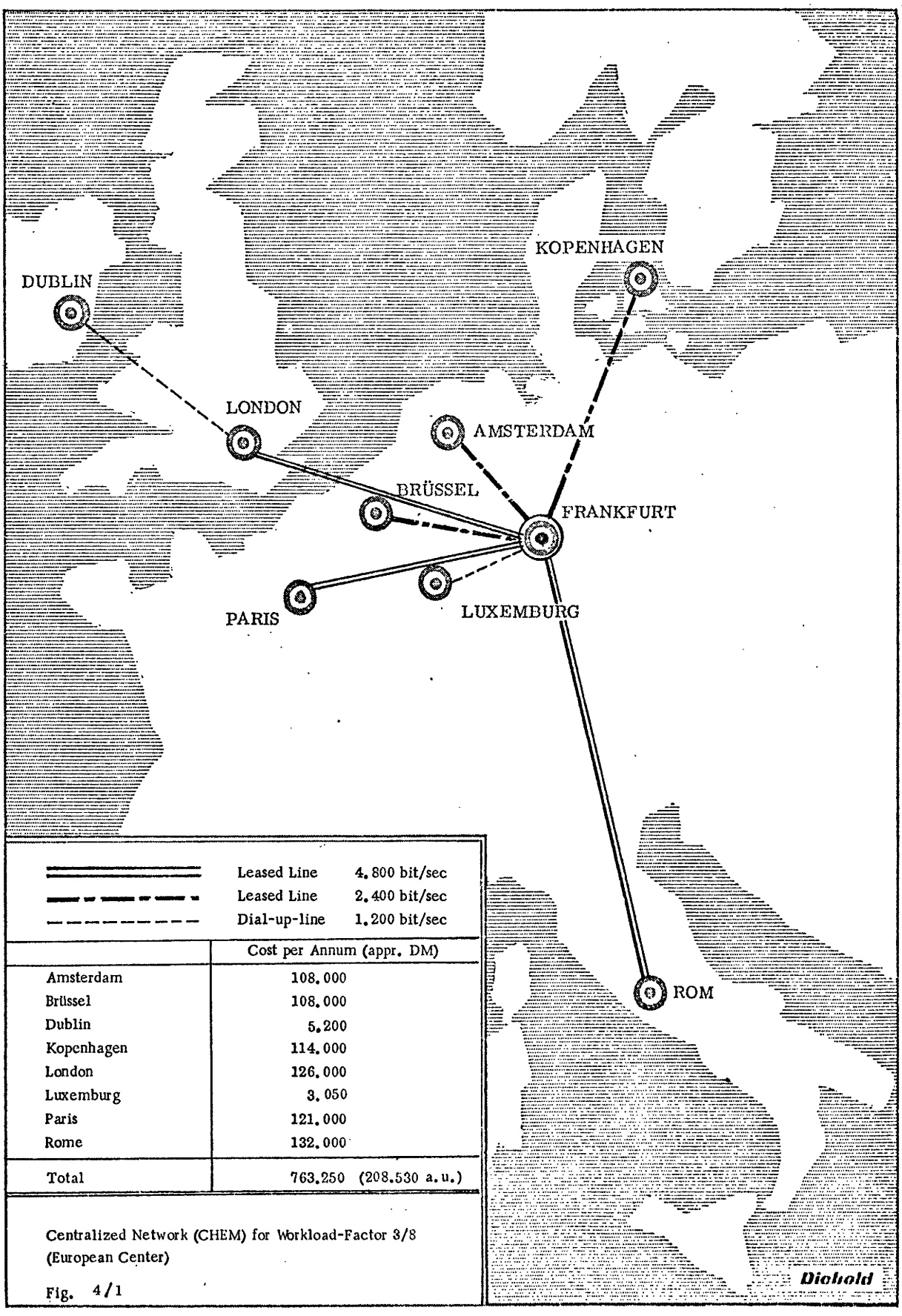
* effective transfer rate

TABLE 4/9	SECTOR: MED, AERO EARSP				ESTIMATE OF TRANSFER TIME 1980															
ITEM / REGION/ COUNTRY	INPUT MINUTES PER DAILY WORKLOAD (1.000 bit/sec.)*				OUTPUT HOURS PER DAILY WORKLOAD (1.000 bit/sec.)*				INPUT MINUTES PER DAILY WORKLOAD (2.000 bit/sec)*				OUTPUT HOURS PER DAILY WORKLOAD (2.000 bit/sec.)*				OUTPUT HOURS PER DAILY WORKLOAD (4.000 bit/sec.)*			
	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10	Orig.	x 3/8	x 1/2	x 1/10
B	10,0	3,8	5,0	1,0	29,0	11,0	15,0	2,9	5,0	1,9	2,5	0,5	15,0	5,5	7,5	1,5	7,5	2,8	3,8	0,8
DK	5,2	2,0	2,6	0,5	14,0	5,3	7,0	1,4	2,6	1,0	1,3	0,3	7,0	2,7	3,5	0,7	3,5	1,4	1,8	0,4
F	60,0	23,0	30,0	6,0	164,0	62,0	82,0	16,0	30,0	12,0	15,0	3,0	82,0	31,0	41,0	8,2	41,0	16,0	21,0	4,1
D	68,0	26,0	34,0	6,8	185,0	69,0	93,0	19,0	34,0	13,0	17,0	3,4	93,0	35,0	47,0	9,3	47,0	18,0	24,0	4,7
IRL	2,6	1,0	1,3	0,3	7,1	2,7	3,6	0,7	1,3	0,5	0,7	0,1	3,6	1,4	1,8	0,4	1,8	0,7	0,9	0,2
I	37,0	14,0	19,0	3,7	100,0	38,0	50,0	10,0	19,0	7,0	8,5	1,9	50,0	19,0	25,0	5,0	25,0	10,0	13,0	2,5
L	0,3	0,1	0,2	0,1	0,7	0,3	0,4	0,1	0,2	0,1	0,1	0,1	0,4	0,2	0,2	0,1	0,2	0,1	0,1	0,1
NL	18,0	6,8	9,0	1,8	50,0	19,0	25,0	5,0	9,0	3,4	4,5	0,9	25,0	9,5	13,0	2,5	13,0	4,8	7,0	1,3
GB	60,0	23,0	30,0	6,0	164,0	62,0	82,0	16,0	30,0	12,0	15,0	3,0	82,0	31,0	41,0	8,2	41,0	16,0	21,0	4,1

