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# Electronical Data Processing as Auxiliary Means of Modern Agricultural Production

## Summary

1. Development of electronical data processing in the German Federal Republic.
2. The actually most important ranges of application of EDP on the section of the German agriculture :
  - 2.1 In the field research and the supervision of the efficiencies of animals.
  - 2.2 As basis of the accounting of the agricultural enterprise.
  - 2.3 As auxiliary means when producing vouchers for economic advise.
  - 2.4 In the range of economic research.
3. Tendencies of development.

### 1. — DEVELOPMENT OF ELECTRONICAL DATA PROCESSING IN THE GERMAN FEDERAL REPUBLIC

In 1956, the first computer for commercial purposes was installed in the German Federal Republic. Previously only scientific institutes had more or less big automatic calculators which were exclusively used for research purposes. The introduction of the first computer for commercial purposes, however, started a development without parallel in history. Already 10 years later--i.e. 1966--more than 2,000 computers worked for commercial purposes (9. p. 82). Until the end of 1969, the number of the installations used had nearly trebled, it amounted to 5,663 (23, p. 32). Seeing the purchases of big firms, you will not fail when supposing a further doubling for the next two years.

Considering this fast development, you will unwillingly ask yourselves : could also agriculture profit of this development and did it use the chances offered to it in the right way ?

### 2. — THE ACTUALLY MOST IMPORTANT RANGES OF APPLICATION ON THE SECTION OF GERMAN AGRICULTURE

- 2.1. — In the field research and the supervision of the efficiencies of animals.

The first bigger application of a computer on the section of agriculture in the German Federal Republic was executed in 1957 by Rundfeldt (13, p. 254) at the variation statistical evaluation of field trials. At that time, Rundfeldt worked at a breeding institute and had to evaluate field trials with sugar beets and grain in a big range. Up to that time, reckoning up the research lot outputs with the analysis respectively co-analysis of variance meant an enormous labour and further included the danger of mistakes.

The use of the computer IBM 650 brought a decisive success early in the first years. Already in the years 1958 to 1960, 215,000 lots were evaluated. Rundfeldt, however, did not only transfer the labour to the computer, but he consciously projected them on the possibilities of the electronic from the very beginning. So he transferred also part of research planning (e.g. arrangements of lots etc.) to the computer which resulted in saving much labour.

These works have continued to be developed. After the introduction of new computer generations, they were adapted to the actual better possibilities and at the same time spread into the ample practice. It may be stated that, nowadays, nearly all German breeding firms and scientific institutes calculate their field experiments electronically. The works produced on the section of breeding have effected as an example for the evaluation of field experiments of other disciplines, of course, though the development there has made such a progress as it could have made according to the state of the technical development.

Rather an interesting application of the EDP in agriculture is to use it for evaluating the individual values of the milk control societies and of the animal breeding societies. These societies united regionally with the assistance of the state administration evaluate the occurring data with the help of the EDP. In the federal land of Lower Saxony e.g. a special computing center was established at Verden for promoting animal breeding. This computing center is

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equipped with an IBM/360-40 (65K) and has an important staff. In Munich the milk control society of Bavaria has run a still bigger computing center for several years, and also in other districts these tasks were transferred to the EDP in a high degree. If there is no own computing center available, the works are executed by service computing centers.

## 2.2. — The EDP as basis of accounting of the agricultural enterprise.

Promoted by tax legislation in the German Federal Republic relatively many agricultural enterprises keep accounts on their receivings and expenditures in comparison with other European countries (1). As the works connected with the exact closing of a book-keeping are rather complicated, a series of private offices (so-called accounting offices) were established already in the 80ies of the 19th century. These accounting offices do not only help with final accounting, but also undertake to establish the whole accounting by expert clerks. Today, medium-sized accounting offices tend 300-500 enterprises, big ones have 1,000 and often even more clients. Actually, about 33,000 of the total number of 42,000 enterprises are tended by the accounting offices which are nearly equally dispersed throughout the whole area of the Federal Republic. The high wages increase in the Federal Republic at the beginning of the 60ies reduced the profits in these enterprises considerably. But as the profit of the farms diminished at the same time, the accounting offices could not transfer the increase of costs without risking to lose a big part of their clients. So the accounting offices were forced to rationalize.

(1) Only the Netherlands have within Europe a higher share of farms with accounting. Due to Buchardi (1, p. 380) the Netherlands have 125,000, the German Federal Republic 42,000, France 20,000, and Italy 2,750 enterprises with accounting.

Simultaneously, however, another development took place. The most usual accounting system in agriculture was a "book-keeping by double entry" which had developed from the commercial accounting. It separated the profits according to cultures and the inputs according to the kinds of costs (e.g. seeds, fodder, etc.). A final account of cost centers respectively of branches of production propagated and executed in Switzerland by Laur (11) already in the 20ies, was however established very rarely. The agricultural advice was justly dissatisfied with this situation. So it is not astonishing that one of its pioneers in the northern German area began to develop a new bookkeeping system which fully exhausted the possibilities of electronic on the basis of an extension service circle (7). At the same time in its beginnings—even still further back—the "Bavarian land accounting office" in Munich developed an accounting system adapted to the E.D.P. (24). It was followed by the "Agricultural accounting society for Schleswig-Holstein and Hamburg" in Kiel (10) and the "data processing company for agricultural accounting" (4), an union of leading accounting offices in the area for Northern Germany.

