Appendix I

METHODICAL DESCRIPTION
of the comparison of the communications flow in Hungary, Japan and the United States, 1960-1980

0. Universal constants

Definitions of Symbols

C: Number of persons above 9 per household. (1)

Sources

(1) Yearly data of the HCSO.

Remark

As in [DSP], volume of consumption was assumed to be equal with volume of supply at point-to-point communication.

1. Radio broadcasting

Equations

1. VS (Volume supplied) = IPR * STR * RIU * 365 * 24 * 60 * C

2. VC (Volume consumed) = IPR * LYR * RAR * PLR * 365

Definitions of Symbols

Equation 1.

IPR: Average number of words spoken per minute in the radio broadcasting. (1)

STR: Average number of Hungarian language radio broadcasting stations available per household. (2)

THR: Number of broadcast hours for all Hungarian language stations available (3)

RIU: Total number of radio sets. (4)

Equation 2.

LYR: Amount of radio listening per individual per day in minutes. (5)

RAR: Rate of attention given to radio broadcasts. (6)

PLR: Population listening to radio. (7)

Sources

(1) IPR=84 words/min. **[DSP]** estimated 87 words/min by measuring a sample from 19 AM stations broadcasting in the Boston area during mid-January, 1979. 42 words/min was obtained from a sample by the following way. All Hungarian language programs of all Hungarian stations on the week between 22nd and 28th July, 1991 were classified into the groups of speech, vocal music (songs, choir) and pure music. Then, the distribution of broadcasting time through these classes was determined. Average number of words in the spontaneous Hungarian speech is 84.11 word/min (See the chapter on phone). Number of words in vocal music varies widely from operas to rock. Aver age was assumed to be 35 word/min. A weighted average of class averages was found to be 42. This indicates that true value for IP may be considerably lower than that for the USA reflecting that Hungarian radio broadcasts more music and less ads.

(2) This number was obtained from (3).

Only domestic and major foreign Hungarian language programs has been considered, because it is a small minority of the citizens only who speaks foreign languages, and foreign language programs were practically not consumed. The 1990 census indicated that 1-2 per cent of citizens speaks English, 2-3 per cent German, and percent other languages, including Slavic and Gipsy. The number of domestic Hungarian language programs was up from the 2.3 stations in 1950 to the 3.5 programs in 1990. This should be compared to the 10.6 in 1960 and 21.6 in 1980 in the USA. However, number of foreign or domestic programs available in Hungarian or non-Hungarian totaled to more than 70 in 1985 and number of channels was more than 200 according to my survey in Budapest. Radio Free Europe, Voice of America, BBC, Deutschlandsender and the programs of other less important stations contribute significantly to the supply. In 1950, foreign Hungarian language supply amounted to half of the overall domestic supply. The broadcast time of the Hungarian language programs in Czechoslovakia, Romania, Yugoslavia, Soviet Union and Austria is subordinate and has been heavily dependent on the policy of the governments there towards or against Hungarian national minorities in these countries. Each program has been broad cast on more wavelengths but this was not taken into consideration.

(3) Yearly survey of HCSO. **[IA/II]** p. 126. col. 2.

(4) Yearly survey of HCSO. **[IA/II]** p. 126. col. 4.

(5) Inter- and extrapolated from the surveys of HCSO in 1977 and 1986. **[IA/II]** p. 201.

(6) RAR=1. **[DSP]**'s constant was not applied for Hungarian figures don't reflect background listening.

(7) **[DSP]** applied population over ten, but children under ten also listen to the radio. We applied the midyear population over nine till 1985 and mean of the population on 1st January and 31st December after 1985. Source: **[Dem85]**, p.16., Table 1.2. col.3.

This gives a systematic difference. Hungarian figures are about 2 per cent higher than those would have been by the strict **[DSP]** method. This difference will be taken into consideration in the course of the analysis.

2. T e l e v i s i o n

Equations

1. VS (Volume supplied) = IPT * THT * TIU * C

2. VC (Volume consumed) = IPT * LYT * RAT * PLT * 365

Definition of Symbols

Equation 1.

IPT: Average number of words spoken or written per minute in the television broadcasting. (1)

STT: Average number of television broadcasting stations receivable in households (sky and ground). (2)

THT: Number of broadcast hours for all TV stations. (3)

TIU: Total number of TV sets. (4)

Equation 2.

LYT: Amount of watching TV per individual per day in minutes. (5)

RAT: Rate of attention given to TV broadcasts. (6)

PLT: TV watching population. (7)

Sources

(1) IPT = 153 words / min. The same constant as used in **[DSP]**.

(2) This was computed from (3). Both foreign and domestic sup ply was considered, since foreign TV broadcasting has also been consumed. Later in the eighties, the figure has been subject to a rapid change from about 2.4 in 1980 to about 9.4 in 1990. Source: Institute for Mass Communication.

(3) Yearly survey of HCSO. **[IA/II]** p. 126. col. 3. and own estimations for foreign broadcasting supply in Hungary.

(4) In the period between 1945 and 1970 the number of sub scribers. At that time, an insignificant number of subscribers had more than one sets. Source: **[OM82]**. p.204., Table 3., col. 7. After 1970 the data were taken from the household statistics. Source: HCSO.

(5) See (5) of the chapter on radio broadcasting!

(6) RAT=1. **[DSP]**'s constant was not applied for Hungarian figures do not reflect background listening.

(7) See (7) of the chapter on radio broadcasting!

3. Cable television

Till 1980 CATV was not significant and surveyed in Hungary.

4. Records and tapes

Equations

1. VS (Volume supplied) = IP * (NDS * TDS + NT * TT) * C

2. VC (Volume consumed) = IP * TRT * PLT * 365

Definitions of Symbols

Equation 1

IP: Average number of words per minute on records and pre-recorded tapes. (1)

NDS: Number of records produced in the year. (2)

TDS: Average playing time of records. (3)

NT: Number of pre-recorded tapes produced in the year. (4)

TT: Average playing time of pre-recorded tapes. (5)

Equation 2

TRT: Average time in minutes per day per person of listening to records and tapes. (6)

PLT: Population listening to records and tapes. (7)

Sources

(1) IP=41. The figure in **[DSP]** was applied.

(2) Yearly survey of HCSO. **[IA/II]** p. 125. col. 2.

(3) Yearly survey of HCSO. **[IA/II]** p. 125. col3./col.4.

(4) Yearly survey of HCSO. **[IA/II]** p. 8. col. 2.

(5) TT=45.5 The figure in **[DSP]** was applied.

(6) See (5) of the chapter on radio broadcasting!

5. M o v i e s

Equations

1. VS (Volume supplied) = IP * MS * (NS / NT) * MIN

2. VC (Volume consumed) = IP * N * MS

Definition of Symbols

Equation 1.

IP: Average number of words per minute, both spoken and writ ten in motion pictures. (1)

MS: Average length of one movie in minutes. (2)

NS: Yearly number of movie shows in the country. (3)

NT: Number of movie theaters in the country (4)

MIN: Total number of seats in four wall movie theaters (5)

Equation 2.

IP: Average number of words per minute in movies. (1)

N: Total number of admissions to movies per year. (6)

MS: Average length of one movie in minutes. (2)

Sources

(1) IP = 110. The figure in **[DSP]** was used.

(2) MS = 135 min. The figure in **[DSP]** was used.

(3) Taken from the survey of HCSO. **[IA/II]** p. 127. col. 2.

(4) Yearly survey of the HCSO. **[IA/II]** p. 119. col. 3.

(5) Yearly survey of HCSO. Source: [Oktatás, mûvelôdés **[OM82]**. No data for open air theaters are available.

(6) Yearly survey of HCSO. **[IA/II]** p. 146. col 2.

6. E d u c a t i o n

Equations

1. VS (Volume supplied) = IPT * NHD * SCTT

Definition of symbols

IPT: Number of words (1)

NHD: Number of schooling hours consumed by students in all educational and training institutes (2)

SCTT: Number of schooling hours consumed by students above ten (3)

Sources

(1) The figure in **[DSP]** was applied.

(2) **[IA/II]** p. 107. and 108.

(3) Own estimation based upon tables in **[IA/II]**.

7. N e w s p a p e r s

Equations

1. VS (Volume supplied) = C * NMI * NP * WPP

1a. VSa (Volume supplied) = VIM * SSP * PD / CPW

2. VC (Volume consumed) = RT * 365 * PRM * RV

Definition of symbols

Equation 1.

NMI: Overall number of copies issued. (1)

NP: Average number of pages per copy. (2)

WPP: Average number of words per page. (3)

Equation 1a.

CPW: Number of characters per word. (4)

VIM: Volume of issued copies in metric tons. (5)

SSP: Specific surface of printing paper produced in Hungary. (6)

PD: Printing density of newspapers. (7)

Equation 2.

TRM: Time spent by reading newspapers. (8)

PRM: Newspaper reading population (9)

RV: Reading velocity (10)

Sources:

(1) Yearly survey of HCSO [IA/II] p.8. col.5.

(2) NP = 16. Raw estimation based upon the figures of Népszabadság and Magyar Nemzet the most frequented dailies. It was made by the present author.

(3) WPP = 2500. Raw estimation based upon the figures of Népszabadság and Magyar Nemzet the most frequented dailies It was made by the present author.

(4) CPW = 6 character/word.

Statistics have been made rather for voices read per time unit than words per time unit.

The average length of spoken, read, or listened words in is 6.7 voice/word in technical texts and 4.8 voice/word in lyric texts by E. Ady and F. Juhász. **[Fón60]**, **[Papp]**.

Hungarian uses two-character denotations for eight consonants (cs, dz, gy, ly, ny, sz, ty, zs) and three-character strings for their long pair (ccs, ddz, ggy, lly, nny, ssz, tty, zzs). Henceforth speeds and word lengths in voices and caharacters fail to coincide. I found 9243 - .9430 voices per character in technical texts of [Drechsler L., Kupcsik J.: Gazdaságstatisztika, Közgazdasági és Jogi Könyvkiadó, Budapest, 1982.].

This is 5.1293 and 7.1596 character/word for lyric and technical texts, respectively. Szende found in average 4.412 consonants and vowels in a word in spontaneous speech. This is 4.68-4.77 character/word. Sentences of spontaneous speech are also significantly shorter.

(5) Yearly survey of HCSO. **[IA/II]** p. 7.

(6) Computed from yearly surveys of CSO. Volumes of [Iparstatisztikai évkönyv].

(7) PD = 120000 char/m^2. Own estimation based upon the issues of Népszabadság and Magyar Nemzet.

(8) The data are taken from the representative time-use survey of the HCSO. Reading during learning was classified as learning and not considered here. A citizen spent 11 and 9 minutes with reading newspapers in 1977 and 1986, respectively **[IA/II]** p. 201.. This is much less than the figures for the US on weekdays and Sunday, which were 22 and 45 minutes respectively. Interim and exterim data were inter- and extrapolated linearly.

(9) Number of Hungarian citizens as of January 1st less number of those under age of 10. Compiled from volumes of [Statistical yearbook] by HCSO.

(10) RV=240.

There are significant velocity differences between speakers of various languages: Dutch 13.1-19.4, Italian 12.1-19.4, Hungarian 9.4-12.89, American 9.92, Japanese 9.54 voice/sec **[Gósy]**. Statistical average velocity of **sound reading Hungarian prosaic texts** is 10.73 voice/sec = 643.8 voice/min **[FóMa].** This provides 146 word/min with the 4.41 voice/word found by Szende. I found an average of 111 word/min for myself while reading dailies at the best intonation and performance.

This gives an average 96.09-134.13 sound read words/min.

However, no sound but **voiceless reading** is relevant to consuming media. Its velocity is much higher. Velocity of rapid voiceless reading may be is as great as 500 words/min or still more. That's why **[DSP]** parameter was chosen.