* effective transfer rate

APPENDIX B

FIGURES

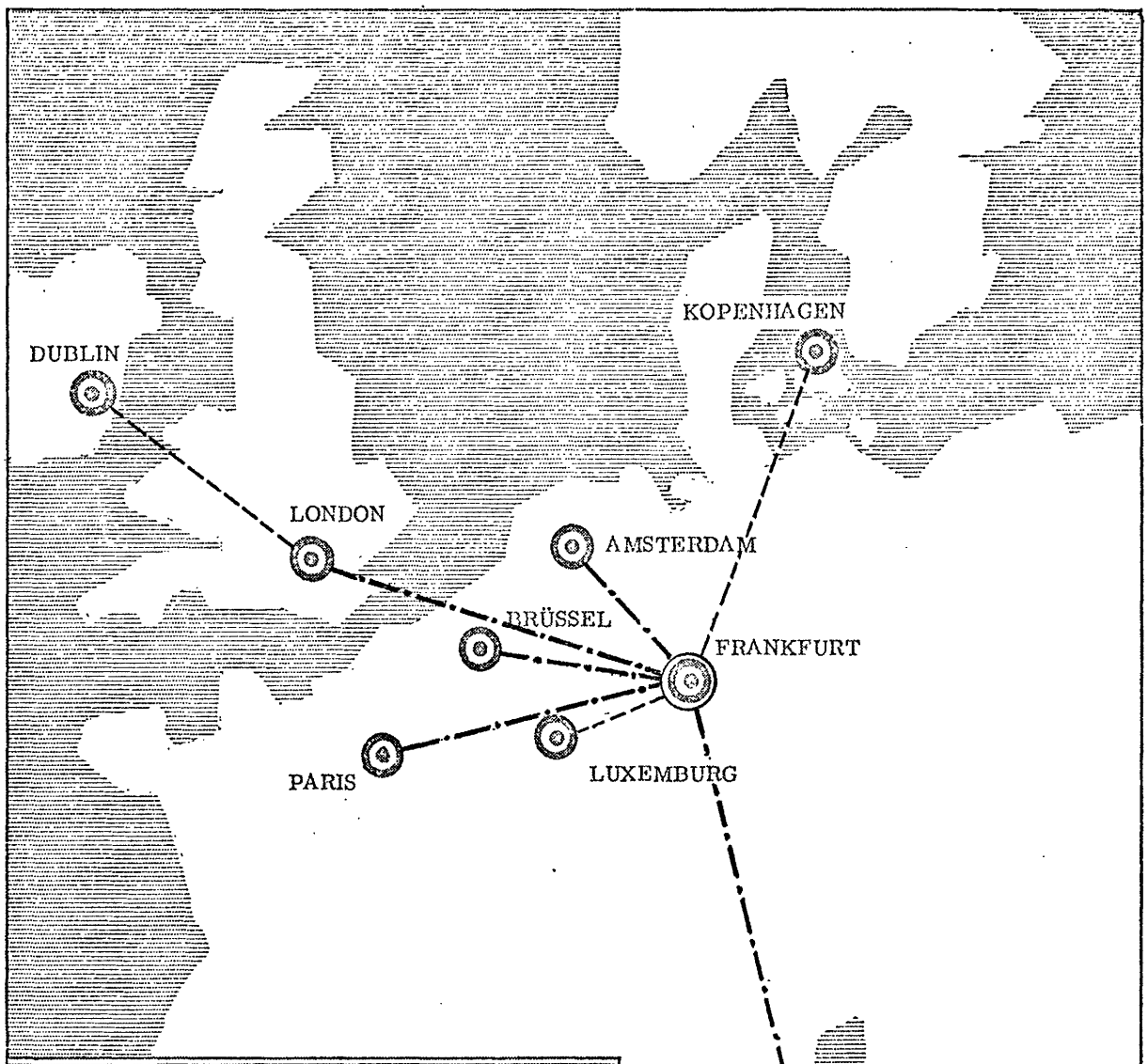


Leased Line	4.800 bit/sec
Leased Line	2.400 bit/sec
Dial-up-line	1.200 bit/sec

	Cost per Annum (appr. DM)
Amsterdam	108.000
Brüssel	108.000
Dublin	5.200
Kopenhagen	114.000
London	126.000
Luxemburg	3.050
Paris	121.000
Rome	132.000
Total	763.250 (208.530 a.u.)

Centralized Network (CHEM) for Workload-Factor 3/8
(European Center)

Fig. 4/1



	Cost per Annum (appr.DM)
Amsterdam	108.000
Brüssel	108.000
Dublin	14.000
Kopenhagen	23.400
London	126.000
Luxemburg	1.500
Paris	121.000
Rom	132.000
Total	633.900 (173.200 a.u.)

Centralized Network (CHEM) for Workload-Factor 1/10
(European Center)

Fig. 4/2

Dicheld

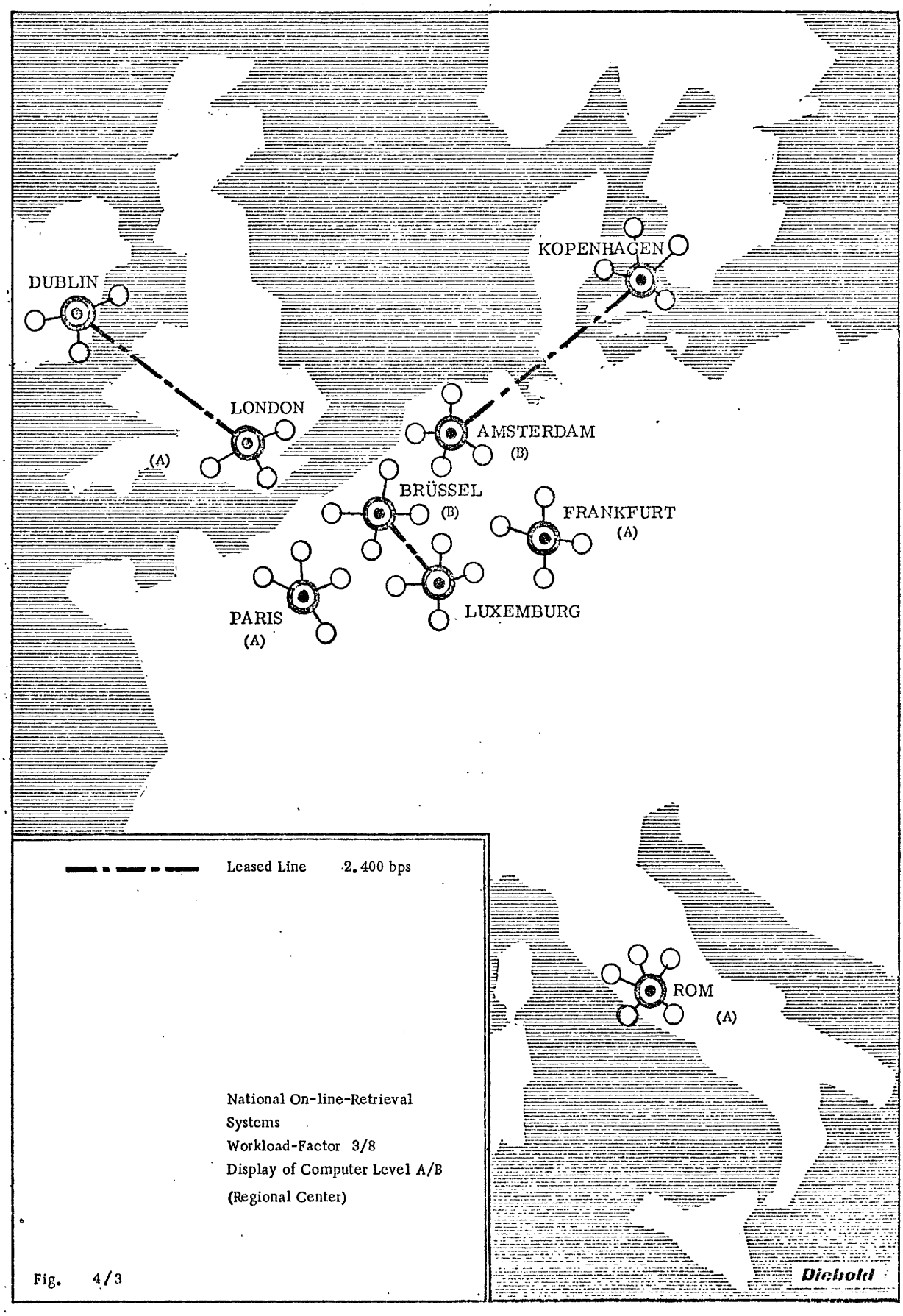

KOPENHAGEN
DUBLIN
LONDON
(A)
AMSTERDAM
(B)
BRÜSSEL
(B)
FRANKFURT
(A)
PARIS
(A)
LUXEMBURG
ROM
(A)
Leased Line 2.400 bps
National On-line-Retrieval
Systems
Workload-Factor 3/8
Display of Computer Level A/B
(Regional Center)
Diebold