So as to be able to compare the results, in 1966, the Federal Ministry for food, Agriculture and Forests made the first step and invited all those interested in accountings for common discussion in Bonn. A committee of coordination was founded in which are represented people of the administration, advice, private accounting offices as well as people of science and research. In was established containing all demands several work sessions first a catalogue to accounting. It was published as the so-called "maximal program" (2) and shall show the range of information to be aimed at by accounting.

The second step was a trial to standardize all systems being developed for the electronic data processing by the initiative of the Federal Ministry, which would have been an enormous progress in the interest of the agricul-

Figure 1 :

Gegenstand der Buchung		U St %	Betriebs-zweig	Beleg	Tag	IN U S	Menge		Soll + (Einnahme, mein Guthaben)		Haben - (Ausgabe, meine Schuld)		Summe			
Bezeichnung	Lieferant/Empfänger						2N Stück	3N Gewicht dz kg	DM	Pf	DM	Pf	F	S1	S2	K
Telefon invois , Sept. paid by post				1	23						52,21		070550			
home consumption				2	24						65,00		070590			
Wages for novice (apprentice)				3	25						105,00		070461			
Petrol, oil and car service in Sept.		11	car	4	25	1					253,80		070401282			
Cash receipt for cauliflower		5	field v	5	25	6	710		280,00				070633630			
Purchase of tulip bulbs		1	cu. fl.	6	26	1	12500				159,00		070743723			
Repair of tractor		11	tr. 3	7	26	1					31,90		070481243			
Receipts for chrysanthemums		5	cu. fl.	8	26	6	382				126,06		070723720			
Sale of cattle to co-operativ society		5	cattle	9	26	6	3 14,-		450,00				045817810			
Transfer of co-operativ to account "Kreissparkasse"				10	28				450,00				061045			
				11												
				12												
				13												
				14												
				15												
				16												

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tural advice and education. The first works resulted in a principal structure of accounts which was recommended to all participants as "code 67" (3). But they could not make up their minds for a general standardization of the accounting systems. Besides merely real reasons, certainly also justified, commercial considerations of the differentiation of offers certainly played a decisive part.

To reach in these circumstances a still further standardization of the agricultural accounting, at the end of 1967, the Federal Ministry decided to have a wide system of computer programmes developed for the agricultural accounting. The Institute for agricultural economic research of the Justus-Liebig-University at Giessen in connection with an office of the company IBM was commissioned with this order. The costs of development of the programmes were paid by the Federal Ministry. After the individual programmes were finished they are now available in the form of a programme package under the denomi-

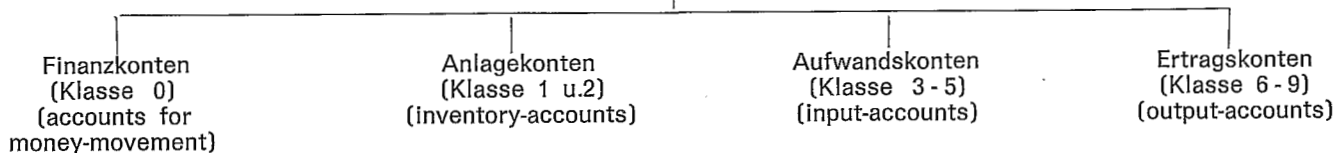
nation "Federal Standard Programme" or abbreviated "Federal Programme" to all who are interested without charge (22). This federal programme is based on the already mentioned maximal programme and was developed in accordance to the latest findings of agricultural accounting. It is not necessary, however, to establish in every farm a voluminous book-keeping fulfilling any wishes of information, but we differentiate several grades. In the lowest grade only a profit and loss account is established, there is a complete cost accounting for the products in the highest.

As the federal programme is an example for using the possibilities offered by the EDP, the foundation of this system will be briefly treated.

Of course, the farmer must put down the individual processes on a formular just as in the manual accounting. Figure 1 shows such a money report with some sample accountings.

The first process is paying a telephone invoice. The farmer or an assistant first writes a text explaining the

Übersicht 1 :  
 (Table 1 .)

 GLIEDERUNG DES EINHEITSCODES  
 (Structure of the Code (Unit - Code))

**Klasse 0**

000-009 Gesperrt (blocked)  
 010-029 Langfristige Finanzk. (long-term accounts)  
 030-039 Mittelfristige Finanzk. (medium accounts)  
 040-079 Kurzfristige Finanzk. (short-term accounts)  
 080-089 Rechnungsabgrenzung (transit accounts)  
 090-099 Eigenkapital (own capital)

**Klasse 1 und 2**

100-109 Grund u. Boden (landed property)  
 110-149 Gebäude u. baul. Anlagen (building and other  
 constructions)  
 150-159 Grundverbesserungen (ameliorations)  
 160-289 Maschinen, Geräte, Vorrichtg. (machinery)  
 290-299 Dauerkulturen, Bestände u. a. (permanent cul-  
 tures)