8. M a g a z i n e s

Equations

1. VS (Volume supplied) = C * NMI * NP * WPP

1a. VSa (Volume supplied) = VIM * SSP * PD / CPW

2. VC (Volume consumed) = RT * 365 * PRM * RV

4. PC (Production costs) = R * S

5. TC (Transmission costs) = S - PC

Definition of symbols:

Equation 1.

NMI: Number of copies issued. (1)

NP: Number of pages per copy. (2)

WPP: Number of words per page. (3)

Equation 1a.

CPP: Number of characters per page. (4)

CPW: Number of characters per word. (5)

VIM: Volume of issued copies in metric tons. (6)

SSP: Specific surface of printing paper produced in Hungary. (7)

PD: Printing density of magazines. (8)

Equation 3.

TRM: Time spent by reading magazines. (9)

PRM: Population (10)

RV: Reading velocity (11)

Sources:

(1) Yearly data of CSO. **[IA/II]** p 10., col. 2. This comprises the magazines distributed by the monopolistic Post Office, printed either in Hungary or abroad, and without non-public (non-distributed) college and trade magazines, newsletters etc.. Their number remained insignificant during the whole period.

(2) NP=39. I found an average 39 pages/issue in five 1985 copies of the magazines with the largest circulation Rádió-és televízió újság (67059), Nôk lapja (53567), Szabad Föld (22751), Ludas Matyi (22623), Magyar Ifjúság (13386), respectively. The number of issued copies in thousands in 1980 is shown in brackets. However, low circulation journals were more voluminous and volume of magazines has been subject to limitations due to recurrent lack of paper and to subsequent re-extension whenever the restrictions were over. Thus, this estimate should be viewed as a raw estimate for

the whole period. Anyway, Hungarian figure is much less than the average 185 found by DSP.

Another estimation can be based upon yearly known volume of magazines in metric tons. Yearly known average weight of paper per one square meter produced in Hungary and mean printing density i.e. number of characters/square meter. The second approach seems to be more robust.

(3) This altogether gives WPP = 2400/6 = 400 words which is some less than the average 436 used in DSP for general magazines. 436 is near 479 I found for the March 9th 1991 issue of Heti Világgazdaság which looks like a standard Western magazine.

(4) I found 400. This is a single raw estimate which should be replaced by time series. Page dimensions have changed several times in the past decades in dependence from press technology.

(5) See (4) of the chapter on newspapers!

(6) HCSO yearly survey. **[IA/II]** p.7

(7) Computed from yearly surveys of HCSO. Imported paper was assumed to have the same specific surface as domestic made.

(8) PD = 50000. This is an estimation of the present author made from five copies and mentioned in (2).

(9) See (7) of the chapter on radio broadcasting!

(10) See (9) of the chapter on newspapers!

(11) See (10) of the chapter on newspapers!

9. B o o k s

Equations

1. VS (Volume supplied) = C * (NPB + NIB - NEB) * NS * CPS / CPW

2. NIB (Number of yearly imported books from 1973 through 1985) = ARP * VIB / (VEB / NEB)

3. ARP (Average rate of import/export prices per volume from 1962 through 1972) = (VIB / NIB) / (VEB / NEB) / 11

3. VC (Volume consumed) = RTB * 365 * PRB * RV

Definition of symbols

Equation 1.

NPB: Number of books printed in the year. (1)

NEB: Number of books exported (2)

NIB: Number of books imported (3)

NS: Average number of printing sheets of the books published in the year (4)

CPS: Average number of characters per printing sheet. (5)

CPW: Average number of characters in a Hungarian word. (6)

Equation 2

VIB: Value of imported books. (7)

VEB: Value of exported books. (8)

Equation 3

RV: Average number of words consumed per minute of reading Hungarian. (9)

RTB: Average minutes of book reading per person per day. (10)

PRB: Population in the age of reading. (11)

Sources:

(1) Yearly survey of HCSO. **[IA/II]** p. 8. col.4.

(2) Yearly survey of HCSO. **[IA/II]** p.13. col.2.

(3) From 1962 through 1972 yearly survey of CSO. **[IA/II]** p.13. col4. After 1972 estimated with Equation 2.

(4) Yearly survey of HCSO. **[IA/II]** p.124. col.5.

(5) 40000 character/printing sheet was assumed.

(6) See (4) of the chapter on newspapers!

(7) The data are taken from the representative time-use survey of the HCSO. Reading during learning was classified as learning and not considered here. A citizen spent 13 and 12 minutes with reading books in 1977 and 1986, respectively. (**[IA/II]** p. 201.) Interim and exterim data were inter- and extrapolated linearly.

(8) Yearly data of HCSO **[IA/II]** p.13. col.3.

(9) See (10) of the chapter on newspapers!

(10) See (7) of the chapter on radio broadcasting!

(11) See (9) of the chapter on newspapers!

Remarks

1. Equation 1: [**DSP]**'s estimate has been based upon number of pages per book, and number of words per page. These data were not available. Word per book volume of books imported may differ from those of domestic origin. As far as import is not significant the bias is not disturbing. The result should be corrected with stock changes. The estimation technique may influence results, but not considerably.

2. Number of books produced was used instead of number of books sold NUS.

3. Equation 2: The same equation was applied as by **[DSP]**.

10. Direct mail advertising

Direct mail advertising was not significant in the past decades in Hungary and no statistical data are available on its volume.

11. First class mail

Equations

1. VS (Volume supplied) = NWM * NMR
2. VC (Volume consumed) = VS

Definitons of Symbols

Equation 1

NWM: Average number of words per mail (1)

NMR: Yearly number of mails received (2)

Sources

(1) A Polish estimation gave a round 300 word per mail, which was used by Visy F. in his computations **[Vis86]**. When assumed that classes of mails (personal correspondence, government correspondence, financial transactions, business letters and greeting cards) contain the same number of words in Hungary as in DSP, then a gross 564 words per mail is obtained. Mailing habit and its change has not been studied in details in Hungary. A round NWM = 400 estimate was used.

(2) Yearly survey of the Hungarian Post. **[IA/II]** p. 207. col. 6.

Remark:

All kinds of mails were considered here.

1 2 . T e l e p h o n e

Equations

1. TTT = LCM * TLC + LCA / ILC * TLC + TCM + DCA / IPPIUC * MPIUC + (NAC + MSFC) * MPIC + ASDTA / IPPIC * MPIC

2. VS (Volume supplied) = TTT * IP
3. VC (Volume consumed) = VS

Definitons of symbols

Equation 1

LCM: Yearly number of manually switched local calls initiated in Hungary in millions (1)

TLC: Average time spent for a local call in minutes (2)

LCA: Yearly number of impulses of automatically switched lo cal calls initiated in Hungary in millions (3)

TCM: Number of million minutes of manually switched distance interurban calls initiated in Hungary (4)

ILC: Average number impulses per a local call (5)

DCA: Number of million impulses of automatically switched interurban calls initiated in Hungary (6)

NAC: Number of foreign calls terminating in Hungary (7)

TTT: Time turned to all phone calls (8)

IPPIUC: Average number of impulses in an automatically switched domestic interurban call. (9)

MPIUC = Average length of a domestic interurban call in minutes. (10)

IPPIC: Average number of impulses of an international call. (11)

ASDTA: Overall number of automatically switched domestic calls to abroad (in thousands). (12)

MPIC: Average length of an international call (in minutes). (13)

Equation 2.

IP: Average number of words in the spontaneous Hungarian speech is 84.11 word/min. (14)

Sources:

(1) Annual statistics of HCSO.

(2) Statisztikai fogalmak: Vezetékes távközlés. Postavezéri gazgatóság, Bp. 1981. TLC = 4 min. This is in a good agreement with the US average 4.15 minutes for residence calls and 3.48 minutes for local business calls in 1977 [DSP].

(3) Annual statistics of HCSO.

(4) Annual statistics of HCSO.

(5) Statisztikai fogalmak: Vezetékes távközlés. Postavezéri gazgatóság, Bp. 1981. 1.35 impulses.

(6) Annual statistics of HCSO.

(7) Annual statistics of HCSO.

(9) Statisztikai fogalmak: Vezetékes távközlés. Postavezérigazgatóság, Bp. 1981.
IPPIUC = 12 imp.

(10) Statisztikai fogalmak: Vezetékes távközlés. Postavezérigazgatóság, Bp. 1981.
MPIUC= 3.44 min.

(11) Statisztikai fogalmak: Vezetékes távközlés. Postavezéri gazgatóság, Bp. 1981.
IPPIC = 75 imp.

(12) Annual data of HCSO: **[IA/II]** p. 44., col.3..

(13) Statisztikai fogalmak: Vezetékes távközlés. Postavezéri gazgatóság, Bp. 1981. 5.6 min.

(14) IP = 84. Szende [Szen73] found 79399 voices in 18000 words in a collection of records of spontaneous speech. Registered length was 214 min. This gives 4.41 voice/word, 84.11 word/min and 371.02 voice/min.

13. T e l e x

Equations

1. VS (Volume supplied) = (TXTF * UE + TXTT * TE) / CPW

1a. VS (Volume supplied) = TXAT * / CPW

2. VC (Volume consumed) = VS

Definitons of Symbols

Equation 1

TXTF: Volume of domestic traffic of telex messages in time zone units (1)

UE: Number of characters per time zone unit (2)

TXTT: Volume of international telex traffic initiated in Hungary in minutes (3)

TE: Number of characters per minute (4)

CPW: Number of characters per word (5)

<u>Equation 1a</u>

TXAT: Volume of domestic and international telex traffic in time zone units (6)

EE: Number of characters per time zone unit (7)

<u>Sources:</u>

(1) Yearly survey of the Hungarian Post. **[IA/II]** p.39. col.8.

(2) UE = 36 char / time zone unit.

(3) Yearly survey of the Hungarian Post. **[IA/II]** p.39.

(4) TE = 600 char/min.

(5) CPW= 6 char/word. See (4) of the chapter on newspapers.

(6) Yearly survey of the Hungarian Post. **[IA/II]** p. 39. col.8.

(7) EE = 36 char / time zone unit.

<u>Remarks:</u>

1. Volume of telex messages terminating in Hungary is not known. Volume of mesages originating in the country was used instead.

14. T e l e g r a m s

Equations

1. VS (Volume supplied) = IPD * NDT + WTT

Definitons of Symbols

Equation 1

IPD: Average number of words per domestic telegram. (1)

NDT: Number of domestic telegrams submitted (2)

WTT: Total number of words received from abroad. (3)

Sources

(1) IPD = 50 word / telegram.

(2) Yearly survey of Hungarian Post. **[IA/II]** p.39. col 2.

(3) Yearly survey of Hungarian Post. **[IA/II]** p.45. col.5.

Remarks:

1. Through 1980, there were available only telex and telegram in Hungary. These replaced mailgram, electronic money order message and other electronic services, which were not introduced.

14. F a c s i m i l e

Till 1980 no public facsimile service was available.

15. Data Communication

Till 1980 no public data communication service was available.

Appendix II.