Fig. 4/3

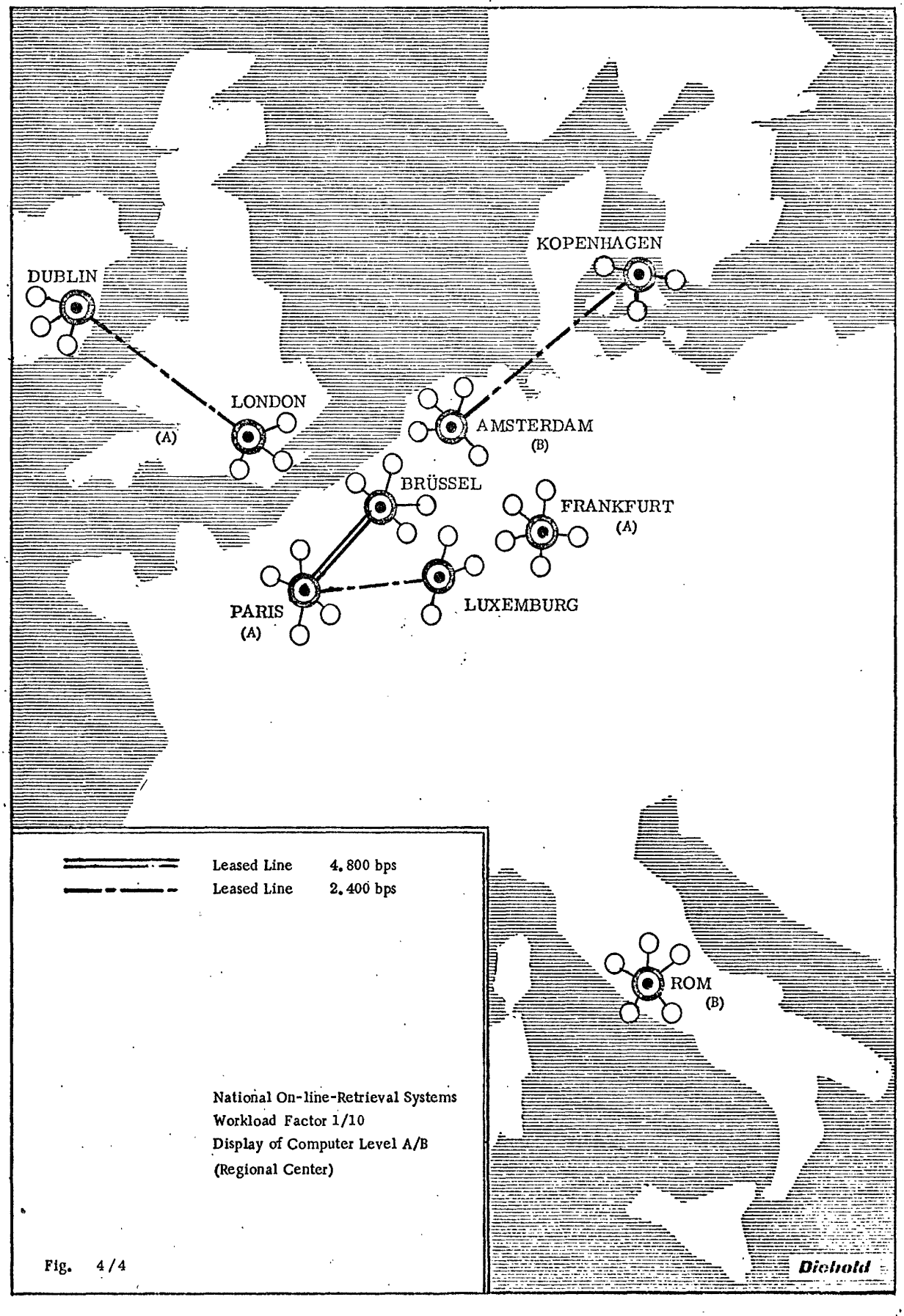
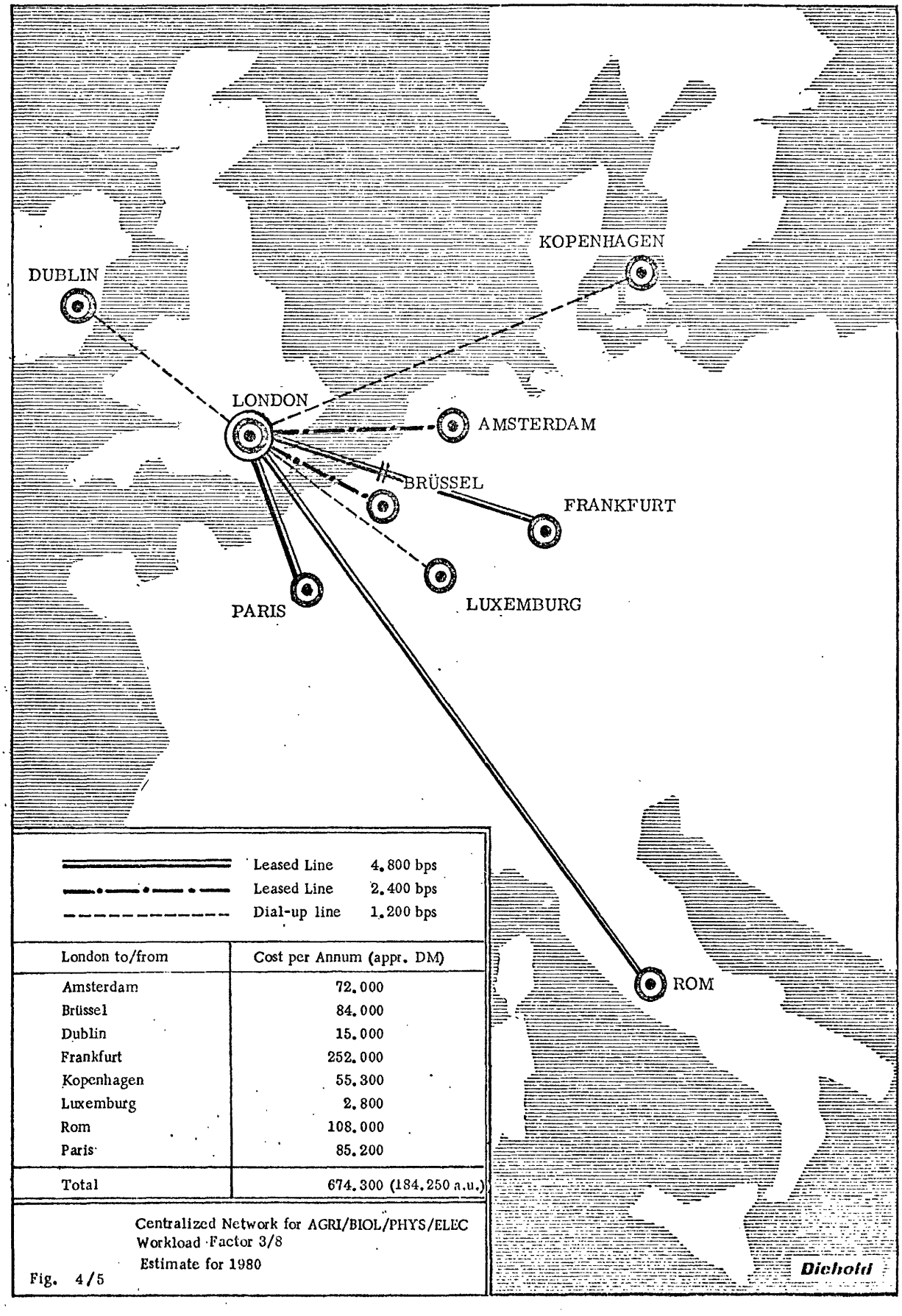

KOPENHAGEN
DUBLIN
LONDON
(A)
AMSTERDAM
(B)
BRÜSSEL
FRANKFURT
(A)
PARIS
(A)
LUXEMBURG
ROM
(B)
Leased Line 4.800 bps
Leased Line 2.400 bps
National On-line-Retrieval Systems
Workload Factor 1/10
Display of Computer Level A/B
(Regional Center)
Diebold

