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Economic Aspects of International Subscriber Dialling in Switzerland

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1 Introduction

The progressive introduction of International Subscriber Dialling (ISD) in the Swiss telephone network over a period of 25 years (1955–1980) is divided into three main stages.

From 1955–1972, ISD was limited to regional service across the frontiers with neighbouring countries. It used the same technique and system of dialling codes as the national trunk service. Though limited in its expansion by insufficient digit storage capacity of the registers, this makeshift arrangement enabled nearly one tenth of the calls to be subscriber-dialled.

Between 1968 and 1972 ISD, now using a new, universal technique, was made available mostly in major towns and new exchanges, and on completion of stage 2 over two thirds of the calls were subscriber-dialled.

Between 1973 and 1980, ISD will be made available in those exchanges where, for cost considerations, it was put off until replacements, major conversions or alterations to the network structure became necessary. By the end of 1980 a remainder of only 5% of the calls will be handled manually.

On completion of stage 2, with two thirds of the calls already on ISD and fairly accurate data on the total cost of conversion available, it was decided to make a detailed calculation of the economies resulting from automation. The available data were completed by forecasts of traffic, interest, prices, wages and salaries for the period 1973–1980. The method of calculation and the main results are given in the following.

2 Traffic

Figure 1 shows the development of traffic on which the calculations are based. The increases for 1973 and successive years have been forecast as

Annual growth of total traffic = 2% of preceding year's traffic + 15% of 1972 traffic
and are as follows:

Year	1973	1974	1975	1976	1977	1978	1979	1980
%	17	14.8	13.2	11.9	10.8	10	9.2	8.6

This shows that the relative growth rate is expected to be rapidly decreasing and the absolute growth rate to be further increasing.

For the calculations it is further assumed that ISD will influence neither the demand for service nor the structure of traffic or the charging of calls. The resulting errors are not significant and even compensate one another to some degree. On the one hand, ISD is expected to lead to an increase in traffic, not least because it cuts out delays; on the other hand, it will no longer be possible to compile statistics of chargeable minutes because of period pulse metering.

Between 1963 and 1972, calls requiring special handling dropped as follows at the Zurich manual office:

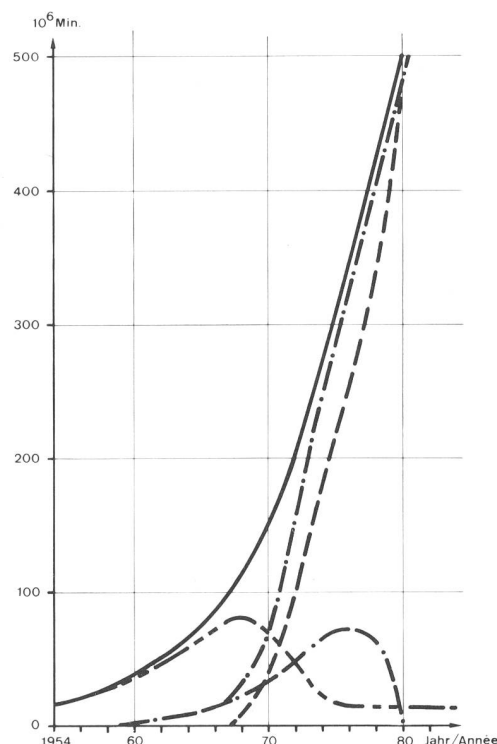


Fig. 1
International outgoing calls in chargeable minutes

--- --	Handvermittelter Verkehr – Manual service
- . - .	Vollautomatischer Grenzverkehr alter Technik – Automatic frontier service using old system
— — —	Selbstwahlverkehr neuer Technik – ISD service using new system
— — —	Totalverkehr – Total
- . - .	Total-Selbstwahlverkehr – ISD total
	Jahr – Year

Year	1963	1964	1965	1966	1967
%	32	30	28	26	19
Year	1968	1969	1970	1971	1972
%	16	12	10	8	7

This, too, may have been the result of increased ISD use.

Finally, it is not examined here whether the time intervals for period pulse metering, which were calculated from the table of rates for manual calls, have in any way affected total revenue, this being a matter of tariff policy.

3 Equipment

The differences in the cost of equipment have been calculated by comparing ISD with a theoretical expansion plan for a purely semi-automatic service.

31 Investments

The change from semi-automatic service to ISD entails expenditure on additional equipment in local and international automatic exchanges, but economies are achieved in the in-

ternational manual offices. Some details are given in the following, and the overall results of the calculations, based on 1972 prices, are shown in Figure 2.