Methodical description of information balances of Hungary 1945-1990

1. GOODS

1.1. Traditional information goods

1.1.1. Printed matter

1.1.1.1. Newspapers

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the antecedent year

2. P (Volume produced) = 1000000 * NMI * NP * ((1 - PPN) * BPS * WPP * SPW + PPN * $^{\underline{2}}$log NGL * DPM * DPM * SMPC)

2a. P (Volume produced) = 1000000 * NMI * $^{\underline{2}}$log NGL * DPMa * DPMa * SMPC

2b. P (Volume produced) = SMPT * BPS * VIN * PD

3. I (Volume imported) = 1000 * NIN * NP * ((1 - PPN) * BPS * WPP * SPW + PPN * $^{\underline{2}}$log NGL * DPM * DPM * SMPC)

3a. I (Volume imported) = 1000 * NIN * $^{\underline{2}}$log NGL * DPMa * DPMa * SMPC

4. E (Volume exported) = 1000 * NEN * NP * ((1 - PPN) * BPS * WPP * SPW + PPN * $^{\underline{2}}$log NGL * DPM * DPM * SMPC)

4a. E (Volume exported) = 1000 * NEN * $^{2}\log$ NGL * DPM * DPM * SMPC

5. C (Volume consumed) = V_{jan} + P + I - E - V_{dec}

6. U (Volume used) = 1000000 * NMS * NP * PPN * $^{2}\log$ NGL * DPM * DPM * SMPC + (365 * TRN * PRN - 1000000 * NMS * NP * PPM *100 * 100 / VV) * (SRV * BPS)

6a. U (Volume used) = 365 * TRN * PRN * VICH

7. V_{dec} (Volume of stock as of December 31st) = (NPOP + NSHOP + NLIB) * NP * ((1 - PPN) * BPS * WPP * SPW + PPN * DPM * DPM * SMPC * $^{2}\log$ NGL)

7a. V_{dec} (Volume of stock as of December 31st) = (NPOP + NSHOP + NLIB) * DPM * DPM * $^{2}\log$ NGL * SMPC

7aa. NPOP = NHH * HH * .1 * 305 + 2 * NMI / 305

7ab. NSHOP = NMI * REMI / 305

7ac. NLIB = NLU * MPPN before and after 1986 and
NLIB = NLUC * PLPAL * MPPN in 1986

Definition of symbols:

Equation 1

Equation 2

NMI: Number of copies of dailies printed altogether in the year (in millions) (1)

NP: Average number of pages per copy (2)

WPP: Average number of words per page (3)

CPW: Average number of strokes in a word (4)

BPS: Average number of bits per stroke (5)

PPN: Average percent of paper surface covered with pictures (6)

NGL: Average number of grey levels (7)

DPM: Resolution of pictures in dots per meter (8)

SMPC: Average surface of a copy in square meters (9)

<u>Equation 2a</u>

VIN: Weight of newspapers printed in the year altogether (metric tons) (10)

SMPT: Average surface of one ton of newspaper in square meters (11)

<u>Equation 3</u>

NIN: Number of copies of periodicals imported in the year (12)

<u>Equation 4</u>

NEN: Number of copies of periodicals exported in the year (13)

<u>Equation 5</u>

<u>Equation 6</u>

TRN: Average time spent with reading newspapers (14)

PRN: Reading population (15)

SRV: Average velocity of still reading (16)

VV: Average velocity of viewing pictures in press products (17)

NMS: Number of dailies sold (18)

<u>Equation 6a</u>

VICH: Channel capacity of the human visual channel (19)

<u>Equation 7</u>

NPOP: Number of copies of dailies held at households (20)

NSHOP: Number of copies of dailies held in the shops, kiosks and stack-rooms of distributors (21)

NLIB: Number of copies of dailies held at libraries (22)

<u>Equation 7aa</u>

NHH: Number of households storing newspapers for more than one year (23)

NH: Number of households in Hungary (24)

<u>Equation 7ab</u>

REMI: Participation of remittenda in the production (25)

<u>Equation 7ac</u>

NLU: Number of periodicals (expressed in library units) in the libraries altogether (26)

MPPN: Share of newspapers in the yearly production of magazines and newspapers altogether (27)

PLPAL: Number of periodicals in public cultural libraries related to the number of periodicals in all libraries (in percents) (28)

NLUC: Number of periodicals (in library units) in public cultural libraries (29)

Sources:

(1) Yearly statistics of HCSO. For the period before 1960, see **[KM]** , p. 77. col. 2.. From 1960 through 1986 **[IA/II]** p. 8. col. 6.., after 1986 **[OM92]** p. 159. col. 2. (bottom subtable). Before 1976, the figure doesn't include the periodicals with circulation of less than 5000.

(2) NP = 16. This was the usual weekday's size of the most widespread dailies. Sunday issues became fatter at the expense of the newspaperless Monday in the seventies.

(3) WPP = 2500. Estimation made by the present author based upon the copies of dailies Magyar Nemzet, Népszabadság and Magyar Hírlap on July 30, 1991.

(4) SPW = 7. Average number of characters in a Hungarian word is about 6 **[Papp].** An additional space was added to this figure resulting in 7.

(5) BPS = 17.6. 8 bit characters were assumed and an average factor of 2.2 was applied for the controll characters and technical overhead. Volume of information can be measured at the level of ASCII, text files, postcript, and image or compressed image files. A number of ISO standards define these formats.

(6) PPN = 2 m^2/m^2 percent. Estimation based upon the copies of dailies Magyar Nemzet, Népszabadság and Magyar Hírlap on July 30, 1991.

(7) NGL = 128. An average of the common industrial standard scanners. This corresponds to 7 bit. Bi-level coding (one bit) is used for coding drawings. Various standards apply for 4-12 bit. 4-5 bit coding is applied in low information demand systems like in chip-cards. Source: **[DIS 10918-1]**.

(8) DPM = 15479 dots per meter for figures. 400 dpi was accepted as a satisfactory standard for scanning figures. The handhold scanners with a typical resolution of 100-200 dpi are offered for texts only. Printing films have been digitized with 1000-3000 dpi.

(9) For the years after 1970, this figure was computed from the average weight of a copy; (10)/(1) and average specific gravity of printing paper: 1/(11) and multiplying by 2 to account both side of the paper. As an estimation SMPC = 0.8m^2/issue was used for the period before 1970.

(10) Yearly statistics of CSO **[IA/II]** p. 7. row 3.

(11) This was subject to permanent change due to cost and import restrictions. The constant SMPT = 14000000 m^2 / t was applied. Change of specific weight of paper may in principle cause as much as 20% error.

(12) Survey of CSO made on an average day for all periodicals (dailies, weeklies, biweeklies and monthlies). **[IA/II]** p. 15. col. 3. multiplied by the number of issues and divided by 2 due to the assumption that in average half the periodicals were newspapers. The number of yearly issues was taken in average as 305. After 1986 **[OM92]** p. 172. bottom line of the bottom table 9.

(13) Survey of CSO made on an average day for all periodicals (dailies, weeklies, biweeklies and monthlies). **[IA/II]** p. 15. col. 2. multiplied by the number of issues and divided by 2 due to the assumption that in average half the periodicals were newspapers. The number of yearly issues was taken in average as 305. After 1986 **[OM92]** p. 172. bottom line of the top table 8.

(14) The data for 1986 and 1977 are taken from the representative time-use survey of the HCSO. Reading during learning was classified as learning and not considered here. A citizen (between 18 and 60) spent 11 and 9 minutes with reading newspapers in 1977 and 1986, respectively [**IA/II**], p. 201.. Interim and exterim data were inter- and extrapolated. The data for the earlier 1983 and 1972 years were computed from **[Anap]** and **[Tom]** . The youngsters under 18 and elderly people in average assumably use less dailies, which is a source of error.

(15) Number of those above the age 7. Computed yearly by HCSO from decennial censuses. This population contains illiterates as well. (Those who are older then 8 and still didn't pass at least one class of the primary school, as of January 1st.) For this group I assumed that average time spent daily with reading is equaling to that found in the age group 18-60 studied in the survey (14).

(16) Statistical average of **loud reading** Hungarian prosaic texts in the fifties was no more than 10.73 voice/sec = 643.8 voice/min. **[FóMa]** Spaces between words were not considered.) Since that time, speech rate has been significantly accelerating **[Gósy]** At

present, normal, loud reading/speech rate is 13.98 voice/sec, while the average of the fast speakers is as high as 23.68 voice/sec.

Voiceless reading - which is relevant for our purposes - may be still much faster. I found an average of 2273 char/min = 37.88 char/sec for myself while reading dailies in an "each letter" way. 20 char/sec was taken as an average.

Voices were transformed to bits via characters. Hungarian uses two-character denotations for eight consonants (cs, dz, gy, ly, ny, sz, ty, zs) and three-character strings for their long pair (ccs, ddz, ggy, lly, nny, ssz, tty, zzs). Henceforth speeds and word lengths expressed in voice and character units fail to coincide. I found .9243 - .9430 voices per character on six pages of technical texts in: Drechsler L., Kupcsik J.: Gazdaságstatisztika, Közgazdasági és Jogi Könyvkiadó, Budapest, 1982.

(17) The speed of "reading" of pictures and graphs is a major problem, particularly for magazines and books containing several pictures.

70 cm^2 / sec was applied for the rate of "picture perception". The time spent for viewing at and perceiving a picture in a press product may depend on the conditions under which people view at them, dimensions, interestingness/familiarity and quality of the picture and state and personality of the viewer. I asked my friends to view at a number of pictures placed in front of them on a table while sitting. The results are reflected in the value of VV. Psychological tests indicate that a surprisingly short time is enough for the perception of a picture.

The author experienced that readers pass pictures faster than texts. The velocity of still reading applied in this study corresponds some 90 cm^2 of plain 10 pitch text. That means picture perception of press products in normal sitting situation may be more than 40 times faster that reading. Reading itself is picture perception, but the elements to be recognized are relatively small and should be interpreted row-wise which may be unnatural for the brain.

The throughput of good quality scanners is higher than that of human video-input.

(18) Yearly data of HCSO. **[OM92]** p. 171. col.2.+3. Subtable "Az összesenbôl napilap"

(19) VICH = 22 million bit * 25 / sec. This was estimated as the number neurons in retina multiplied with their number of firing cycles per one second.

(23) In a representative household survey, it was found that 53 percent of the respondents replied "yes" when asked: "Are there such periodicals whose copies you have been storing for more than one year?". People, however, store rather magazines than dailies. Hence the 53 percent was corrected by a factor of .1

(24) Data of HCSO which were published in various volumes of Háztartásstatisztika and Statisztikai évkönyv.

(25) Hungarian Post used to be the monopolistic organisation of distribution of dailies and magazines by 1992. The stocks of kiosks, newsstands and shops show a significant daily fluctuation. The morning stock of dailies can be approached as one day's production, the closing stocks can be approximated with the volume of remittenda or zero. After its removal from the kiosks, remittenda was still stored for a while in stack-rooms of the distributor. On principle, the account reflects the state of affairs at midnight, January 1.. Hence, volume of one-day remittenda multiplied by 2 was applied to estimate NSHO. This is significantly less than one day's production. For instance in 1960, 665 million copies of periodicals were published of which some 5 million copies, 17 thousands a day were registered as remittenda. The average one day production was 2179 thousands copies. (**[KA]** p. 102., table on the top, col. 1. and 5.). In 1990, 1.4 million copies of dailies were published a day of which 340 thousands were sent back as remittenda.(**[OM92]** p. 163., bottom line.) The figures of remittenda were taken from the above sources and Közmûvelôdés 1972-1976, KSH, Bp, 1978, 170 p., p. 90, bottom lines.

(26) Quattroannual census of HCSO. **[IA/II]** p. 131. col. 4., **[OM92]** p. 175. col. 3.

(27) Computed from volumes of production in metric tons: (7) of this chapter and (7) of the chapter on magazines.

(28) Computed from (22) and interpolated.

(29) Yearly data of CSO **[IA/II]** p. 133. col.3., **[OM92]** p. 175. col.3.

<u>Remarks:</u>

<u>Equation 1-7</u>

Line drawings were left out of computations.

Equation 6

Time-use surveys provide data for the average length of time spent with reading newspapers. I noticed, in the points (16) and (17) of the present chapter, that the velocity of perceiving pictures is round 40 times faster in dailies than reading plain texts. One can easily check with (16) and (17) that people don't spend as much time with newspapers as would be needed to read them completely. On such conditions, the volume of information use depends on readers' preferences. If they prefer pictures to text, they can use more information during the same time than in the opposite case.