Fig. 4/4

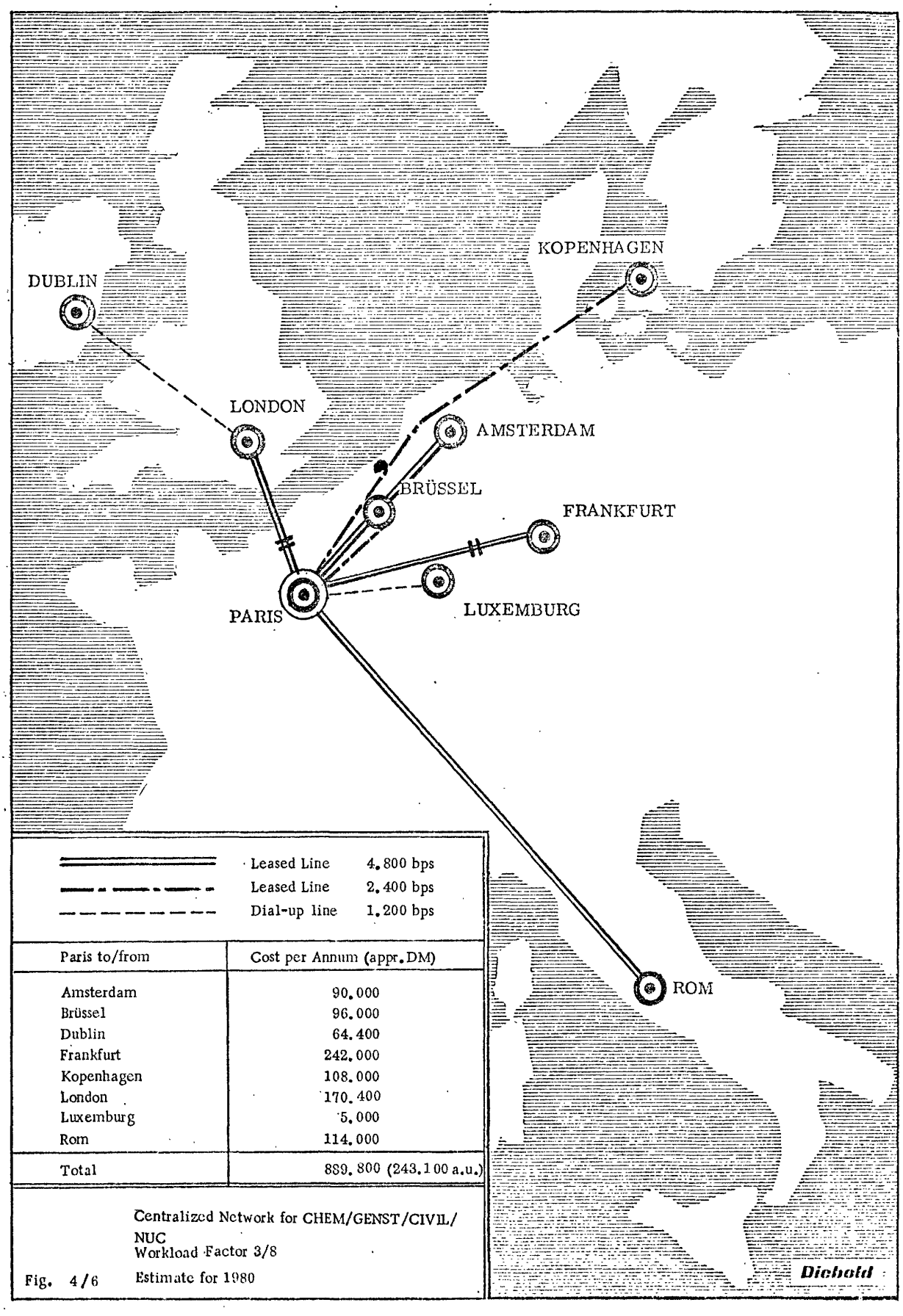


London to/from	Cost per Annum (appr. DM)
Amsterdam	72.000
Brüssel	84.000
Dublin	15.000
Frankfurt	252.000
Kopenhagen	55.300
Luxemburg	2.800
Rom	108.000
Paris	85.200
Total	674.300 (184.250 a.u.)

Centralized Network for AGRI/BIOL/PHYS/ELEC
Workload Factor 3/8
Estimate for 1980

Fig. 4/5

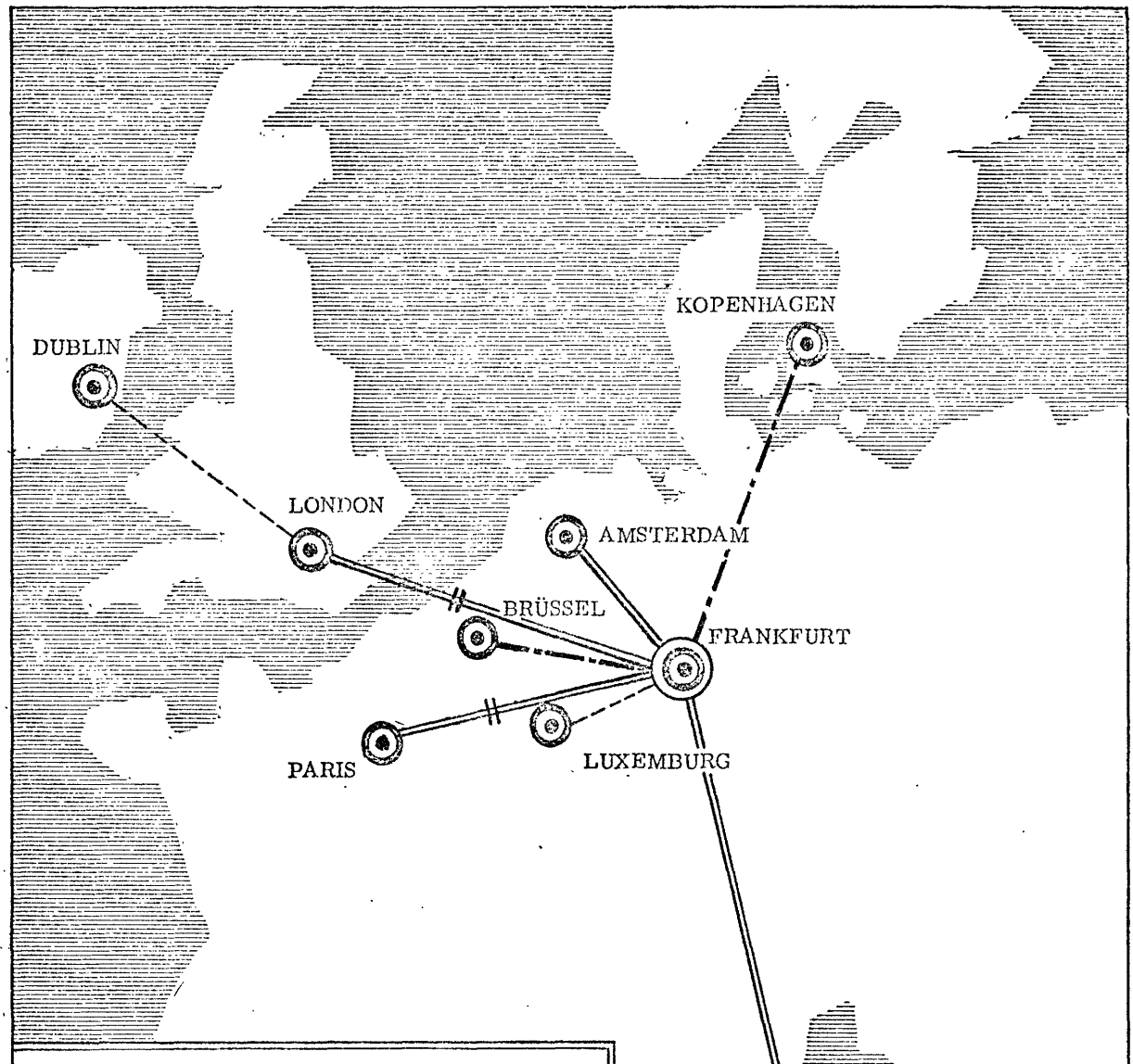
Diebold



Paris to/from	Cost per Annum (appr. DM)
Amsterdam	90.000
Brüssel	96.000
Dublin	64.400
Frankfurt	242.000
Kopenhagen	108.000
London	170.400
Luxemburg	5.000
Rom	114.000
Total	889.800 (243.100 a.u.)