**Klasse 3 - 5**

300-339 Düngemittel (fertilizers)  
 340-349 Pflanzenschutz (chemicals)  
 350-389 Futtermittel (fodder)  
 390-399 Sonst. Material (other materials)  
 400-409 Treib- u. Schmierstoffe (gasoline and oil)  
 410-419 Heizstoffe (heating materials)  
 420-449 Sonst. Einzelaufwendungen (other inputs)  
 450-479 Lohnaufwand (wages)  
 480-489 Unterhaltung-Instandsetzung  
 (maintenance-repairs)  
 490-499 Abschreibung (amortisation)  
 500-519 Versicherungen (insurances)  
 520-539 Steuern (taxes)  
 540-559 Gebühren, Beiträge (fees, contribution)  
 560-589 Allgemeine Aufwendungen (general inputs)  
 590-599 Haushalt (home consumption)

**Klasse 6 - 9**

600-609 Getreide (grain)  
 610-619 Hülsen- u. Ölfrüchte, Faserpflanzen (leguminous  
 and oil plants, fibre-plants)

620-629 Kartoffeln, Zuckerrüben (potatoes, sugar-beets)  
 630-649 Fedgemüse (field-vegetables)  
 650-659 Sonst. Marktfrüchte (other products)  
 660-669 Feldfutter (field fodder)  
 670-679 Dauergrünland (permanent green land)  
 680-689 Zwischenfrüchte (second crops)  
 690-699 Sonst. Flächen u. Erträge (other areas and  
 crops)  
 700-709 Marktgemüse (vegetables for the market)  
 710-719 Gemüse unter Glas (glass house vegetables)  
 720-729 Zierpflanzen, Schnittblumen (ornamental and  
 cut flowers)  
 730-739 Topfpflanzen (pot plants)  
 740-749 Gemüsesamen u.a. (vegetable seed and others)  
 750-759 Baumobst (tree fruit)  
 760-769 Strauchobst (bush fruit)  
 770-779 Rebland (vineyards)  
 780-789 Erträge der Dauerkulturen u. Rebanlagen (out-  
 put of permanent culture)  
 790-799 Sonstige Kulturen (other cultures)  
 800-809 Pferdehaltung (Einhufer) (horse keeping)  
 810-839 Rindviehhaltung (cattle)  
 840-849 Schaf- u. Ziegenhaltung (sheep and goat)  
 850-859 Schweinehaltung (pigs)  
 860-879 Geflügelhaltung (poultry)  
 880-889 Sonst. Viehhaltung, Vieherzeugnisse  
 (other animals)  
 890-899 Sonst. Erträge Landwirtschaft (other agricul-  
 tural outputs)  
 900-919 Forstwirtschaft (forestry)  
 920-929 Jagd, Fischerei (hunting and fishing)  
 930-939 Landff. u. Gärtner. Nebenbetriebe (secondary  
 agricultural and horticultural holdings)  
 940-949 Geschäfte (shops)  
 950-969 Sonst. Nebenbetriebe (other secondary hol-  
 dings)  
 970-979 Fremden-gewerbe (tourism.)  
 980-989 Gewerbebetriebe (trade holding)  
 990-998 Gesellschafter (partner)  
 999 Durchgangskonto (transfer account)

process and books the amount in the column credit (expenditures). In this case DM 52.21. Then the work for the farmer is finished. The figures under the columns with the headline "coding" are not booked by the farmer, but by a specialist of the book-keeping firm. The first column F (= finance account) then has the figures 070, the denomination for the cash of the enterprise. For coding the individual processes, a big standard code (or unit-code) was created. Table 1 contains this structure and the construction of this code. Because of the big volume (990 codes) it cannot be presented here in detail. It is subdivided into 10 groups (= classes). The class 0 contains the finance accounts, the codes 040-079 the short term finance accounts. The reader will certainly be able to imagine that individual accounts are co-ordinated to the figures from 040 to 079. Thus the figures from 041 to 047 can be chosen for those business partners for which a current account has to be kept, the figures 051 to 059 are provided for bills of exchange, the account 060 for the post-office transfer account, and the figures 061 to 069 for the various banks. Then 070 is the main cash of the holding and 071 to 079 are reserved for other dashes.

In the example of the figure 1 the figure 070 was correctly booked as finance account. The following column is headed S1. S1 means furnitures and fixtures account. Here the figure is booked from the standard code which describes the process as a kind of profit, kind of input or perhaps also as a pure financial process. The example shows 550. This figure belongs, due to table 1, to the input accounts, subheading "fees and contributions". The name of the account in the standard code even is "telephone". As the amount stands in the column "expenditures", the programme books this line under the account "household expenditures" because each individual figure of the codes of the programme is co-ordinated to a fixed collecting account.

In figure 1 the column S1 is followed

by column S2. In the example of the telephone invoice it does not contain any figures. S2 means furnitures and fixtures account 2. A cost center accounting is possible with it. In the actual case of the telephone invoice it was not necessary to fill in the column S2 because the telephone charges cannot be co-ordinated to any section of the enterprise and charge the whole enterprise as common costs.

This is different in the fourth example presented in figure 1. Here a bill was paid amounting to DM 253.80 for petrol, oil and car service at the petrol station. The finance account is again 070 (main cash), as S1 (= 401) petrol was booked and as S2 the figure 282. According to table 1 282 belongs to the group "machinery" of the input accounts and is called "passenger car" (PKW). This coding makes it possible at an evaluation on the furnitures and fixtures account 2 that all expenses for the passenger car are delivered in one sum so that the manager knows at once what he has spent for his passenger car. In larger farms, where there are for instance several tractors, this possibility of the individual accounting for each tractor is of great help for the management. The 7th line of the figure shows how simply an invoice for the repair of tractor 3 (= 243) can be booked.