311 Local exchanges

The additional cost depends mainly on the number of exchange lines and the total volume of traffic, the number of international calls being of little significance. The cost is calculated per exchange line in operation. This simplified method of presentation can be used because the growth rates for subscribers and calls are almost identical. The fixed cost arrived at in this way is given as two separate amounts, one showing the average cost of replacing equipment unsuitable for ISD and increasing digit storage capacity for existing lines up to 1972, the other representing the cost of increasing digit storage capacity for new lines from 1973:

	Existing line fr.	New line fr.
Additional digit storage capacity	12.40	8.—
Backward transmission of metering pulses from international pulse generator		
– to subscriber's meter	5.70	—
– to charge indicator on subscriber's premises	1.90	—
	20.—	8.—

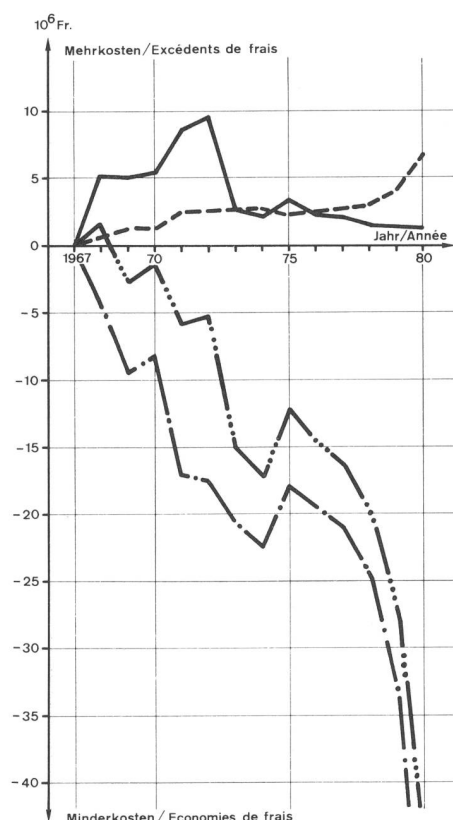


Fig. 2
Difference in annual investments for ISD and semi-automatic plant

— Ortszentralen – Local exchanges
 --- Fernzentralen – Trunk exchanges
 Differenzkosten – Cost difference
 -.-.- Vermittlerplätze – Switching positions
 Jahr – Year

Mehrkosten – Extra cost
 Minderkosten – Economies

Except for the digit storage capacity, all ISD requirements are met by a new line as a result of progressive network modernization.

312 Trunk exchanges

Investments in trunk exchanges have to be made to the extent that ISD is opened in further areas and traffic increases. The expenditure involved is termed here conversion cost and expansion cost.

The conversion cost is due to modifications as required for the temporary storage and transmission of dialled digits and the performance of other transit functions. The cost is dependent on the number of equipments and the type of system used. On average, it amounts to 1 fr. for each exchange line in operation.

In the international exchanges, the ISD conversion cost is relatively small, but there are increasing annual expansion costs. These can be calculated from the yearly traffic increase as well as the price and traffic capacity of the international metering-pulse generator. The 1972 price of the generator, including associated equipment, is 5000 fr.; the average annual traffic amounts to 72,000 chargeable minutes.

313 Operator positions

The economies in equipment for semi-automatic service are considerable. The 1972 price of an operator position, including associated equipment, amounts to 85,000 fr. The progressive reduction in the number of positions, each of which can on average handle 160,000 call minutes a year, is calculated on the basis of ISD traffic growth.

32 Annual costs

The annual cost comprises depreciation, interest, maintenance and buildings.

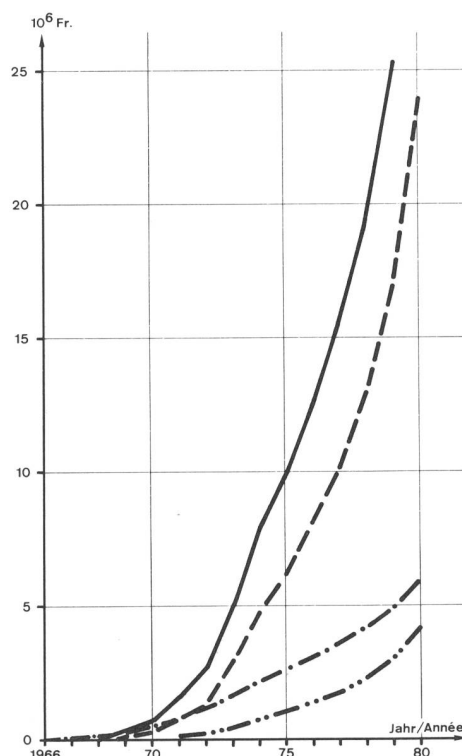


Fig. 3
Savings in annual equipment and building costs

--- Tilgung der Anlagen – Depreciation of equipments
 Unterhalt der Anlagen – Maintenance of equipments
 -.-.- Tilgung und Unterhalt der Gebäude – Depreciation and maintenance of buildings
 — Total der Einsparungen – Total savings
 Jahr – Year

Depreciation and interest are calculated for the investments shown in Figure 2. The useful life is fixed at 15 years, interest and allowance for price increases at 5.5% each.

Maintenance, including staff, is fixed at 1.5% of the replacement costs.

The 1972 cost of buildings is 108 fr. per m²; the floor space requirements are:

40 m² for 1 million francs of equipment

4.5 m² for an operator position

3.5 m² for a switching operator (cloakroom, staff restaurant, recreation, training, etc.)

The savings in depreciation, interest, maintenance and building costs are shown in Figure 3.