Centralized Network for CHEM/GENST/CIVIL/NUC
Workload Factor 3/8

Fig. 4/6 Estimate for 1980

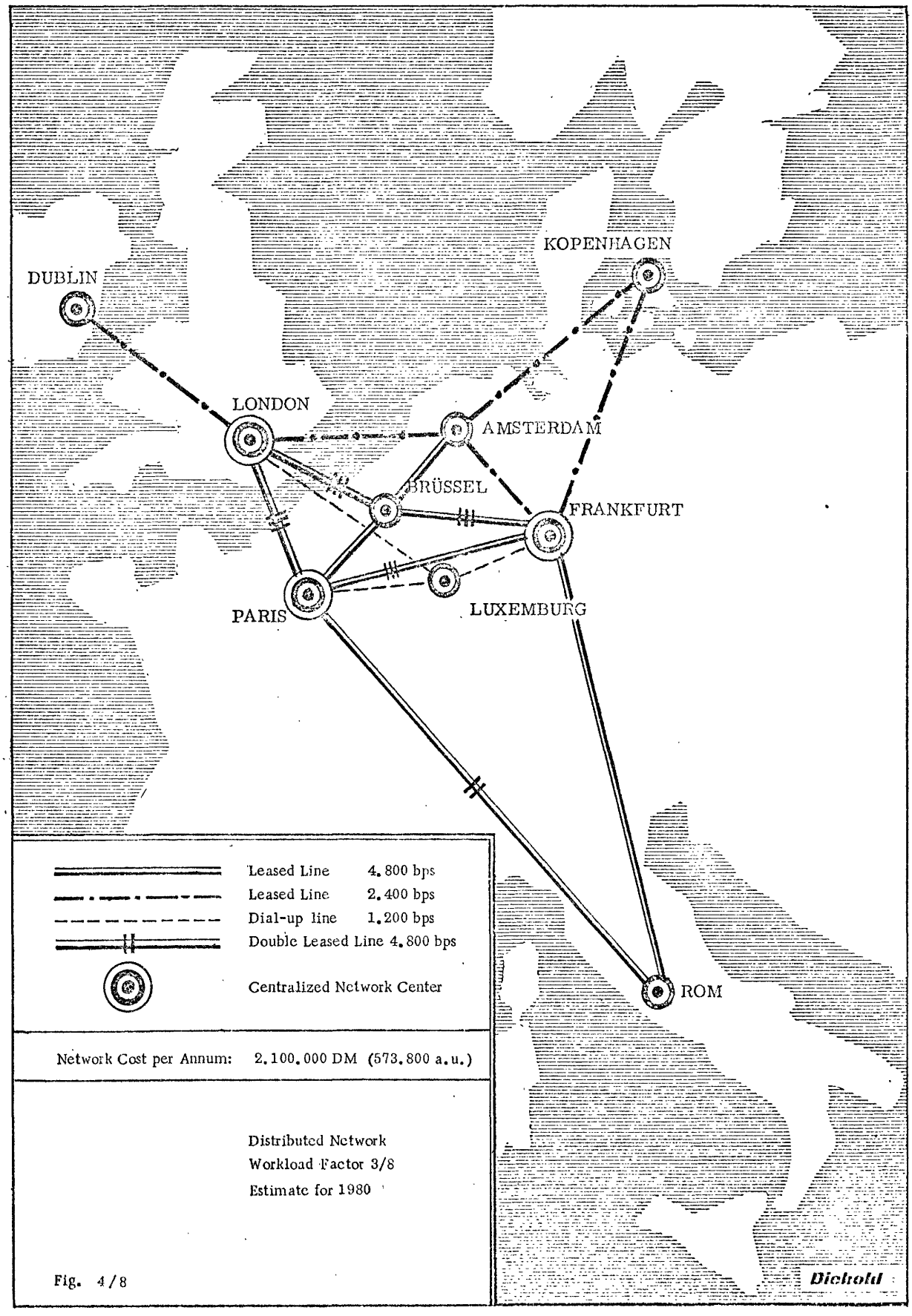


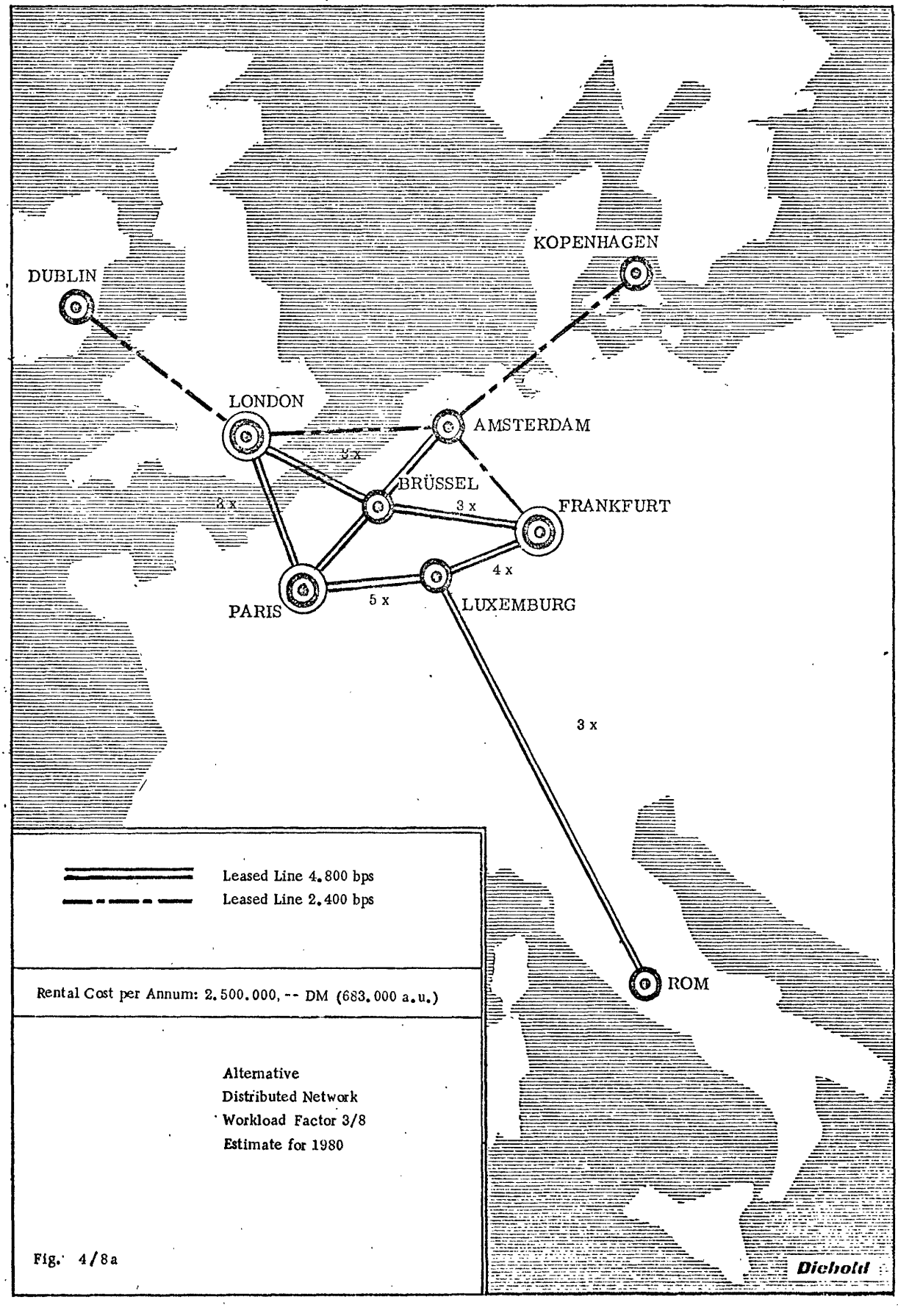
Leased Line	4.800 bps
Leased Line	2.400 bps
Dial-up line	1.200 bps