Just as machines can be accounted individually, each section of production respectively each cost center can be accounted separately. In figure 1, besides the passenger car and the tractor 3 also the production sections field vegetables = 630 and cut flowers = 723 were seized by using the code under S2. The last column in figure 1 is called K (= group of accounts). Here figures are booked only when an accounting process in the profit and loss statement, deviating of the standard, shall be co-ordinated to a special group of accounts. This happens only rather seldom, however.

After periods to be fixed individually the farmer sends his money reports to the book-keeping firm. There they are coded by a specialist and then transferred

Figure 2 :

Example for an adding tape

```

1 N
1 5 0 3 N
7 0 0 0 C
3 6 3 /
9 1 3 0 1 N
3 5 0 0 /
0 7 0 0 6 1 /
1 N
3 5 0 0 0 C
0 6 1 0 7 0 /
1 0 1 4 0 1 N
1 0 0 0 0 0 0 /
0 1 9 /
1 1 1 5 1 N
4 0 0 0 0 C
0 1 9 1 2 /
1 N
6 0 0 0 0 C
5 6 1 0 1 9 /
1 2 1 6 0 1 N
4 0 0 0 0 /
0 5 9 0 1 9 1 2 /
1 N
4 0 0 0 0 C
0 1 9 /
1 3 1 7 0 1 N
1 0 0 0 0 /
0 6 1 5 6 1 0 1 9 9 2 /
1 4 1 8 0 1 N
2 0 0 0 0 /
0 5 9 8 9 2 0 4 1 9 7 /
1 N
    
```

Table 2:

Anlage zu 5.3.2. (Seite 2)

G E W I N N - V E R L U S T - RECHNUNG FÜR DEN BERICHTSZEITRAUM VON 01.07.67. BIS 30.06.68.											SEITE	01
FÜR DEN BETRIEB A-BETRIEB		C-GEMEINDE		D-STRASSE		BUCHSTELLE		E-BUCHSTELLE		BETR-NR. 55 3333 44400		
KSTKONTEN-	KTKONTEN-	EINNAHMEN		AUSGABEN		SONSTIGER		ERTRAG		AUFWAND		
BEZEICHNUNG NR/	BEZEICHNUNG					ERTRAG						
KG*		DM	PF	DM	PF	DM	PF	DM	PF	DM	PF	
*KOSTENSTELLE**K**												
899SK	LANDWIRTSCH	603W	INTERROGGEN		107,52						107,52	
		606	HAFER		349,64						349,64	
		612	ACKERBOHNEN		159,29						159,29	
		620SK	KARTOFFELN		470,16						470,16	
		30*	SAAT-PFLANZGUT		***1086,61						***1086,61	
		324NPK	DUENGER		1095,36						1095,36	
		31*	DUENGMITTEL		***1095,36						***1095,36	
		340SK	PFLANZENSCHU		365,12						365,12	
		341			23,81						23,81	
		32*	PFLANZENSCHUTZ		***388,93						***388,93	
		851	FERKEL		12239,29						12239,29	
		856	ZUCHTSAUEN		2843,70						2843,70	
		857	ZUCHTEBER		971,03						971,03	
		34*	VIHZAUKAUF		**16054,02						**16054,02	
		365E	IWEISSKONZENTR		362,94						362,94	
		371			2291,27		0,13				2291,40	
		372			48505,23		3,53				48501,70	
		380SK	BEIFUTTER		90,09						90,09	
		385M	INERALSTOFF		246,51						246,51	
		35*	FUTTERMITTEL		**51496,04		*****3,40				**51492,64	
		430SK	EINZ-AUFW-VH		6,85						6,85	
		431T	IERARZT		775,04						775,04	
		432	ARZNEIEN		134,14						134,14	
		433	BESAMUNG		22,60						22,60	
		434	HERDBUCH		29,00						29,00	
		36*	SO-EINZ-AUFW-VH		***967,63						***967,63	
		3**E	INZELAUFWAND		***71088,59		*****3,40				**71085,19	
		461			2880,00						2880,00	
		472	VERPFLEGUNG-WIH		6708,36						6708,36	
		530	LOHNSTEUER		150,30						150,30	
		40*	LOHN-GEHALT		***9738,66						***9738,66	
		476	BERUFSGEN-SCHAF		333,40						333,40	
		513	SOZIALVERSICHRG		665,42						665,42	
		41*	SOZIALABGABEN		***998,82						***998,82	

to data carriers. At present, the federal programme offers three possibilities:

1. The direct transfer to a tape — which causes the cheapest processing costs, but requests more expensive acquisition devices.

2. The transfer to paper tapes.

3. The transfer of the data to record tapes which can be read from the computer by optical character readers. In this case higher processing costs are caused, but the price for an adding machine with an optically readable type set is only about 2,000--DM so that, as a rule, the smaller book-keeping firms prefer this way in the beginning. But this way is not generally known yet at present, figure 2 contains a section of such an adding tape. Unfortunately it is not possible to explain the structure of this tape more detailed here. The interested reader, however, will find with Zilahi-Szabo (22) a detailed description of the whole system including all forms of the acquisition.