Some people read news and pictures of dailies as they follow each other, which will be called "linear reading". The majority of readers nevertheless prefers sports, world's events or pictures. These strategies will be referred as to "Sports first", "pictures first". I made estimations assuming that
- each reader is "linear reader" and
- each reader is a "pictures first" reader.

Equation 6 is the formula for the "pictures first" assumption. The "linear reading" hypothesis provides lower estimates.

1.1.1.2. Magazines, journals

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the antecedent year.

2. P (Volume produced) = 1000000 * NPM * NPC * ((1 - PPM) * (BPS * WPP * SPW) + PPM * $^{2}\log$ NGL * DPM * DPM * PLPC * ANC)

2b. P (Volume produced) = BPS * WPM * PD * SMPT

3. I (Volume imported) = 1000 * NIM * NPC * ((1 - PPM) * (BPS * WPP * SPW) + PPM * $^{2}\log$ NGL * DPM * DPM * PLPC * ANC)

4. E (Volume exported) = 1000 * NEM * NPC * ((1 - PPM) * (BPS * WPP * SPW) + PPM * $^{2}\log$ NGL * DPM * DPM * PLPC * ANC)

5. C (Volume consumed) = V_{jan} + I - E + P - V_{dec}

6. U (Volume used) = 1000000 * NSM * NP * PPM * ${}^{2}\log$ NGL * DPM * DPM * SMPC * ANC + (365 * TRM * RP - 1000000 * NSM * NP * PPM *100 * 100 / VV) * (SRV * BPS)

6a. U (Volume used) = 365 * TRN * PRN * VICH

6b. U (Volume used) = 365 * TRN * PRN * ((${}^{2}\log$ NGL * DPM * DPM * SMPC *ANC * PPM * VTX / ((1 - PPM) * VV + PPM * VTX) + SRV * BPS * (1 - PPM) * VV / (1 - PPM) * VV + PPM * VTX))

7. Vdec (Volume of stock as of December 31st) = (VPOP + VSHOP + 1000 * VLIB) * NPC * ((1 - PPM) * (BPS * WPP * SPW) + PPM * ${}^{2}\log$ NGL * DPM * DPM * PLPC * ANC)

7a. VPOP = (Σ (Pj * NIj) / Σ NIj) * (NHH * HH) + NPM / (Σ (Pj * NIj) / Σ NIj)

7b. VSHOP = NPM / (Σ (Pj * NIj) / Σ NIj)

7c. VLIB = NLU * MPPP before and after 1986

VLIB = NLUC * PLPAL * MPPP in 1986

Definition of symbols:

<u>Equation 1</u>

<u>Equation 2</u>

NPM: Number of magazines and journals produced yearly (in million copies). (1)

NPC: Average number of pages per issue (2)

WPP: Average number of words per page. (3)

SPW: Average number of strokes per word (4)

BPS: Average number of bits per stroke (5)

PPM: Per cent of sheet surface covered with pictures including toned pictures, graphs and line drawings. (6)

DPM: Average resolution (7)

NGL: Average number of grey levels (8)

ANC: Average number of colors (9)

PLPC: Average surface of a copy in square meters (10)

<u>Equation 2b</u>

WPM: Volume of magazines and journals produced in the year (in metric tons) (11)

<u>Equation 3</u>

NIM: Number of imported copies of periodicals. (12)

<u>Equation 4</u>

NEM: Number of exported copies of periodicals. (13)

<u>Equation 5</u>

<u>Equation 6</u>

TRM: Time of reading journals (14)

RP: Population in the reading age (15)

SRV: Velocity of reading journals (16)

NSM: Number of magazines sold (17)

VV: Average velocity of viewing pictures in press products, cm2/sec units. (18)

VTX: Average velocity of reading texts in press products, cm2/sec units. (19)

Equation 7

VPOP: Number of issues in households. (20)

VSHOP: Number of issues in kiosks and at other distributors. (21)

VELIB: Number of issues in the libraries. (22)

Equation 7a

NH: Number of households in the year in thousands. (23)

NHH: Number of households storing at least one volume of at least one periodical. (24)

MPPP: Share of magazines in the yearly production of magazines and newspapers altogether. (25)

Pj: Number of copies of journals with periodicity j, produced. (26)

NIj: Number of yearly issues of a journal with periodicity j. (27)

Equation 7b

Equation 7c

NLU: Number of periodicals in library units in the libraries altogether. (28)

PLPAL: Number of periodicals in public libraries related to number of periodicals in all libraries in percents. (29)

NLUC: Number of periodicals in library units in public cultural libraries. (30)

<u>Sources:</u>

(1) Yearly statistics of HCSO. Before 1960 **[KA]**, p. 77. Table 2. col. 3., from 1960 through 1986 **[IA/II]** p. 8. col. 5. less col. 6., after 1986 **[OM92]** p. 159.bottom subtable col. 3.

(2) NP = 39. See (2) of the chapter on magazines in Appendix 1.

(3) WPP = 400. This figure was found by me in a small sample consisting of

(4) SPW = 7. See the previous chapter on newspapers!

(5) BPS = 17.6 bit/stroke.

(6) I found 13 percent pictures in a sample consisting of 15 pieces of most frequented journals in 1986. PPM = .13.

(7) DPM = 400 dpi was applied.

(8) NGL = 128. See the antecedent chapter!

(9) Color printing has gradually gained ground in the past decades. Average number of colors of printed products has been growing up to in 19 from in 19. The value of ANC can be computed from the figures that were published yearly by CSO in Statistical Yearbook of Hungarian Industry.

(10) Yearly statistics of CSO. **[IA/II]** p. 7. row. 2.

(11) See (12) of the chapter on newspapers!

(12) See (13) of the chapter on newspapers!

(13) The data for 1986 and 1977 are taken from the representative time-use survey of the HCSO. Reading during learning was classified as learning and not considered here. A citizen (between 18 and 60) spent 2 and 10 minutes with reading magazines in 1977 and 1986, respectively. (HCSO **IA/II**, p. 201.) Interim and exterim data were inter- and extrapolated. The data for the earlier 1983 and 1972 years were calculated from **[Anap]** and **[Tom]**.

(14) See (15) of the chapter on newspapers!

(15) See (15) of the chapter on newspapers!

(16) See (16) of the chapter on newspapers!

(17) **[OM92]** p. 171. col. 2.+3. Subtable "Összesen terjesztett" less Subtable "Az összesenbôl napilap"

(18) See (17) of the chapter on newspapers! As magazines publish more pictures, introduction of a "browsing rate" expressed in m^2/min units is timely. No large-sample empirical data, however, are available for the value of this indicator. Besides it isn't clear what happens when one rapidly runs over a journal. Treating of superficially "half-read" sentences, words, letters (!) and pictures is not yet solved.

(19) See (19) of the chapter on newspapers!

(23) Publications of HCSO.

(24) See (23) of the chapter on newspapers but the coeffient . 9 was applied!

(25) Computed from volumes of production in metric tons: (10) of this chapter and (10) of the chapter on newspapers.

(26) **[KA]** p. 77. bottom table col. 4.,5.,6. and 7. **[OM92]** p. 159. col.4.,5., 6.

(27) Weeklies, biweeklies and monthlies are distinguished in the present day official statistics. Earlier a fourth category "Periodicals with other periodicity" persisted including quarterlies.

(28) Quattroannual census of HCSO. **[IA/II]** p. 131. col. 4., **[OM92]** p. 173 "Összesen" lines.

(29) Computed from (28) and (16) and interpolated. See (28) of the chapter on newspapers!

(30) See (29) of the chapter on newspapers!

Remarks:

Equation 1-7

One could have assumed that the transformation to the bit-term figures was made with a universal color scanner. In this case, the number of pixels should have been multiplied by 16-26 in dependence of the definition of an "average color scanner". A 26 bit scanner can discern more colors than human eye. Instead, I assumed the minimal quantity of information. Consequently the results are influenced by a growing factor, that of average number of colors. It should be noticed that we consider raw uncompressed data so as they outflow of digitizing. Compressing algorithms, like Huffman coding in **[DIS10918-1]** are very effective.

Equation 6

Time-use surveys provide data for the average length of time spent with reading journals and magazines. I noticed, in the points (16) and (17) of the previous chapter, that the velocity of perceiving pictures in press products is round 40 times faster than reading plain texts. This is particularly important, for journals may contain as much picture as 30 percent of their page-surface. One can easily check with (16) and (17) that people don't spend as much time with journals as would be needed to read them completely. For instance, two independent estimations from the weight and number of copies of journals produced provide 21 minute per capita per day what would be needed for a complete reading of all copies sold in 1986. The time use survey found 10 minutes of reading journals. On such conditions, the volume of information use depends on readers' preferences. If they prefer pictures to text, they can use more information during the same time, than in the opposite case.

Some people read the news and pictures of dailies systematically as they follow each other, which will be called "linear reading". The majority of readers nevertheless prefers sports, world's events or pictures. These strategies will be referred as to "Sports first", "pictures first". I made estimations assuming that

- each reader is "linear reader" and
- each reader is a "pictures first" reader.

Both approaches were applied here.
Equation 6 is the formula for the "pictures first" assumption. The "linear reading" hypothesis provides lower estimates.

Equation 6b

This is the estimation which is valid for the linear reading case.

Equation 7

Equation 7a

It was assumed that households store the last issues of each magazine. Furthermore, the households, which store magazines for a longer time, store all copies back a year.

1.1.1.3. Books

Equations:

1. Vjan (Volume of stock as of January 1st) = Vdec of the antecedent year.

2. P (Volume produced) = 1000000 * NPB * ANS * ((1 - PPB) * BPS * SPS + PPB * ^{2}log NGL * DPM * DPM * PLPC * ANC)

3. I (Volume imported) = 1000 * NIB * ANS * ((1 - PPB) * BPS * SPS + PPB * ^{2}log NGL * DPM * DPM * PLPC)

4. E (Volume exported) = 1000 * NEB * ANS * ((1 - PPB) * BPS * SPS + PPB * ^{2}log NGL * DPM * DPM * PLPC * ANC)

5. C (Volume consumed) = Vjan + P + I - E - Vdec

6. U (Volume used) = 365 * TR * RP * ((^{2}log NGL * DPM * DPM * SMPC *ANC * PPM * VTX / ((1 - PPM) * VV + PPM * VTX) + SR * BPS * (1 - PPM) * VV / (1 - PPM) * VV + PPM * VTX))

6a. U (Volume used) = 365 * TR * RP * VICH

7. Vdec (Volume of stock as of December 31st) = (NPOP + NSHOP + NLIB) * ANS * ((1 - PPB) * BPS * SPS + PPB * ^{2}log NGL * DPM * DPM * PLPC * ANC)

7a. NSHOP = STVA / AVPR

Definition of symbols:

Equation 1

Equation 2

NPB: Number of books printed in the year. (1)

ANS: Average number of sheets per book. (2)

SPS: Average number of strokes per sheet. (3)

BPS: Average number of bits per stroke. (4)

PPB: Per cent of sheet surface covered with toned pictures excluding graphs and line drawings. (5)

NGL: Average number of grey levels (6)

DPM: Average resolution of pictures in dots per inch (7)

ANC: Average number of colors (8)

PLPC: Average surface of a printing sheet (9)

Equation 3

NIB: Number of books imported in the year (10)

Equation 4

NEB: Number of books exported in the year (11)

Equation 6

TR: Average time (minutes) spent with reading books per person per day (12)

RP: Population in the age of reading. (13)

SR: Average speed of reading Hungarian (14)

VV: Average velocity of viewing pictures in press products, cm^2/sec. (15)

VTX: Average velocity of reading texts in press products, cm^2/sec. (16)

Equation 7

NPOP: Number of books in the households. (17)

NSHOP: Number of books in shops. (18)

NLIB: Number of books in all kinds of libraries. (19)

ANC: The average number of colors in the past ten years (20)

Equation 7a

STVA: Value of (book)stock in retail and wholesale trade (21)

AVPR: Average price of books (22)

Sources:

(1) Yearly survey of CSO. This is a survey of books and booklets without maps, music notes, reprints **[KA]** p. 30 col. 2. + col. 3. From 1965 through 1986 **[IA/II]**, p. 8., col. 2.. After 1986 **[OM92]**. Since 1984 the figures don't cover miscellaneous publications and multiplied/xerocopied university lecture-notes.