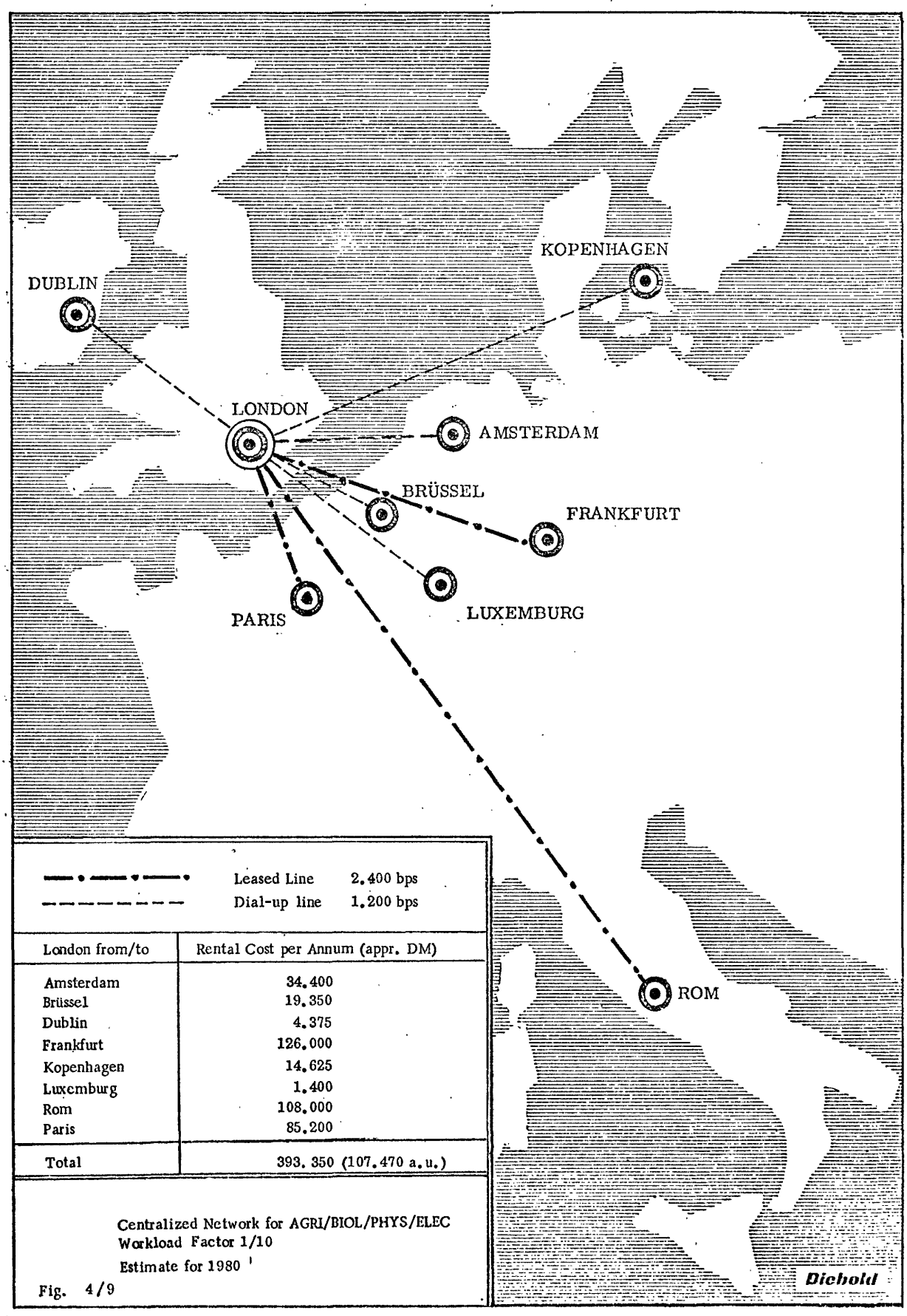
Frankfurt to/from	Cost per Annum (appr. DM)
Amsterdam	108.000
Brüssel	108.000
Dublin	86.400
Kopenhagen	114.000
London	252.000
Luxemburg	4.600
Paris	242.000
Rom	132.000
Total	1.047.000 (286.100 a.u.)

Centralized Network for MED/AERO/EARSP
Workload Factor 3/8
Estimate for 1980

Fig. 4/7


KOPENHAGEN
DUBLIN
LONDON
AMSTERDAM
BRÜSSEL
FRANKFURT
PARIS
LUXEMBURG
ROM
Leased Line 4.800 bps
Leased Line 2.400 bps
Dial-up line 1.200 bps
Double Leased Line 4.800 bps
Centralized Network Center
Network Cost per Annum: 2.100.000 DM (573.800 a.u.)
Distributed Network
Workload Factor 3/8
Estimate for 1980
Fig. 4/8
Diebold

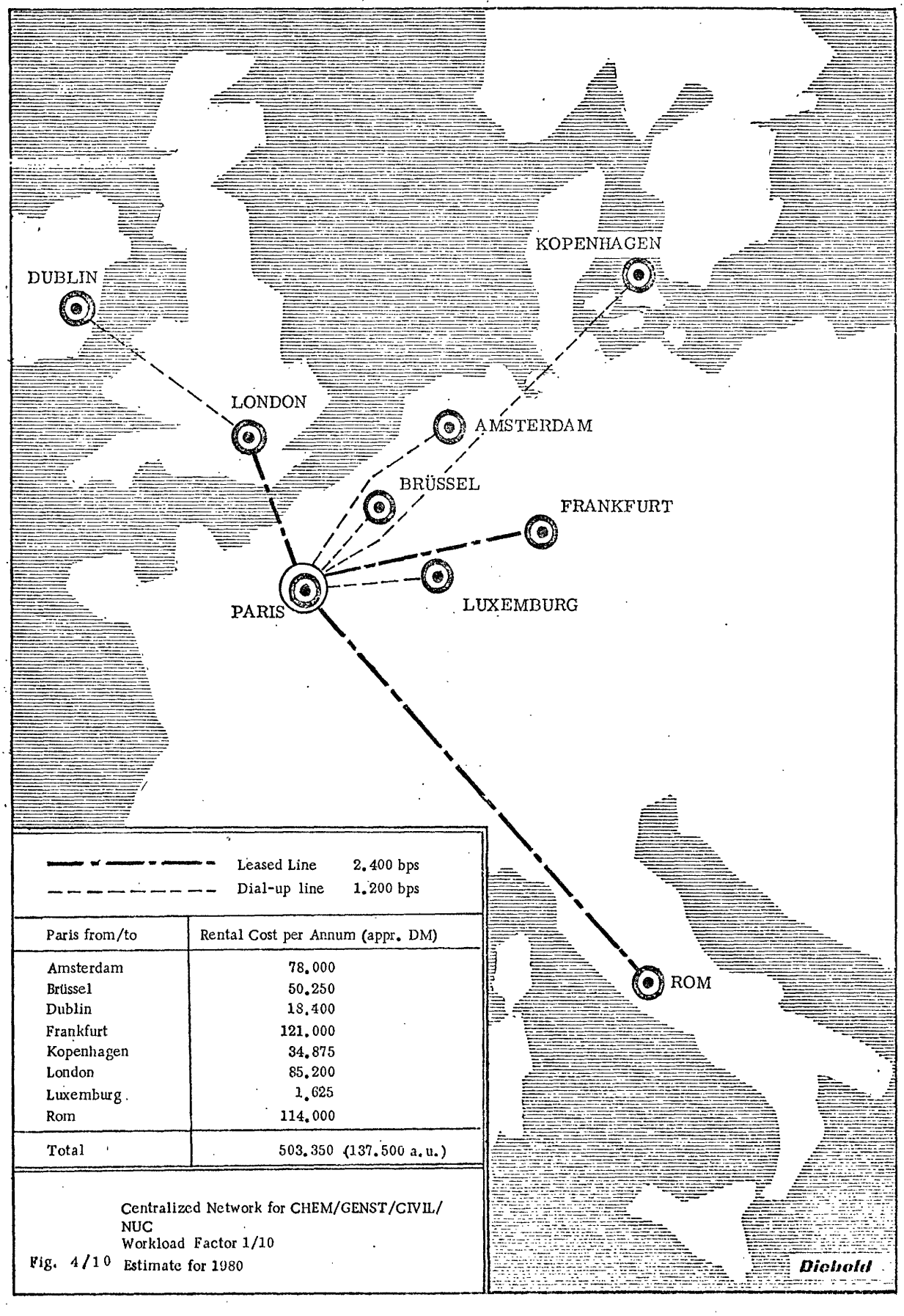

KOPENHAGEN
DUBLIN
LONDON
AMSTERDAM
3 x
BRÜSSEL
3 x
3 x
FRANKFURT
4 x
PARIS
5 x
LUXEMBURG
3 x
ROM
Leased Line 4.800 bps
Leased Line 2.400 bps
Rental Cost per Annum: 2.500.000,-- DM (683.000 a.u.)
Alternative
Distributed Network
Workload Factor 3/8
Estimate for 1980
Fig. 4/8a
Diebold



London from/to	Rental Cost per Annum (appr. DM)
Amsterdam	34.400
Brüssel	19.350
Dublin	4.375
Frankfurt	126.000
Kopenhagen	14.625
Luxemburg	1.400
Rom	108.000
Paris	85.200
Total	393. 350 (107.470 a.u.)