As possible results the federal programme offers today:

1. A report of money movement in the period passed (you can choose: month, 3 months or 6 months). Table 2 contains an example of such a report.

2. A printing of accounts (at request).

3. A profit and loss accounting as known to every manager from the book-keeping by double entry.

4. A fully automatically produced balance (which besides the money report, of course, requests many additional information. For this purpose besides the money reports other kinds of data are put in).

5. An accounting of the section of production respectively of cost centers which is being developed into a complete cost accounting.

It must be pointed out as a special advantage of the federal programme that it is possible to produce the vouchers for the EEC information net (EEC statistic sheet) in a fully automatic way.

On concluding this kind of problems, of course, the question must be discussed in how far this programme was undertaken by the private accounting firms till now, after, as mentioned before, some parallel developments were to be found. As far as the author is informed, at present three data processing companies respectively data centers work with this programme.

A) The "Neue Landbuch Gesellschaft" in Bonn, a processing company of the German main society of the agricultural accountants and experts,

b) the "Rechenzentrum zur Förderung der Tierzucht in Niedersachsen" at Verden which evaluates for several accounting firms in Lower Saxony,

c) the data center of the Ministry for Food, Agriculture, Viticulture and Forests in Stuttgart, that works for various accounting firms in the federal land Baden-Württemberg.

Of all companies which started their own developments in 1967, none, however, could make up its mind to undertake the federal programme. They all continued to develop their programmes

in the meantime and process on their own systems. Though, considered from the matter, this aspect has to be regretted, it can be stated that the individual systems have much adapted to each other by the works of development at the federal programme and the discussions resulting from it. So nearly all systems work with 3 sections respectively 2 sections of coding (4, 7, 21). At the output there are much similar finals in the sequence : retrograde report, writing of accounts, profit and loss statement, balance and accounting of sections of production or they are being prepared. Also the structuring of accounts differs only a little and only in the individual list pictures individual tendencies were more considered. As an example table 3 shows an accounting of sections of production of the "Landwirtschaftliche Buchführungsverband Schleswig-Holstein, Kiel" which widely corresponds to that of the federal programme. Besides merely agricultural accounting firms there is rather a big number of accounting firms which tend, besides farms and nursery gardens, also firms of

TABLE 3 :

BETRIEBSZWEIG : ZUCKERRÜBENBAU Cost centre : sugar-beets)	W.J. 67/68		BETRIEB : 200/75375	
	MENGE IN DZ	PREIS/ STCK	DM GESAMT	DM/H ABF
1 PRODUKTVERKAUF (sale of products).	853,73	7,70	6 576,39	3 288
2 EIGENES SAATGUT (own seeds).				
3 HAUSH. DEP. ALTENTEIL (household).				
4 VERFÜTTERT (as fodder).				
5 SONST. ABGANG (other sales).				
6 SONST. ZUGANG (other receipts).			1 037,28	
7 BESTANDSVERÄNDERUNG (change of cash-balance).				
8 MARKTFÄHIGE LEISTUNG (MFL) (marketable output).	853,73		7 613,67	3 807
9 SAATGUT INSGES (total seeds).	12		221,25	89
10 STICKSTOFFDÜNGER (nitrogenous fertilizer).			836,11	335
11 SONST. HANDELSDÜNGER (other fertilizers).			337,62	135
12 PFLANZENSCHUTZ (protection of plants).				
13 UNKOSTEN FELDWIRTSCHAFT (expenses field crops).				
14 FRUCHTSPEZIFISCHE KOSTEN (specific fruit expenses).			1 394,98	559
15 FRUCHTSPEZ. VERGLEICHSWERT (specific fruit comparison value).			6 218,70	3 248
16 ANBAUFLÄCHE HA (area of cultivation)	2,00			
17 " % DER LN.	4,69			
18 " % DER AF.	9,41			
19 ERNTE (crop) DZ/HA.	426,86			



trade and commerce. Many of these firms decided in the last two years on bookkeeping programmes developed particularly for trade enterprises, such as the programme of the DATEV-Norimberg (5), a society of professional auditors. This must be regretted, for with these programmes for clients from commerce and trade it is not possible to excute economically important summaries, such as the accounting of sections of production. One of these accounting offices already retreated from such an union and hired a computer of its own, i.e. one of the GE55 series.

### 2.3. — The EDP as auxiliary means when producing vouchers for economic advia.

Establishing an economically oriented accounting is certainly already an important auxiliary means for economic advice. But in addition two other developments are to be considered.

The comparison of enterprises on the basis of code numbers is an old auxiliary means introduced on a large scale for German advice. The accounting results are transformed into code numbers and made accessible in the form of horizontal or vertical statistics respectively published. Since much counting is necessary for this purpose, it was already tried early to transfer these works to the EDP. Already in 1957, the statistic for horticulture was produced by the IBM 650 (15, p. 19) and since 1964 this statistic is written directly with the computer on offset matrices. The statistics of other agricultural sections had a similar development. Deselaers e.g. reports on it already in 1964 (6).

During these works it was asked whether it would possible to transfer -- beyond making up tables of figures -- part of advice in the form of written letters to the computer. The author dealt with these problems in a research (15) and showed with the help of a system for horticultural enterprises that this is possible within certain limits.