(2) Published yearly by HCSO **[IA/II]**, p. 124., col. 5.

(3) 40000 strokes / printing sheet was assumed. This is some more than that has been found.

(4) BPS = 17.6 bit/stroke.

(5) There are no regular data with respect to this indicator. Participation of pictures in the books is an indicator of the level of printing industry and as such is expected to show a monotonous growth. This agrees with the author's experience. 5 percent was applied as a guestimation.

(6) NGL = 128.

(7) See (8) of the chapter on newspapers!

(8) See (9) of the chapter on magazines!

(9) Surface of a printing sheet is one m^2.

(10) Yearly survey of HCSO. **[KA]** p. 67., bottom line, **[IA/II]**, p.13., col. 2.

(11) Yearly survey of HCSO **[KA]** p. 69. bottom line, **[IA/II],** p.13., col. 4.

(12) See (14) of the chapter on newspapers!

(13) See (15) of the chapter on newspapers!

(14) See (16) of the chapter on newspapers! This number is some less than the 110 what was found in [DSP]. The difference may be due to language differences and sampling error.

(15) See (17) of the chapter on newspapers!

(16) See (17) of the chapter on newspapers!

(17) In 1964 VPOP = (58 book / family) * 2 967 thousand family = 171 648 649 book. Number of families doesn't agree with number of households, whose number was 3 154 thousand as HCSO reported. In average, a family consisted of 3.395 person. **[Mán65]** p 51..

In 1978 VPOP = (167 book / family) * 3 668 000 family = 614 390 thousand books. **[Kul83]** p. 78, col 1..

According to a representative survey of HCSO, there were 771 301 thousand books at Hungarian households in 1986.

(18) Published periodically by HCSO. **[IA/II]**, p. 131-132, col. 2., and after 1984 computed as (21)/(22).

(19) Yearly survey of HCSO. **[IA/II]** p. 11. col. 3., **[OM92]** p. 173., col. 2., lines "Összesen".

(20) See (8) of the present chapter!

(21) For 1952-54 **[KuA]** p. 97., Table 2., col. 3. divided by col.2.. **[IA/II]** p. 12. row 4. After 1986 [OM92] p. 156. Table 22. col.2.

(22) **[KA]** p. 65. col. 4. line "Összesen", **[OM85]** p. 144. col. 3., **[OM92]** p. 156. col. 2.

Remarks:

Equation 1:

[DSP]'s estimate has been based upon number of pages per book, and number of words per page. These data were not available. Word per book volume of the books imported may differ from those of domestic origin. As far as import is not significant the bias is negligible. The result should be corrected with stock changes. The estimation technique may influence results, but not considerably.

NUP: Number of books produced was used instead of number of books sold NUS.

Equation 2:

The same equation was applied as by **[DSP]**.

Equation 6

The equation reflects the linear reading hypothesis. This is a good assumption though children and low culture adults follow the "pictures first" strategy.

1.1.1.4. Informatory printed material

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the previous year

2. P (Volume produced) = 2 * BPS * PD * (1 / SWP) * VPM

3. I (Volume imported) = 2 * BPS * PD * (1 / SWP) * IIM

4. E (Volume exported) = 2 * BPS * PD * (1 / SWP) * EIM

5. C (Volume consumed) = V_{jan} * RWO

6. U (Volume used) = UNIN * (V_{dec} + V_{jan}) / 2

7. V_{dec} (Volume of stock as of December 31st) = V_{jan} + P - E + I - C

Definition of symbols:

Equation 1

Equation 2

BPS: Average number of bits per stroke (1)

PD: Average number of strokes per m^2. (2)

SWP: Average specific weight of printing paper in g/m^2 units (3)

VPM: Annual production of informatory material in metric tons (4)

Equation 3

IIM: Annual import of informatory material in metric tons (5)

Equation 4

EIM: Annual export of informatory material in metric tons (6)

Equation 5

RWO: Rate of weeding out informatory materials (7)

Equation 6

UNIN: Average number of uses in the year (8)

Equation 7

Sources:

(1) Own estimation. See (5) of the chapter on newspapers!

(2) Own estimation. This is some less than the information density of books and magazines.

(3) SWP = 75 g/m^2, i.e. 13 1/3 m^2/kg, value of an average light book printing paper was assumed **[Pap80], [Nyom79].**

(4) Annual data of HCSO.

(5) Annual data of HCSO.

(6) Annual data of HCSO.

(7) Own guestimation. RWO = .4, i.e. 40 percent.

(8) Own guestimation.

Remarks:

Equations 2,3 and 4

Informatory printed material was assumed to be printed on both sides.

1.1.1.5. Business forms

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the previous year

2. P (Volume produced) = BPS * IDBF * (1 / SWP) * PBF

3. I (Volume imported) = BPS * IDBF * (1 / SWP) * IBF

4. E (Volume exported) = BPS * IDBF * (1 / SWP) * EBF

5. C (Volume consumed) = (1 - SBF) * (P + I - E)

6. U (Volume used) = NUBF * (V_{jan} + P - E + I)

7. V_{dec} (Volume of stock as of December 31st) = SBF * (P + I - E)

Definition of symbols:

Equation 1

Equation 2

BPS: Average number of bit per stroke (1)

IDBF: Average information density of business forms in strokes per m^2 (2)

SWP: Average specific weight of printing paper in g/m^2 units (3)

PBF: Annual production of business forms in metric tons (4)

Equation 3

IBF: Imports of business forms in metric tons (5)

Equation 4

EBF: Exports of business forms in metric tons (6)

Equation 5

Equation 6

NUBF: Average number of uses of business forms (7)

Equation 7

SBF: Share of business forms to be stored for more than one year (8)

Sources:

(1) Standard 17.6 bps was chosen.

(2) Own estimation based on a small sample of statistical questionnaires of the Hungarian Central Statistical Office.

(3) See (3) of the chapter on informatory material!

(4) Annual data of HCSO. Important classes of business forms are tax returns, receipts for registered letters, and parcels, postal order blanks, customs declarations, address registration sheets, and bill-books.

(5) Annual data of HCSO.

(6) Annual data of HCSO.

(7) As a rule, business forms are filled in and then used as business files or documentation. Therefore business forms are supposed to use only once. Revision at the printing office and transport were considered to be no use. Several forms are filled out in more phases during which a considerable time elapses and the filling is done by more data supplier. However, in these cases "business forms" are assumed to be consumed during its first filling out and the further procedures are thought to be made with "business files"

(8) SBF = .2, i.e. 20 percent was assumed. This is a rough guestimation.

Remarks:

Equation 5 and 7:

No solid statistical data are available for these quantities. As a matter of fact, several common forms like those of Inland Revenue Office and Central Statistical Office are soon outdated or become obsolete and only some of them are reprinted and used in an invariable way for a longer time. These estimations are highly speculative.

1.1.1.6. Post Stamps

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the previous year

2. P (Volume produced) = DPI * DPI * ANC * $^{2}\log$ NGL * (1 / SWP) * PST

3. I (Volume imported) = DPI * DPI * ANC * ${}^{2}\log$ NGL * (IES * ASPS + IPE * (1 / SWP))

4. E (Volume exported) = DPI * DPI * ANC * ${}^{2}\log$ NGL * (EES * ASPS + EPE * (1 / SWP))

5. C (Volume consumed) = P - DVDO

6. U (Volume used) = P + V_{jan}

7. V_{dec} (Volume of stock as of December 31st) = V_{jan} + P - C - E + I

7a. For 1990: NPOP = DPI * ANC * NGL * ASPS * (NCPS * ANPS)

Definition of symbols:

Equation 1

Equation 2

DPI: Average resolution in dots per inch (1)

ANC: Average number of colors (2)

NGL: Average number of grey levels (3)

PST: Annual production of post stamps in metric tons (4)

SWP: Specific weight of paper (5)

Equation 3

IES: Number of post marks imported in the frames of exchange between philatelies and collectors. (6)

IPE: Number of post marks imported as printed matter (7)

Equation 4

EES: Number of post marks exported in the frames of exchange between philatelies and collectors. (8)

EPE: Number of post marks exported as printed matter (9)

Equation 5

Equation 6

Equation 7

Equation 7a

NCPS: Number of registrated collectors of post stamps (10)

ANPS: Average number of post stamps in the collection of registrated collector (11)

ASPS: Average area of a post stamp in mm^2 (12)

Sources:

(1) DPI = 600 dot/inch was used due to dimensions of post stamps and printing technology.

(2) Gross average of the printing products was applied here as an estimation. The data were published by HCSO in the issues of "Iparstatisztikai évkönyv". Actually post stamps may not follow the trend of "coloration" of printed matter, i.e. i.e. the new products are more and more colored, for post stamps have always been products of high standards. A lower estimation can be determined as 1, a third of the value of 1990.

(3) The standard NGL = 128 was applied here, too.

(4) Annual data of HCSO's industrial statistics.

(5) SWP = 14.286 m^2/ kg (70 g/m^2), value of an average post-stamp paper was assumed **[Pap80]**, **[Nyom79]**.

(6) Estimated from the average price of a piéce of post stamp (Courtesy of Hungarian Philately) and value of exports (Annual data of HCSO).

(7) Annual data of HCSO.

(8) Estimated from the average price of a piéce of post stamp (Courtesy of Hungarian Philately) and value of exports (Annual data of HCSO).

(9) Annual data of HCSO.

(10) Courtesy of National Association of Hungarian Collectors of Post Stamps.

(11) Estimated by a Member of Board of National Association of Hungarian Collectors of Post Stamps.

(12) ASPS = 4cm^2. Own estimation based upon: [Magyar bélyegek katalógusa (Catalogue of Hungarian postmarks), Magyar Posta, Bp.1986] and 1989. Area of post stamps was subject to changes. In the fifties many big stamps were issued. Later on, in the sixties and seventies, the majority of stamps were small again.

Remarks:

Equation 2:

Production of both new and invalidated (used) post stamps should have been taken into account. These come from three major sources. First, domestic printing industry produces a considerable amount of (new) post stamps. Collectors and some corporations are also engaged in removing post stamps from sendings received both from abroad and from domestic senders. These (invalidated) post stamps should have been considered as domestic production, too. In my approach removed post stamps are new tertiary products and as such their production should be considered in gross information production as [SNA92] suggests.

Equation 3:

Post stamps entered the country in the following ways in the past decades. Scarcely stamps were imported as printing product to be later issued by Hungarian Post as a Hungarian post stamp. As a rule, Hungary is rather an exporter then an importer of post stamps. Hungarian Philately also imports used and clear post stamps issued by foreign post offices in the frames of exchange agreements. Last but not least, collectors exchange post stamps. As it was mentioned earlier, the post stamps on sendings arrived are not considered import of post marks but import of letters/post cards. Post stamps produced by their removing from letters and post cards are viewed as a result of domestic production.

Equation 4:

See Equation 3 mutatis mutandi!