Centralized Network for AGRI/BIOL/PHYS/ELEC
Workload Factor 1/10
Estimate for 1980

Fig. 4/9

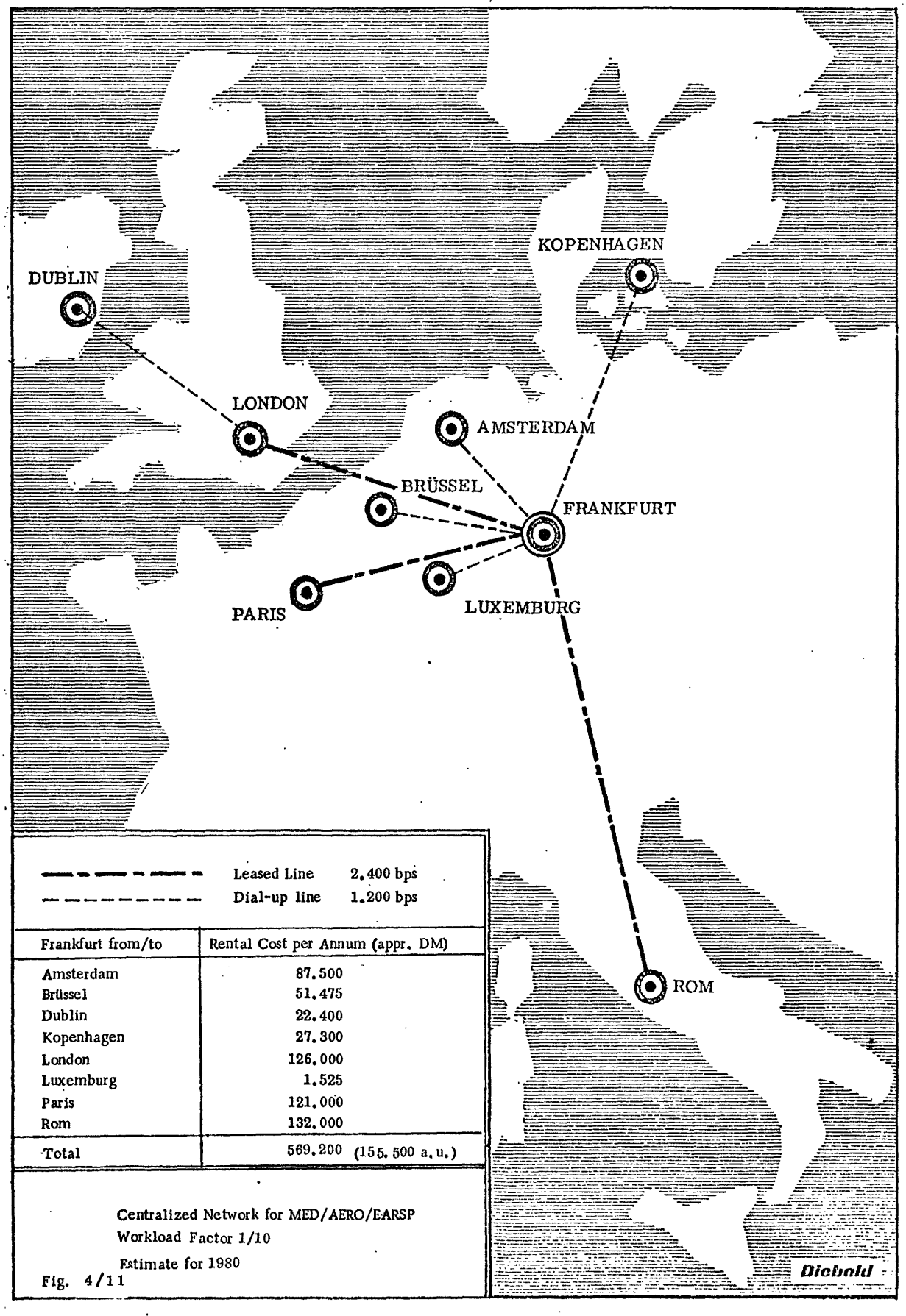


Paris from/to	Rental Cost per Annum (appr. DM)
Amsterdam	78.000
Brüssel	50.250
Dublin	18.400
Frankfurt	121.000
Kopenhagen	34.875
London	85.200
Luxemburg	1.625
Rom	114.000
Total	503.350 (137.500 a.u.)

Centralized Network for CHEM/GENST/CIVIL/NUC
Workload Factor 1/10

Fig. 4/10 Estimate for 1980

Diebold



Frankfurt from/to	Rental Cost per Annum (appr. DM)
Amsterdam	87.500
Brüssel	51.475
Dublin	22.400
Kopenhagen	27.300
London	126.000
Luxemburg	1.525
Paris	121.000
Rom	132.000
Total	569.200 (155.500 a.u.)