The tables 4 and 5 show with the

example of a horticultural enterprise the first and last pages of such an advising letter. The first page (table 4) contains the summary of its results for the last 4 years for the enterprise N° 11 in district 6. Additionally, the average values of all enterprises in this group were printed in the column "average". Here the values of the 30th line have to be regarded. The size of the heatable glass house area of the enterprise to be advised amounted to 2 060 m<sup>2</sup>. It did not change in the last four years. The average heatable glass area of all enterprises which have to be classified into this group was, however, 2 530 m<sup>2</sup>. Behind this figure follows a column marked as E-BETR at the head of the table. Here average values of the most successful enterprises were inserted (1). On an average, these enterprises had a glass house area of 3 194 m<sup>2</sup>. Even if the economic groups are formed most carefully, the success of the enterprise to be advised cannot be measured directly at the average values. Therefore also the figures of two existent enterprises were put down in the columns VERGL 1 and VERGL 2. These enterprises were selected independently from a very big enterprise matrice by the computer with the help of ample operations of comparison. They represent the enterprises best suited for a comparison. In the example of table 4 the glass areas of the compared enterprises are 1 542 m<sup>2</sup> and 2 325 m<sup>2</sup>.

What information such comparison figures can give becomes evident in line 24. It contains the net results of the enterprises. The tested enterprise shows a loss of 14,791 DM (negative profit in 1965), but on an average a profit of 3,852 DM could be reached. The successful enterprises even had a profit of DM 28,591. But certainly more important than these values is the fact that the smaller first compared enterprise could make a profit of DM

(1) As successful enterprises are considered those which in a classification of the enterprises according to falling output/AK range in the first third of the group.

TABLE 4

Beratungsbrief 1965

Betrieb NR = 11

Gebiet 6

Betriebstyp = 221

average

Buchstelle NR = 38

Seite 1

	1962	1963	1964	1965	Mittel	E-Betr.	Vergl. 1	Vergl. 2
1. Jahr .....	620	630	640	650	777	888	651	651
<b>ERTRAG</b>								
2. Erträge aus eigenpr. (+ - Vorräte) .....	94274	92768	106093	101438	97197	140853	41676	89847
3. + Unbare Leistungen des Betriebes .....	1600	2400	2400	2700	1392	1149	650	4200
4. = Betriebsertrag .....	95874	95168	108493	104138	98588	142003	42326	94047
<b>AUFWAND</b>								
5. Fremdlohn .....	10202	10245	12815	11841	8344	10713	2677	1060
6. + Lohnanspruch der Familie .....	17244	17388	21351	13012	14543	12776	10855	18769
7. = Lohnaufwand .....	27446	27633	34166	24853	22887	23489	13532	19829
8. Ertragssteigernder Aufwand .....	56796	52495	39063	56756	38803	50185	8557	30152
9. + Helfender Aufwand .....	5359	13175	13460	14293	8980	11232	2796	2282
10. + Barer Unterhaltungsaufwand .....	5471	5480	5346	6752	4787	5014	1427	1668
11. + Betriebswirtschaftl. Abschreibung .....	7597	6924	6700	8553	11841	13993	7952	20793
12. + Abzugsfähige Steuern + Lasten .....	1574	1815	2341	2396	1942	1975	320	1347
13. = Sachaufw. des betr. + Steuer .....	76797	79889	66910	88750	66353	82400	20152	56242
<b>ERFOLGSRECHNUNG</b>								
14. Betriebsertrag .....	95874	95168	108493	104138	98588	142003	42326	94047
15. - Sachaufw. des betr. + Steuer .....	76797	79889	66919	88750	66353	82400	20152	56242
16. = Betriebseinkommen .....	19077	15279	41583	15388	32235	59603	22174	37805
17. - Fremdlohn .....	10202	10245	12815	11841	8344	10713	2677	1060
18. + Roheinkommen .....	8875	5034	28768	3547	23891	48890	19497	36745
19. - Lohnanspruch der Familie .....	17244	17388	21351	13012	14543	12776	10855	18769
10. + Reinertrag des Betriebes .....	-8369	-12354	7417	-9465	9348	36114	8642	17976
21. - Schuldzinsen und Pachten .....	1286	1660	2992	7315	6268	8880	595	1724
22. = Reingewinn des Betriebes .....	-9655	-14014	4425	-16780	3079	27233	8047	16252
23. + Handelsüberschuss (+sonst. Einn.) .....	1027	4601	1018	2061	1163	2170	-	680
24. = Reingewinn des Unternehmens .....	-8628	-9413	5443	-14719	3852	28591	8047	16932
25. Roheinkommen .....	8875	5034	28768	3547	23891	48890	19497	36745
26. - Schuldzinsen und Pachten .....	1286	1660	2992	7315	6268	8880	595	1724
27. = Familieneinkommen .....	8616	7975	26794	-1707	18395	41367	18902	35701
<b>BETRIEBSFLÄCHEN</b>								
28. Gärtnerisch genutztes Freiland QM .....	1740	1740	1740	1740	851	736	-	-
29. + Nicht heizbare Glasfläche .....	-	-	-	-	133	4	-	-
30. + Heizbare Glasfläche in QM .....	2060	2060	2060	2060	2530	3194	1542	2325
31. = GG (Grundfläche der Gart Gew) .....	3800	3800	3800	3800	3514	3933	1542	2325
32. + Freiland mit landw. Kulturen QM .....	9000	9000	9000	9000	4440	3171	-	47172
33. + Sonstige Flächen (hof, geb. USW) .....	-	-	-	-	3294	2774	-	-
34. = Betriebsfläche QM .....	12800	12800	12800	12800	11249	9878	1542	49497
<b>ARBEITSKRÄFTE</b>								
35. Familien ak (ohne Arbeitsvertr) .....	2.60	2.60	2.60	1.20	1.44	1.18	1.00	2.00
36. Gesamt ak 1 AK = 270 arbeitstage .....	3.79	4.16	4.16	2.89	2.84	2.86	1.50	3.00
37. Davon ständige AK .....	3.60	3.60	3.60	2.70	2.34	2.21	1.50	3.00