1.1.1.7. Calendars

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the previous year

2. P (Volume produced) = PCAL * 1/SWP * (PP * DPI * DPI * ANC * NGL + (1 - PP) * BPS * PD)

3. I (Volume imported) = (IECA + IPCA) * 1/SWP * (PP * DPI * DPI * ANC * NGL + (1 - PP) * BPS * PD)

4. E (Volume exported) = (EECA + EPCA) * 1/SWP * (PP * DPI * DPI * ANC * NGL + (1 - PP) * BPS * PD)

5. C (Volume consumed) = P + I - E

6. U (Volume used) = NUCA * V_{jan}

7. V_{dec} (Volume of stock as of December 31st) = V_{jan} + P + I - E

Definition of symbols:

Equation 1

Equation 2

DPI: Average resolution in dots per inch (1)

ANC: Average number of colors (2)

NGL: Average number of grey levels (3)

SWP: Average specific weight of printing paper for calendars (4)

PCAL: Production of calendars in metric tons (5)

Equation 3

IECA: Foreign trade imports of calendars in metric tons (6)

IPCA: Postal imports of calendars in thousand piéces (7)

Equation 4

EECA: Foreign trade exports of calendars in metric tons (8)

EPCA: Postal exports of calendars in thousand piéces (9)

Equation 5

Equation 6

NUCA: Annual average number of uses of calendars (10)

Sources:

(1) One use per day was assumed. I believe this is a lower estimation. NUCA = 356.

(2) Annual data of HCSO.

(3) NGL= 128.

(4) SWP = 100 g/m^2 (10 m^2/kg), value of an average halftone paper was assumed **[Pap80], [Nyo79].**

(5) Annual data of HCSO.

(6) Annual data of HCSO.

(7) Communications by the Hungarian Post.

(8) Annual data of HCSO.

(9) Communications by the Hungarian Post.

(10) One use per day was assumed. However, mostly no more than some pages like a week is used. This provides NUCA = 356/52. I believe this is a lower estimation.

1.1.1.8. Playing cards

Equations

1. V_{jan} (Volume of stock as of January 1st) = Vdec of the previous year

2. P (Volume produced) = $PPLC * DPI * DPI * (1 / SWP) * {}^{2}\log NGL * ANC$

3. I (Volume imported) = $IPLC * DPI * DPI * (1 / SWP) * {}^{2}\log NGL * ANC$

4. E (Volume exported) = $EPLC * DPI * DPI * (1 / SWP) * {}^{2}\log NGL * ANC$

5. C (Volume consumed) = RSO * (Vjan + Vdec) / 2

6. U (Volume used) = NUPC * (Vjan + Vdec) / 2

7. Vdec (Volume of stock as of December 31st) = Vjan + P + I - E - C

Definition of symbols:

Equation 1

Equation 2

PPLC: Annual production of playing cards in metric tons (1)

DPI: Average resolution in dot per inch units (2)

SWP: Average specific weight of printing card in g/m^2 (3)

NGL: Average number of grey levels (4)

ANC: Average number of colors (5)

Equation 3

IPLC: Annual import of playing cards in metric tons (6)

Equation 4

EPLC: Annual export of playing cards in metric tons (7)

Equation 5

RWO: Rate of weeding out playing cards (8)

Equation 6

NUPC: Average number of uses of a playing card (9)

Equation 7

Sources:

(1) Annual data of HCSO.

(2) 300 dot/ inch was chosen as a guestimation.

(3) SWP = 280 g/m^2 was chosen. This is assumed to be a good estimation. **[Pap80], [Nyo79].**

(4) NGL = 128. See the chapter on newspapers!

(5) Practically all playing cards are colored. An average of 3 colors was accepted. See the remarks in the chapter on newspapers!

(6) Annual data of HCSO.

(7) Annual data of HCSO.

(8) Rate of sweeping out playing cards. It was assumed that 20 percent is sweeped out yearly. This is a guestimation.

(9) In the period studied, professional "casino" play was not authorized. At households, most popular adults' games are three or four person "ulti" and "rummy". It was assumed that in average a packet of playing cards is used 5 times a year, each time in fifteen games. Packets of most popular adults' games consist of 52 or 32 cards, the "French" and "Hungarian" cards, respectively. Children's packets contain 20-80 cards. An average of 40 cards was assumed. As an average, 80% of all cards was assumed to take part and each such card five times in a game. This provides NUPC = 180. Time-use studies provide an upper limit to cards' use. In average a Hungarian adult spent 2 minutes with chess, playing cards and other games in both 1977 and 1986, comparing with 11 and 9 minutes spent with reading dailies (**[IA/II]** p. 201., line 10.). Reading, however, is a slow input channel, which explains the differences between the bit and time unit figures, especially when considering that chess is certainly much less popular than playing cards are. Anyway, a sure lower estimate may be as low as one tenth of the figure applied. This lends great uncertainty to the estimations made.

1.1.1.9. Stamps

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the previous year

2. P (Volume produced) = PS / SWP * DPI * DPI * 2 log (NGL) * ANC

3. I (Volume imported) = IS / SWP * DPI * DPI * 2 log (NGL) * ANC

4. E (Volume exported) = ES / SWP * DPI * DPI * 2 log (NGL) * ANC

5. C (Volume consumed) = 0.3 * V_{jan}

6. U (Volume used) = VTLC * ANU + VBN * ANUBN

7. V_{dec} (Volume of stock as of December 31st) = VBN + VTLC

7a. VBN = 1000000 * (TTH * VIB3 + FTF * VIB)

7b. VTLC = P / 52

Definition of symbols:

Equation 1

Equation 2

PS: Annual production of stamps in metric tons (1)

PD: Average printing density of stamps in strokes per m^2 units (2)

SWP: Specific weight of printing paper (3)

BPS: Average number of bits per stroke (4)

Equation 3

IS: Imports of stamps in metric ton units (5)

Equation 4

ES: Exports of stamps in metric ton units (6)

Equation 5

Equation 6

ANUBN: Average number of uses of banknotes. (7)

VTLC: Volume of information carried by toto and lottery coupons available as of December 31st (8)

ANU: Average number of uses of toto and lottery coupons. (9)

VBN: Volume of information carried by banknotes available at the year-end (10)

Equation 7

TTH: Number of toto and lotto coupons that have been returned, million piéces (11)

VIB3: Volume of information a coupon carries (12)

FTF: Number of 10/20/50/100 Ft banknotes in circulation, million piéces (13)

VIB: Volume of information a banknote carries (14)

Sources:

(1) Banknotes, personal identity cards, passports, driving licenses, policies, bonds, toto and lottery coupons make the bulk of goods surveyed under this heading. Data are taken from annual industrial statistics of HCSO.

(2) For an account on the conceptual level, PD = 20000 stroke/m^2 was assumed. This is my estimation based upon estimations made on measuring information density of some wrappers.

(3) SWP = 75 g/m^2 was chosen. This is assumed to be a good estimation. **[Pap80], [Nyo79]**.

(4) Standard 17.6 bit/stroke was applied.

(5) Annual statistical data of HCSO of international trade..

(6) Annual statistical data of HCSO of international trade.

(7) The average number of use of banknotes was estimated from the values of cash flow published by HCSO and a model of use of banknotes. The use during

households' purchasing can be approached by taking the size of population above 7 and multiplied with daily average two buying and the number of days yearly, assuming the use of 5 banknotes and coins each time. This provides about 2000 uses yearly per capita, round 1000 petabit altogether, assuming 100 Mbit per banknote at sensory level, and 1 petabit at the perception level.

(9) Toto and lottery coupons are supposed to be used twice in average.

(11) Data of National Toto and Lottery Directorate.

(12) A monocolor lotto coupon carries round 8 Kilobit on the sensory level (75 dpi), and round 2 halves of the coupon * 5 tips * 2 * 2 char / tip + 2 * 20 (serial number) = 800 bit on the conceptual level, if sender, address – which are usually not filled – not taken into account.

(13) The banknotes in the tresors of Hungarian National Bank and other banks as part of the national reserves and reserves of households are included. These data were provided by an official of the Department of Emission of the Hungarian National Bank. The figures represent the difference of cumulated issues and cumulated withdrawals of banknotes. Also HCSO publishes yearly data for the amount of money stocks.

(14) A Hungarian 500/100 and 5000 Ft banknote is 8.2 cm wide and 16.8 cm long. 10/20/50/100 Ft denominations are 7.1 cm wide and 16.2 cm long. These carry round 100 Mbit each, assuming three colors and 400 dpi at he sensory level.

Remark:

Equation 3 and 4

There is a significant legal and illegal transborder transfer of banknotes. According to COMECON agreements, the national banks of the partner countries provided a prefixed amount of their currency yearly which was then sold for tourists. The volume of transborder migration of banknotes altogether, however, has never been known, because illegal flow is significant. Flow of coupons, identity cards and passports has always been forbidden and not significant in quantitative terms.

Equation 6

Use of passports identity cards and driving licenses should be two orders of magnitude less, than that of coupons and banknotes.

1.1.1.10. Miscellaneous printed matter

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the previous year

2. P (Volume produced) = PMP * PD * BPS / SWP

3. I (Volume imported) = IMP * PD * BPS / SWP

4. E (Volume exported) = EMP * PD * BPS / SWP

5. C (Volume consumed) = V_{jan} + I - E + P - V_{dec}

6. U (Volume used) = C

7. V_{dec} (Volume of stock as of December 31st) = RSMP * P

Definition of symbols:

Equation 1

Equation 2

PMP: Annual production of miscellaneous printed matter in metric tons (1)

PD: Average printing density of miscellaneous printed matter in strokes per m^2 units (2)

SWP: Specific weight of printing paper (3)

BPS: Average number of bits per stroke (4)

Equation 3

IMP: Imports of miscellaneous printed matter in metric ton units (5)

Equation 4

EMP: Exports of miscellaneous printed matter in metric ton units (6)

Equation 5

Equation 6

Equation 7

RSMP: Volumen of stocks related to the annual production (7)

Sources:

(1) Annual data of HCSO.

(2) PD = 200 stroke/m^2 was assumed. This is my estimation based upon estimations made on measuring information density of some wrappers.

(3) SWP = 100 g/m^2 was chosen. This is assumed to be a good estimation **[Pap80]**, **[Nyom79]**.

(4) Standard 17.6 bit/stroke was applied.

(5) Annual statistical data of HCSO.

(6) Annual statistical data of HCSO.

(7) No statistical data are available. Five percent was assumed.

1.1.1.11. Maps

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the previous year

2. P (Volume produced) = (VPM / SWM) * AID

3. I (Volume imported) = (VIM / SWM) * AID

4. E (Volume exported) = (VIM / SWM) * AID

5. C (Volume consumed) = V_{dec} * ROC

6. U (Volume used) = V_{dec} * AUN

7. V_{dec} (Volume of stock as of December 31st) = V_{jan} + P + I -E -C

Definition of symbols:

Equation 1

Equation 2

VPM: Weight of maps and plans produced (printed or drawn) in metric tons. (1)

SWM: Specific weight of one m^2 of plain paper. (2)

AID: Average volume of bits per one m^2 of topographic maps. (3)

Equation 3

VIM: Volume of maps and plans imported (in metric tons). (4)

Equation 4

VEM: Volume of maps and plans exported (in metric tons). (5)

Equation 5

ROC: Average rate of weeding out maps (6)

Equation 6

AUT: Average number of yearly use (7)

Sources:

(1) HCSO yearly industrial statistics.

(2) SWM = 110 g/cm^2. Source: **[Nyom79]** p. 680..

(3) AID = 223832779 bit / m^2. Source: **[Deme86]**.

(4) HCSO yearly international trade statistics.

(5) HCSO yearly international trade statistics.

(6) ROC = 0.15. This is an estimation based upon official provisions of deleting and subjective assumptions for the households.

(7) AUN = 10. Subjective assumption. The average lending rate in libraries has varied from 3 to 1 in the past three decades. Cadastral property maps, automobile and military maps are frequently used.