Centralized Network for MED/AERO/EARSP
Workload Factor 1/10
Estimate for 1980

Fig. 4/11

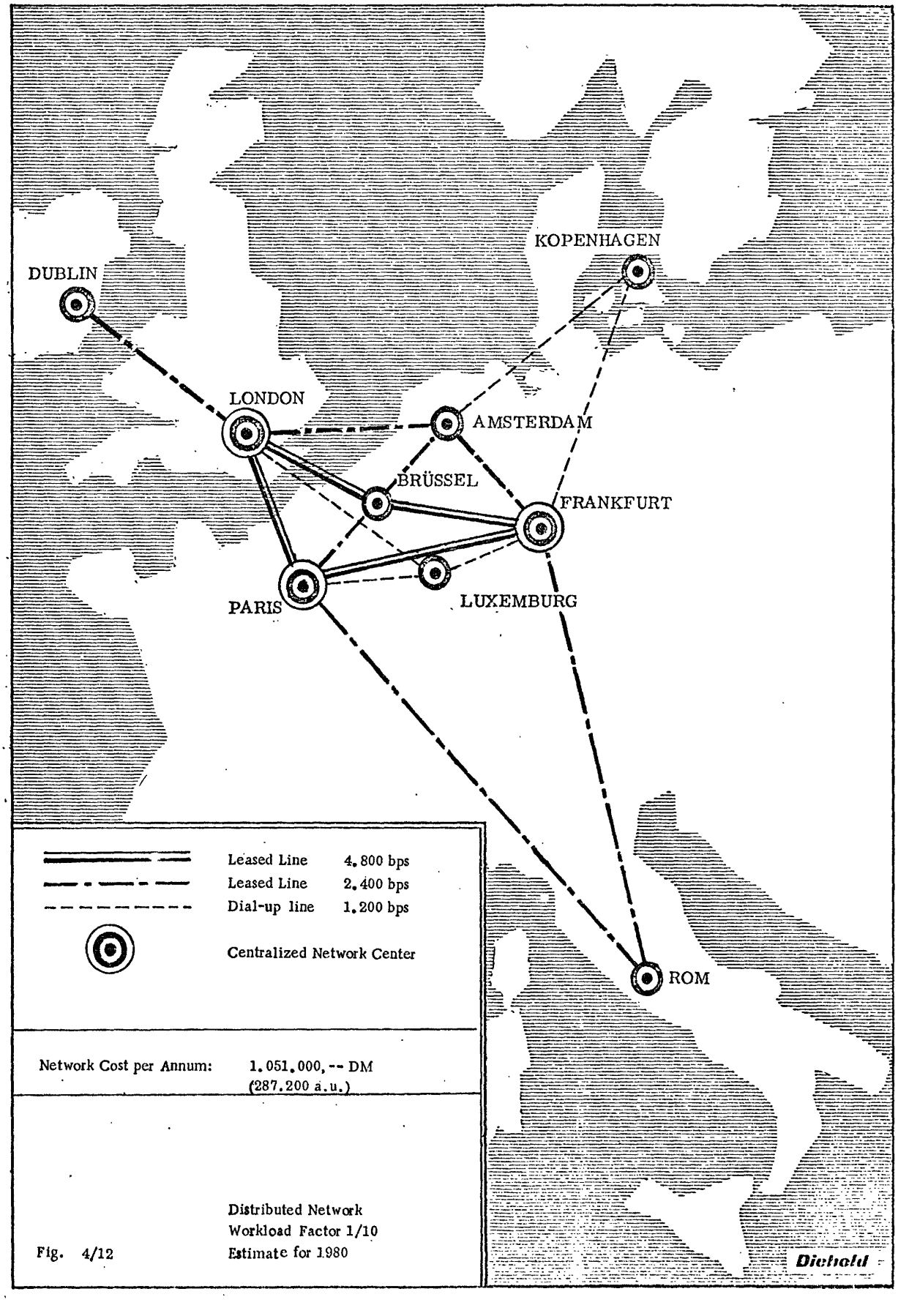

KOPENHAGEN
DUBLIN
LONDON
AMSTERDAM
BRÜSSEL
FRANKFURT
PARIS
LUXEMBURG
ROM
Leased Line 4.800 bps
Leased Line 2.400 bps
Dial-up line 1.200 bps
Centralized Network Center
Network Cost per Annum: 1.051.000,-- DM
(287.200 a.u.)
Distributed Network
Workload Factor 1/10
Estimate for 1980
Diebold

Fig. 4/12

APPENDIX C

ENCLOSURES

C-1

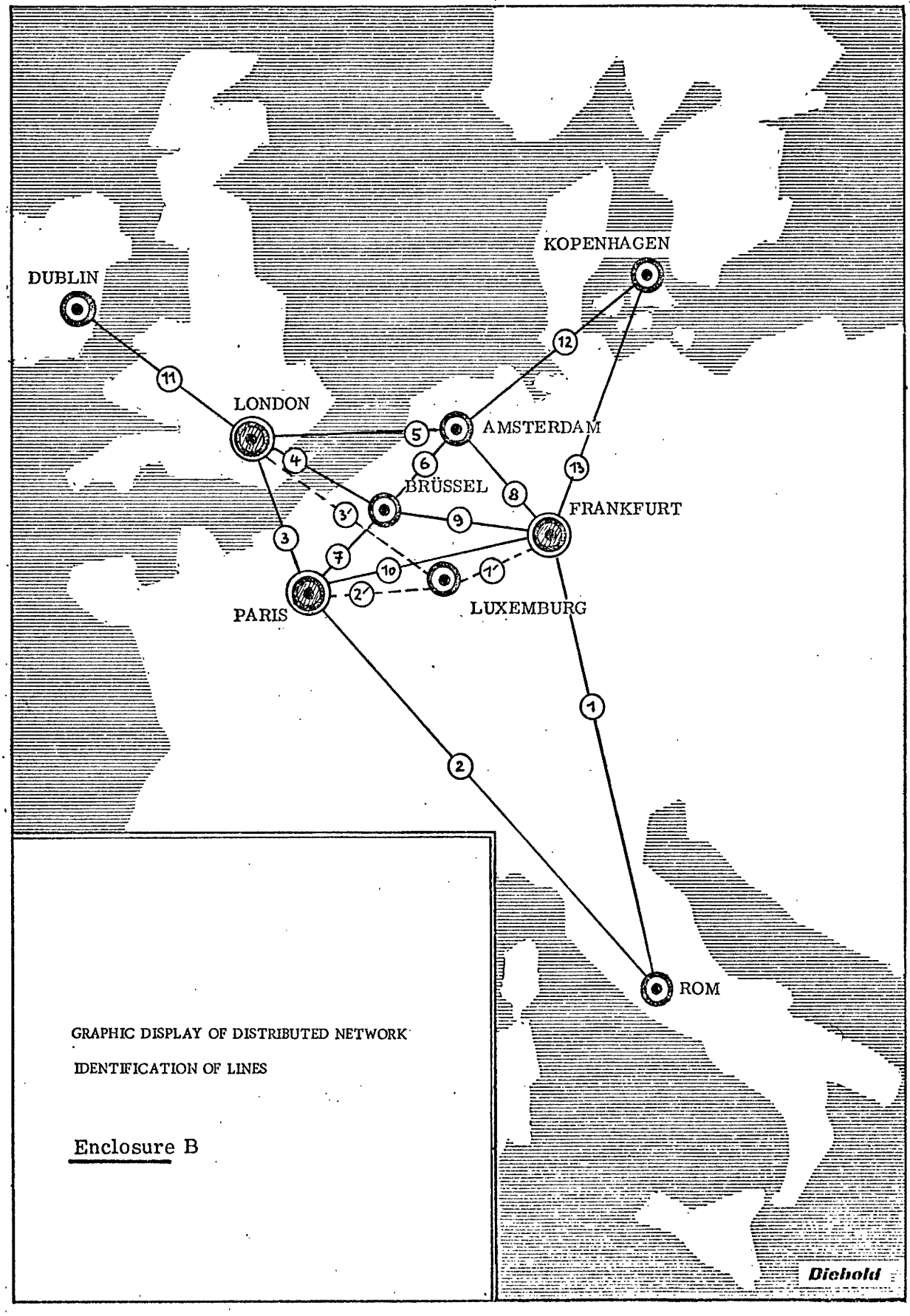
Enclosure A: Table of Line Fees — Anlage A

Rental Cost* per Annum for Leased Lines 2.400 (4.800) bit/sec/4 wire/M 102
Connection Cost* (Day Tariffs) for 250h/year for Dial-up Lines 1.200-2.400 bit/sec
(all costs are average values in DM)

a) LEASED LINE b) DIAL-UP LINE 250h/year	AMSTERDAM	BRÜSSEL	DUBLIN	FRANKFURT	KOPENHAGEN	LONDON	LUXEMBURG	ROM	PARIS
AMSTERDAM	b) \ a)	42.000	84.000	108.000	84.000	72.000	96.000	120.000	90.000
BRÜSSEL	10.750		84.000	108.000	108.000	84.000	60.000	121.200	96.000
DUBLIN	25.000	18.750		144.000	108.000	18.000	97.200	144.000	108.000
FRANKFURT	17.500	17.750	32.000		114.000	126.000	96.000	132.000	121.000
KOPENHAGEN	15.000	16.750	37.500	19.500		108.000	108.000	132.000	108.000
LONDON	10.750	10.750	8.750	20.750	16.250		72.000	108.000	85.200
LUXEMBURG	10.750	8.750	26.250	15.250	18.000	14.000		114.000	96.000
ROM	20.000	21.250	27.500	21.250	21.750	17.000	21.500		114.000
PARIS	15.000	16.750	23.000	21.250	23.250	13.750	16.250	23.750	

* Cost Basis 1975

Anlage B


KOPENHAGEN
DUBLIN
LONDON
AMSTERDAM
BRÜSSEL
FRANKFURT
PARIS
LUXEMBURG
ROM
1
2
3
3'
4
5
6
7
8
9
10
11
12
13
1'
2'
GRAPHIC DISPLAY OF DISTRIBUTED NETWORK
IDENTIFICATION OF LINES
Enclosure B
Diebold

ENCLOSURE C SOURCES

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Guidelines for Data Communications Planning and Implementations	E 123 R
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Information Dissemination	E 133 M

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