Sie beliefern eine Versteigerungszentrale.  
 Spezialkulturen in ihrem Betriebe sind.  
 Nelken.  
 Rosen und Chrysanthemen.  
 Ihrem Produktionsbetrieb ist kein nebenbetr. Angegliedert.

8,047 and the second, which is a little larger, DM 16,932! It was evident that there were mistakes in the management of the tested enterprise. The advising letter then contains on the pages 2 and 3, not reproduced here, ratio figures, such as output of the holding for worker or expenditure for wages in % of the input.

Without any doubt page 4 (figure 7) is most important. Here important hints for advice are written down fully automatically by the computer. These texts are controlled on schemes established by expert advisers. As they are not part of the machine programme, they can easily be changed and adapted to new developments. (A short description in English language is to be found with Schenk (16)).

A further important application of the EDP for advising is the establishment of optimal plans with the linear programming. Already in the middle of the 60th LPs were counted in a greater extent by the advising service. The land Baden-Wuerttemberg e.g. founded at Donaueschingen an "Institute for adapting agriculture", which does not only train systematically the advisers in the application of linear programming at the advice, but also executes an important number of optimizations in the data center of the ministry for agriculture in Stuttgart every week.

#### 2.4. — The application of the EDP in the range of economic research.

After the first computers had been installed at the German universities, nearly all institutes started works aiming at adapting the linear programming to particulars of the region or the enterprise. On this occasion many principal questions were discussed, as for instance in an essay by Zapf (18) in 1965. Just lately especially the works at time influenced models have been propelled, for which publications by Reibe (12) and Steiger (17) shall be mentioned. For several years, they intensely worked at

methods on the base of random techniques.

It is not necessary to point out especially that nowadays the computer is used for the application of analysis of factors or regression.

### 3. — TENDENCIES OF DEVELOPMENT

In the frame of this contribution some applications of EDP were selected and discussed as examples. Some works exposed more than others without intending to value their importance on the whole. Many others which may be of similar importance were not even mentioned. The reason is that the author did not aim at completeness, but wanted to show above all how far the electronic data processing touches the agricultural section and has become an indispensable auxiliary means.

Such a subject should not be concluded without thinking of the future. How will it go on?

First of all, the processes developed until now will be polished and refined in the next years and will be spread widely. The estimation is that e.g. already at the end of the year 1971 nearly 90 % of the accountings in the German Federal Republic which are tended by accounting firms will be done electronically. Besides, problems of secondary importance will be cared about intensely. In 1968, an office was opened at Bremen which does not only write the invoices for cemetery gardeners, but also plans where labourers have to work (8). Similar offices for calculating the composition of mixed fodder are well probable for example. Quite certainly many accounting firms will enlarge the service beyond accounting and e.g. undertake the settlement of wages with payment on account for their clients.

The next important step will be to save a lot of work at the acquisition of data by exchanging data. There will be trials to co-ordinate the code numbers of the agricultural good centers and agricultural banks with those of the accounting programmes for being able to trans-

fer directly the processes available on electronic storage media. A consequent restriction of clients and suppliers could restrict labour input for the book keeping on a minimum in the practice when using this system.

Beside a strong advance of the EDP in all sections of accounting including the supervision of the efficiency of animal production, the computer will become more and more important in the coming years for establishing estimates of labour and solving problems of sequence. In the section of agricultural research the computer will soon be a self evident and irretrievable mean of auxiliary.

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## TABLE 5

BERATUNGSBRIEF 1965    BETRIEB NR = 11    GEBIET 6    BETRIEBSTYP = 221    BUCHSTELLE NR = 38    SEITE 4

Arbeitskreis betriebswirtschaftliche Beratung im Gartenbau Elektronenrechner CDC 1604/A

1. Vollautomatische Betriebsberatung durch den programmiert von dipl. Gärtner E.-W. Schenk Hann.

## SEHR GEEHRTER HERR BETRIEBSLEITER

Auch in der betriebswirtschaftlichen Beratung ist es heute möglich, viele der täglich anfallenden Arbeiten einem Rechner zu übertragen. So haben wir ein System entwickelt, das automatisch einfach strukturierte Betriebe untersucht und wichtige Hinweise als Diskussionsgrundlage zwischen Berater und Betriebsleiter herauschreibt. Unsere Information über ihren Betrieb haben wir nur von der Buchstelle. Dadurch können leicht fehlerhafte Einschätzungen entstanden sein.