1.1.1.12. Posters

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the previous year

2. P (Volume produced) = (VPM / SWP) * ((BPS * PD) * (1 -PP) + PP * (ANC * DPM * DPM * $^{2}\log$ NGL))

3. I (Volume imported) = (VPI / SWP) * ((BPS * PD) * (1 -PP) + PP * (ANC * DPM * DPM * $^{2}\log$ NGL))

4. E (Volume exported) = (VPE / SWP) * ((BPS * PD) * (1 -PP) + PP * (ANC * DPM * DPM * $^{2}\log$ NGL))

5. C (Volume consumed) = V_{jan} + I - E + P - V_{dec}

6. U (Volume used) = P * DP * VF * SF

7. V_{dec} (Volume of stock as of December 31st) = (DP / 365) * P

Definition of symbols:

Equation 1

Equation 2

VPM: Volume of posters produced (in metric tons). (1)

SWP: Average specific weight of posters per one m^2. (2)

PP: Average rate of pictures (m^2/m^2). (3)

PD: Printing density in character per m^2 (4)

DPM: Printing density in dot per meter. (5)

ANC: Average number of printing colors. (6)

Equation 3

VPI: Volume of posters imported (in metric tons). (7)

Equation 4

VPE: Volume of posters exported (in metric tons). (8)

Equation 5

Equation 6

DP: Average on-display lifetime of a poster (9)

VF: Average number of people noticing and watching an individual copy of the poster. (10)

SF: Rate of attention given to looking at the poster (11)

Equation 7

Sources:

(1) Yearly industrial statistics of HCSO from 1970 and linearly interpolated. The data for the years from 1965 through 1969 are extrapolated values.

(2) SWP = 75 g / m^2. Source: **[Nyom79]** p. 680.

(3) PP = .5. Estimation.

(4) PD = 10000 character / m^2. Own estimation.

(5) DPM = 100 dot/inch. Own estimation.

(6) Yearly volumes of industrial statistics of HCSO.

(7) Yearly foreign trade statistics of HCSO.

(8) Yearly foreign trade statistics of HCSO.

(9) DP = 14 days. Estimation by an expert of MAHIR.

(10) VF = 200. Own guestimation. Of course, the number of people passing by a poster or just looking at the poster but not realizing its presence may be assumed much higher.

(11) Psychology of advertisments deals with perception of advertisements. SF = .01 was applied here as an own estimation.

1.1.1.13. Printed matter NEC

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the antecedent year

2. P (Volume produced) = $VPNEC * (1 / SWNEC) * (PPNEC * ANC * DPM * DPM * {}^{2}\log NGL + (1 - PPNEC) * PD * BPS)$

3. I (Volume imported) = $INEC * (1 / SWNEC) * (PPNEC * ANC * DPM * DPM * {}^{2}\log NGL + (1 - PPNEC) * PD * BPS)$

4. E (Volume exported) = $ENEC * (1 / SWNEC) * (PPNEC * ANC * DPM * DPM * {}^{2}\log NGL + (1 - PPNEC) * PD * BPS)$

5. C (Volume consumed) = $V_{jan} + P + I - E - V_{dec}$

6. U (Volume used) = NUS * P

7. Vdec (Volume of stock as of December 31st) = 0,1 * P

<u>Definition of symbols:</u>

<u>Equation 1</u>

<u>Equation 2</u>

VPNEC: Annual production of printed matter NEC in metric tons (1)

SWNEC: Average specific weight of printing paper (2)

PPNEC: Average coverage of printed matter NEC by pictures (3)

ANC: Average number of colors (4)

DPM: Average resolution in dot per inch units (5)

NGL: Average number of grey levels (6)

PD: Average printing density in character per m^2 units (7)

BPS: Average number of bits per character (8)

<u>Equation 3</u>

INEC: Weight of imported printed matter NEC, in metric tons (9)

<u>Equation 4</u>

ENEC: Weight of exported printed matter NEC, in metric tons (10)

<u>Equation 5</u>

Equation 6

NUS: The average number of uses of printed matter NEC (11)

Equation 7

DP: (12)

Sources:

(1) Yearly industrial statistics of HCSO from 1970 and linearly interpolated. The data for the years from 1965 through 1969 are extrapolated values.

(2) SWNEC = 90 was applied. This is an arbitrary assumption based upon **[Pap80]**, **[Nyom79].** I assume that the exact value may lie somewhere in the interval between 70 and 200 g/m^2.

(3) PPNEC = .50 was chosen. This is a guestimation. Value of this parameter may have varied widely in the past decades. Each of P, I and E is very sensible for the error in this factor, because information density of pictures is much higher than that of texts.

(4) The average for all printing products was applied here. Its deviation from correct values is unknown.

(5) An average DPM = 200 was applied.

(6) NGL = 128.

(7) PD = 2000 character / m^2.

(8) BPC = 17.6.

(9) Annual data of HCSO.

(10) Annual data of HCSO.

Remarks:

Equation 2, 3 and 4

These equations are hypothetic. As it has been indicated earlier, all factors in the equation may be subject to great error. However, the share of printed matter NEC in gross production is low, and its error will not influence and bias significantly it.

Equation 1, 5, 6 and 7

These equations don't represent solid and well founded relations between the factors.

1.1.2. Miscellaneous Information Goods

1.1.2.1. Households' Paper-Based Documents

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the antecedent year

2. P (Volume produced) = $P_{cb} + P_{d} + P_{pb} + P_{doc} + P_{for}$

2a. P_{cb} = 1000 * WDCB * (PCB + ICB - ECB) * (1 / (1000 * SWP)) * BPC

2b. P_{d} = DIAR * (VDA / 2) * NHOU * CPW * BPC

2c. P_{pb} = NPS * VPB * BPC * 2

2d. P_{doc} = NM * SL * VMAI * CPW * BPC

2e. $P_{for} = \Sigma \; P_{for,j}$

3. I (Volume imported) = 0

4. E (Volume exported) = 0

5. C (Volume consumed) = $V_{jan} + P + E - I - V_{dec}$

6. U (Volume used) = $U_{cb} + U_{d} + U_{pb} + U_{doc}$

6a. U_{cb} = NUCB * V_{cb}

6b. U_{d} = NUD * V_{d}

6c. U_{pb} = NUPB * V_{pb}

$$6d.\ U_{doc} = NUDO * V_{doc}$$

$$7.\ V_{dec} \text{ (Volume of stock as of December 31st)} = V_{cb} + V_{d} + V_{pb} + V_{doc}$$

$$7a.\ V_{cb} = 1000 * WDCB * (PCB_i + ICB_i - ECB_i) * (1 / (SWP * 1000)) * BPC$$

The summa is taken for the year and the preceding two years.

$$7b.\ V_{d} = 1000 * DIAR * VDA * NHOU * CPW * BPC$$

$$7c.\ V_{pb} = VPB * NPS * BPC$$

$$7d.\ V_{doc} = DOC * NHOU * BPC$$

Definition of symbols:

Equation 1

Equation 2

P_{cb}: Annual production of copy-books in petabit units (1)

P_{d}: Annual production of diaries in petabit units (2)

P_{pb}: Annual production of personal phone-books in petabit units (3)

P_{doc}: Annual production of household documentation NEC in petabit units (4)

P_{for}: Annual supply of information for government authorities in petabit units (5)

Equation 2a

SWP: Average specific weight of paper of copy books in g/m^2 units (6)

WDCB: Average writing density of copy-books, in characters per m^2 (7)

PCB: Production of copy-books, in metric tons (8)

ICB: Imports of copy-books, in metric tons (9)

ECB: Exports of copy-books, in metric tons (10)

Equation 2b

DIAR: Percent of households keeping personal records/diary (11)

VDA: Average volumen of a diary in word units (12)

NHOU: Number of households, in thousands (13)

Equation 2c

VPB: Average volumen of a personal phonebook, in characters (14)

NPS: Overall trunk line capacity (15)

Equation 2d

SL: Percentage of personal correspondence within all types of mails (16)

NM: Annual number of mails dispatched in Hungary, in millions (17)

DOC: Percent of households holding old family writings and notes (18)

LPC: Length of a piéce of personal correspondence in word units (19)

Equation 2e

(20) $P_{for,j}$: Volumen of the data supplied for the i-th government agency by households, in petabit units.

Equation 3

Equation 4

Equation 5

Equation 6

Equation 6a

NUCB: Average number of the uses of a character of a copy-book (21)

Equation 6b

NUD: The average number of the yearly uses of a diary (22)

Equation 6c

NUPB: Average number of uses of a phone-book yearly (23)

Equation 6d

NUDO: Average number of yearly uses of a piéce of household documentation (24)

V_{cb}: Volume of information accumulated in copy-books at the end of the year, in petabit units (25)

V_{d}: Volume of information accumulated in diaries at the end of the year, in petabits (26)

V_{pb}: Volume of information accumulated in phone-books at the end of the year, in petabits (27)

V_{doc}: Volume of information accumulated in documents at the end of the year, in petabits (28)

Equation 7a

Equation 7b

Equation 7c

Equation 7d

Sources:

(1) The yearly volume of information carried by the lecture-notes made by students and pupils in copy books. Computed from the Equation 2a.

(2) The yearly volume of information carried by private diaries written by individuals for recording family and professional events. Computed from the Equation 2b.

(3) The yearly volume of information carried by private phone-books written by individuals for recording family and professional phone numbers. Computed from the Equation 2c.

(4) The yearly volume of information carried by private household documentation not elsewhere classified. Computed from the Equation 2d.

(5) Annual supply of information for government authorities in forms of applications, complaints, lawsuits etc. Statistical surveys with filling up questionnaires and forms by households are also included. This was computed from the Equation 2e.

(6) SWP = 68 g/m^2, a medium-heavy note-book paper was taken as an average with an attention to the semi-thick cover fitted regularly to copy books.

(7) Own estimation. The writing that is characteristic for an adult, may become consolidated from 14 to 18, but significant changes may occur later. The size of handwriting tends to diminish with age. The constant that was applied in this study, is the average found in six standard copy-books of three different students from primary and secondary grammar schools, aged 6, 14 and 18. Three of the copy-books were lined, two gridded and one was free of preprinting. After a visual study of writing in the copy-books of their classmates these are thought to be "typical" concerning the size of letters and the spaces left free. I mean the error is less than 20 percent. The sample may not be representative for other classes and schools. University students were not represented, but their proportion is low.

(8) Annual data of HCSO.

(9) Annual data of HCSO.

10) Annual data of HCSO.

(11) This figure was taken from a small-sample survey. Percent of those who responded with "Yes" for the following question: Source:

(12) As a rule, diaries take the form of books, calendars or copy-books, each of which contains the events of a year with regular daily records. Sometimes a diary consists of no more than one calendar or copy book with irregular records. Under "diary of a person" all of his/her records will be understood in all books or in any other documentation. Average volume of diary of a person is a function on time. Unfortunately no statistical data are available for this variable. Thus in daily average, five sentences, each with ten words, were assumed. This is based upon a diary which was thought to be typical. This figure is less than that of some well-known literary diaries written in the past century. I also assumed that those who write a diary keep its writing for two years.

(13) Annual data of HCSO, published yearly in Statistical Year book.

(14) A standard, medium size phone-book was taken as a representative, assuming 50 percent completed. This provides 750 items. 15 characters were applied for an average name record (mostly abbreviated names are used in phone-books), 40 character for an address record and six characters for a phone number were added to obtain 61 * 750 = 38250 character for average overall volumen of a personal phone-book.

(15) Annual data of HCSO from 1937. **[IA/II]** p. 27., col. 7. The data for the fifties and sixties are interpolated from quinquennially data. This figure is slightly greater than the number of subscribers with a trunk line.

(16) **[DSP]** used a report by Arthur D. Lyttle from 1976, which provided 29 percent when financial transactions were not considered. Hungarian Post conducted surveys which suggests significantly higher values, about 40-60 percent. Personal correspondence in Hungary - similarly to other Eastern European countries - is not intensive, although more intensive than in the rest of these countries, according to the testimony of per capita figures. This indicates the lower activity of the business sphere, which can be illustrated, for instance, with almost complete lack of direct mailing.