4 Personnel

The savings in personnel costs are calculated from the volume of ISD traffic as well as the cost of, and the number of calls handled by, a switching operator.

The various manual switching operations are expressed in work units (wu), 100 of which correspond to one hour's full work at an operator position. The relevant statistics show that the following economies can be achieved for 100 effective ISD calls:

Operation	Number	Weighting	Work units
Booking of an ordinary call	88	2	176
Booking of a call requiring special handling	12	2.5	30
Connecting a semi-automatic outgoing call (ticket)	100	3	300
Notifying the requested subscriber of a call requiring special handling	12	3	36
Subscriber or line engaged, no reply, not through	152	1.5	228
Notification of duration or charges	20	1.5	30
Routing check	50	1	50
			<u>850</u>

On average an operator works 2000 hours a year (holidays and sick-leave excluded). However, allowance must also be made for administrative and supervisory functions, training, night duty, coffee breaks, etc., which brings down to 1143 hours the time she is fully engaged at a switching position.

Given 8.5 wu for an effective call, 1143 hours of 100 wu, and an average call duration of 5 minutes, the operator can handle 67,235 chargeable minutes a year.

The average annual personnel cost for the period under consideration amounts to 24,000 fr. per operator. It is calculated on the basis of an hourly wage of 9 fr., plus 3 fr. covering holidays, illness, insurance, contributions to pension funds, allowances and overheads.

The reductions in the number of operators and annual personnel cost are shown in Figure 4.

5 Result

The overall result of the calculations for the period 1955–1980 is shown in Figure 5. By 1980 the accumulated annual economies amount to 1300 million francs in terms of 1972 cash value, which corresponds to 2000 million francs effective value. The savings achieved up to 1972 are 168 million francs.

Some readers may have been surprised to see that economies are shown with regard not only to personnel, but also to

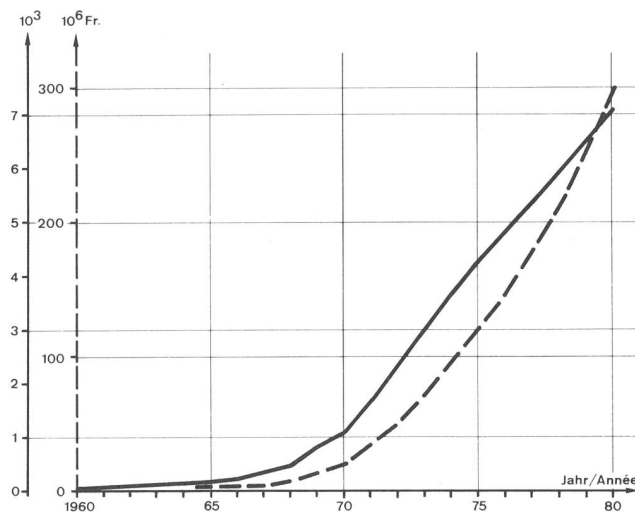


Fig. 4
– Personnel and wage economies

— Arbeitskräfte – Operators
- - - Löhne – Wages
Jahr – Year

plant. However, in view of the relatively small differences in the cost of equipments, one tends to overlook the fact that their absolute annual costs exceed the staff expenditure for semi-automatic service.

The savings in personnel cost are such that a positive result would have been achieved even with considerable extra expenditure on plant. However, in case of purely technical alterations to the system (e.g., multi-frequency signalling or pushbutton dialling) the success of the operation may depend to a great extent on recent installations and additions being able to accommodate the new facility without requiring major modifications or replacements.

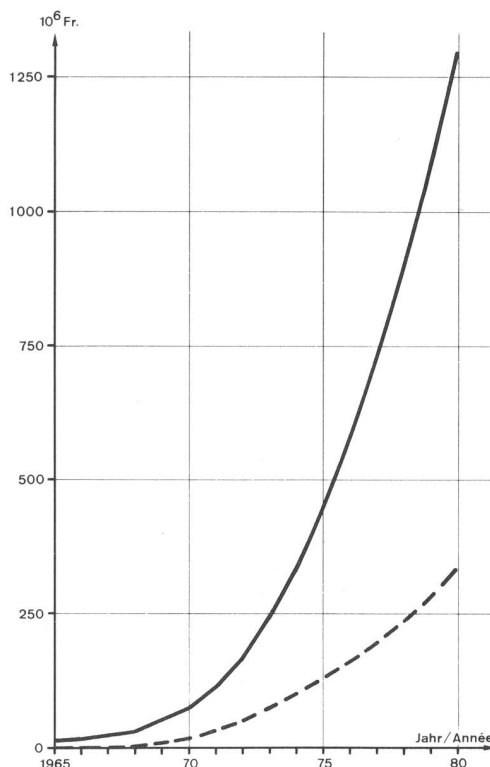


Fig. 5
Overall result

- - - Einsparungen an Jahreskosten (Zeitwert) – Savings in annual cost
— Summe der auf Barwert 1972 umgerechneten und ab 1955 aufaddierten Einsparungen – Accumulated savings, in terms of 1972 cash value, for the period 1955–1980