## BEURTEILUNG DER FLÄCHENLEISTUNG (FLÄCHENPRODUKTIVITÄT)

Unter Berücksichtigung ihrer Absatzform und ihrer Marktlage muss beim Vergleich mit ähnlichen, gleichstrukturierten Betrieben festgestellt werden, dass der von ihnen erwirtschaftete bereinigte Betriebsertrag (Umsatz + Unbare Leistungen — Zukäufe an Saat — und Pflanzgut, Rohware, Vieh) unter dem Durchschnitt liegt.

Beim Überprüfen ihres Heizmaterialaufwandes je QM heizbare Glasfläche fiel uns auf, dass sie für die von ihnen gewählten Kulturen einen sehr geringen Verbrauch haben. Sollte ihre geringe Flächenleistung mit durch nicht optimale Wachstumstemperaturen bedingt sein, so würde eine Steigerung dieses Aufwandes sicher nicht ohne positive Wirkung auf das Gesamtbetriebsergebnis bleiben.

Zieht man vom Betriebsertrag den Sachaufwand und die Betriebssteuern und Lasten ab, so erhält man das Betriebseinkommen. Daraus müssen der Fremdlohn und Lohnanspruch abgedeckt werden. Im Untersuchungsjahr reichte ihr Betriebseinkommen zur Abdeckung des Lohnanspruches nicht aus, betriebswirtschaftlich (unter Berücksichtigung der Abschreibung und des eigenen Lohnanspruches) arbeiteten sie mit Verlust (negativer Reinertrag).

## BEURTEILUNG DER ARBEITSPRODUKTIVITÄT

Der bereinigte Betriebsertrag je AK lag unter dem Durchschnitt. Bei einem derzeitigen Lohn je AK von etwa 8-9000 DM muss der bereinigte Betriebsertrag mindestens bei 20 000 DM liegen. Erfolgreiche Betriebe erwirtschafteten im Untersuchungsjahr oft sogar mehr als 25 000 DM/AK.

UNTERSUCHUNGSJAHR = 18 015    1964 = 18 052    1963 = 12 337    1962 = 16 276    DURCHSCHNITT = 25 918

Zieht man vom Betriebsertrag den Sachaufwand und die Betriebssteuern ab, so erhält man das Betriebseinkommen. Daraus müssen der Lohn (Fremdlohn und Lohnanspruch der Familie) und der Zins abgedeckt werden. Das Betriebseinkommen/AK muss also über dem Lohn/AK (8-9 000 DM) liegen. Im Untersuchungsjahr blieb ihr Ergebnis jedoch erheblich unter diesem Wert — sie mussten also auf eine Verzinsung des Kapitals und auf einen Teil des Lohnanspruches verzichten.

## UNTERSUCHUNG DES BETRIEBSAUFWANDES

Da ihre Bruttoflächenleistung nicht befriedigte, haben wir ihren Sachaufwand als Ganzes überprüft und festgestellt, dass er durchaus vergleichbar mit dem sehr erfolgreicher Betriebe ist. Wenn nicht einmalige Ausfälle durch Krankheiten und andere Umstände das schlechte Ergebnis bedingen, sollten dringend ihre Kulturmethoden und ihr Sortiment überprüft werden.

Es wurde oben bereits auf die geringen Flächenerträge hingewiesen. Nun zeigt sich bei der Arbeitsproduktivität ebenfalls ein nicht befriedigendes Bild. Das kommt natürlich zum Teil von den geringen Flächenleistungen, zum anderen erscheint aber auch ihr AK-Besatz hoch. Sollten die geringen Flächenerträge nicht zufällig sein, so sollten sie unbedingt auch die Arbeitswirtschaft rationalisieren. Rufen sie einmal ihren Arbeitswirtschaftlichen Berater an.

## ZU DEN KAPITALVERHÄLTNISSEN

Für besonders nachteilig halten wir, dass ein erheblicher Teil des eingesetzten Fremdkapitals sehr kurzfristig ist. Dadurch kann unter Umständen ihre Entscheidungsfreiheit bei der Betriebsführung stark eingeschränkt werden. Sie sollten deshalb unbedingt bestrebt sein, ihre kurzfristigen Verbindlichkeiten in länger laufende Kredite umzuwandeln.

Zur Betriebsführung ist es notwendig, für die laufenden Ausgaben genügend Zahlungsmittel zur Verfügung zu haben. Beim Abschluss des Buchführungsjahres wurde für ihren Betrieb eine verhältnismässig niedrige Summe an Zahlungsmitteln ausgewiesen. Sollte es sich dabei nicht um eine zufällige Lücke handeln, so erlauben wir uns, auf die Vorteile einer erhöhten Zahlungsbereitschaft (Skonto-vorteile) hinzuweisen.

Wie oben erwähnt, ist der Ihnen vorliegende vollautomatisch erstellte Beratungsbrief Ergebnis einer neuen Entwicklung, sollte der Rechner Ihren Betrieb vollkommen falsch eingeschätzt haben, so wären wir sehr verbunden, wenn Sie uns dieses mitteilen könnten, damit wir daraus lernen und unsere Programme weiter verbessern können.

Mit freundlichen Grüßen  
E.-W. SCHENK.