(17) From 1937 through 1986 the annual data of HCSO: **[IA/II]**, p. 207. col. 2.. The lacking data after 1945 were linearly interpolated. Excluded from this account were coupons of number-lottery and also football pool (toto) coupons. Included in these figures were post cards.

(18) This figure was taken from a small-sample survey. It is the percentage of those who responded with "Yes" for the following question: "Let me allow to ask if there were in the property of the family old or recent written or other remembrances: particularly diaries." Source: Gereben A.

(19) was applied. This was computed from average parameters of writings by Hungarians. These parameters were received from G. Agárdi, Head of Institute for Graphology. **[DSP]** applied 1052, 453,332, 453 and 94 words in personal, government, financial, business letters and in post cards respectively. These figures were taken from an 1976 study for the U.S. Postal Service by RCA Government Communications Systems. The words in the US study are seven characters long.

(20) These were taken from a separate non-published study by the present author.

(21) According to the standard didactic methods in Hungary, customary in primary and secondary schools, copy-books should be used at least four times. Once when the lesson is elaborated, a second time when a chapter is closed and reiterated, third time when - at the end of the semester - the whole subject will be summarized and a fourth time when - in the next semester it will be refreshed. However, I am sure many of the students doesn't follow this way. The text in the copy-books will be read several times on each turn. As a result, I assumed NUCB = 6 and I believe this is a lower estimate.

(22) A hypothetical value of 365*(1/365) was applied, assuming that each record will be used at least once.

(23) I assumed that a personal phonebook is used in average 7 times a day. This is less than the daily number of calls per one trunk, assuming that people remember the numbers they call frequently and they have to consult phone register when looking for a new station. For paging and search a tenth of the book was assumed to be used on each occasion.

(24) I have no idea about the usage of this kind of documentation. Anyway, rate of usage should be low. As a hypothetic value 1/year was applied. This should be an extremely low figure for such professionals like storytellers, poets, or journalists.

Remarks:

Equation 2c

It was assumed that the number the of personal phone-books is greater than the number of phone subscribers and the latter has been applied to estimate the former by multiplying it with a constant factor.

Equation 2d

Private letters were considered under this heading. After dispatching the letters together with the post stamps and envelope will be reclassified as mails.

Equation 2e

There are several forms and questionnaires the citizens fill out upon the request of Tax and Audit Office, Statistical Office and other public organizations every year. These filled documents could be treated as output goods of households or as those of the competent offices.

If those are viewed as goods produced by the authorities, households contribute to their production when supply an obligatory service with providing information added. For practical reasons I shall view these questionnaires as goods produced by the households, whose dispatched copies will be viewed to be transformed later into government documentation. This formula expresses gross **direct** data supply for the government agencies.

This figure shows large-scale fluctuations due to the years of population censuses and microcensuses and elections. Tax returns have been constituting a significant contribution to data supply by households, after personal income tax was introduced in 1988. Gross direct supply altogether should be completed with **indirect** supply in Hungary, in sectoral accounts. This needs some explanation.

Up to the end of the eighties it was Hungarian Social Workers Party which ruled Hungary. It controlled legislation and administration, state-owned and controlled banks, health service, schools, post, social security, security institutions and even "corporations". That means any data supply for these organizations could be considered as **indirect** data supply for the government, because it had an access to these data. Indirect data supply had an extraordinary importance, perhaps much more than direct data supply, but of course, I have no data about its volume.

Equation 3 and 4

Copy-books of foreign students should be considered as exports and the copy-books of Hungarian students conducting studies in abroad as imports. However these were neglected in the computations.

Equation 6

Obviously personal letters in the U.S. seem to be more lengthy than in Hungary. This is another proof of the closedness of Hungarians (See (6) of the present chapter and the chapter on oral communications and phone!).

Equation 7b

It was assumed that in average 2 diaries had been held in those households where a diary was reportedly having been kept.

1.1.2.2. Paper-based business and government documentation

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the antecedent year

2. P (Volume produced) = 1000 * (WWP + IWP - EWP) * (1 / (SWWP / 1000)) * IDWP + 1000 * (WCP + ICP - ECP) * (1 / (SWCP / 1000)) * IDCP + P_{form} + 1000 * NCPF * (1 / (SWBF / 1000)) * (WBF + IBF - EBF)

2a. P_{gov} = PATT + PHLTH + PCOUR + PSOC + PLGVT + PCSO + PCSTM + PMIN

3. I (Volume imported) = E

4. E (Volume exported) = FSIA * ATHD * AND * (1 / THDOC) * NSPS

5. C (Volume consumed) = V_{jan} + I - E + P - V_{dec}

$$6.\ U\ (\text{Volume used}) = ANU * (V_{jan} + Vdec) / 2$$

$$6a.\ U_{gov} = UATT + UHLTH + UCOUR + USOC + ULGVT + UCSO + UCSTM + UMIN$$

$$7.\ Vdec\ (\text{Volume of stock as of December 31st}) = (1 / THDOC) * IDWP * VARCH + (1 / THDOC) * NPOP * (MEDI + LEGA) * IDWP / 16) + \Sigma P_i$$

The sum is taken for five antecedent years.

$$7a.\ V_{dec,gov} = VATT + VHLTH + VCOUR + VSOC + VLGVT + VCSO + VCSTM + VMIN$$

Definition of symbols:

Equation 1

Equation 2

WWP: Weight of writing paper produced yearly, in metric tons (1)

IWP: Weight of writing paper imported yearly, in metric tons (2)

EWP: Weight of writing paper exported yearly, in metric tons (3)

SWWP: Average specific weight of writing paper, g/m^2 (4)

IDWP: Average number of strokes per m^2 on a writing paper (5)

WCP: Weight of computer printout paper produced yearly, in metric tons (6)

ICP: Weight of computer printout paper imported yearly, in metric tons (7)

ECP: Weight of computer printout paper exported yearly, in metric tons (8)

SWCP: Average specific weight of computer printout paper, in g/m^2 units (9)

IDCP: The average number of strokes per one m^2 of computer printout paper (10)

Pform: Volume of preprinted information on business forms, petabits (11)

NCPF: Volume of information added on business forms per one m^2 (12)

SWBF: Average specific weight of business forms, g/m^2 (13)

WBF: Production of business forms, in metric ton units (14)

IBF: Imports of business forms, in metric ton units (15)

EBF: Exports of business forms, in metric ton units (16)

Equation 2a

PGOV: Production of paper-based government documents altogether (in petabits) (17)

PATT: Production of paper-based documents at Attorney's Offices (in petabits) (18)

PHLTH: Production of documents in the institutes of Health Service (in petabits) (19)

PCOUR: Production of documents at courts (in petabits) (20)

PSOC: Production of documents in the offices of Social Security Administration (in petabits) (21)

PLGVT: Production of documents at local governments (in petabits) (22)

PCSO: Production of documents in Central Statistical Office and its filials (in petabits) (23)

Equation 3

Equation 4

NSPS: Average number of strokes per one printing sheet (24)

Equation 5

WDOC: Thickness of documents weeded out from public archives, thousand running metres (25)

Equation 6

NBOR: The annual number of searches in the archives (26)

ATHD: The average thickness of a document in an archive (in centimetres) (27)

AND: Average number of documents requested in a search in an archive (28)

Equation 7

THDOC: Average thickness of a paper sheet, millimetre (29)

VARCH: Volumen of documents archived in official archives in thousand running metres (30)

LEGA: Average thickness of legal documentation hold by an adult (cm) (31)

MEDI: Average thickness of medical documentation hold by an adult (cm) (32)

Sources:

(1) Annual data of the HCSO.

(2) Annual data of the HCSO.

(3) Annual data of the HCSO.

(4) SWP = 75 g/m^2 **[Pap80]**.

(5) In the forties and fifties handwritten documents were still common both in government and business. In the sixties typewriting became overhelming. In the nineties, typewriting has been loosing importance in favor of computer output. Xerocopies became widespread everywhere in the offices.

For our purposes, average information density of a standard A/4 format (210mm*297mm) writing paper was taken. Standard typewriting with 25 lines and 50 strokes were assumed. This provides an upper limit of 20000 strokes/m^2. I mean this is the most frequent product which occurs in private and public files.

As a rule, sheets are not completely covered with texts and some documents have A/5 format. On the other hand, A/3 tables and standard extended pages (with 32 lines and 60 strokes = 49920 strokes/m^2) contain more than 1250 strokes.

The mixed usage of one and double sided documents present a major problem for their proportion is not known. My own experience is that there are some less double sided sheets than one sided. I assumed that half of documents is double sided. All this provides IDWP = 30000 stroke/m^2. Our estimate provides a 60 percent coverage if extended single sided pages are considered.

(6) Annual data of the HCSO linearly interpolated and extrapolated.

(7) Annual data of the HCSO linearly interpolated and extrapolated.

(8) Annual data of the HCSO linearly interpolated and extrapolated.

(9) 70 g/m^2 was applied here.

(10) As far as the average area of a standard character (plus a line) was in the seventies and eighties 2.52mm * 4.12mm = 10.39mm^2, this gives a general upper limit of 96246 stroke/m^2 on a single side of the paper. An industry standard wide mainframe printer may print maximum 7920 strokes on a 72 line and 122 position (305mm*382 mm considering also the area of perforated margins) sheet. This offers an upper limit of 75393 strokes/m^2.

The data applied here were taken from two unpublished reports whose objective was to determine the actual number of characters on standard computer media. **[Tan85]** obtained 3812 character/page +- 22% with neglecting spaces between the records. This corresponds to 32718 character/m^2. When this is corrected for "useful" spaces, 37392 stroke/m2 can be obtained.

Another survey, made with the aid of the operating system of a Honeywell computer at the same institution, counted 10090859 printed lines on 322500 sheets. This shows less than 43 percent useful area what gives 32418 stroke/m2 as an upper limit for this computer centre.

[Fej86] found 7127 stroke/page +- 10.3% (i.e. 61170 stroke/m^2). The spaces between records were included. These data reflect the average information density in the computer centres where the studies were conducted of which the first continued data processing for the central government and the second for businesses. I took the corrected and rounded average of the two figures including "useful" spaces between records: IDCP = 50000 stroke/m^2. This figure is thought to be acceptable from 1975 through 1985.

Earlier, non standard Soviet and other printers make the estimation difficult, but I don't believe that the value of IDCP would have deviated significantly from the value above.

After 1985 the impact of personal computers and workstations and their printers might cause a major change in the data above. Relative importance of the non-printed perforated margin at 80 and 100 column printers could have grown and value of IDCP could have decreased some percent. Also new applications areas, particularly word processing and graphical applications might cause perceivable changes.

(11) See Equation 2 of the chapter on business forms!

(12) This parameter was obtained by taking the average of a small sample consisting of an 1992 customs declaration, an 1991 tax return and a set of 1990 population census questionnaires. Instructions to tax return are one-three tiny 10-50 page brochures attached to the tax return sheet which were qualified as informatory printed material. A guidance to the customs declaration has been printed on the back page.

This provided 5000 character/m^2, or 1 added character / 4 preprinted character. All these questionnaires were designed for usage by both highly and less educated people. Therefore field/box names are long and a considerable amount of comments are given.

(13) 75 g/m^2 was applied **[Pap80], [Nyom79]**. This is probably a good estimation.

(14) Yearly data of the HCSO and linearly interpolated.

(15) Yearly data of the HCSO and linearly interpolated.

(16) Yearly data of the HCSO and linearly interpolated.

(17) This figure has been taken from : Dienes I. Information production in and for the Hungarian government of the 80-s. Budapest, 1992. Manuscript.

(18) There is a detailed survey which revealed that the central and regional offices of attorneys produce a significant and ever increasing volume of information **[Sta86]**. See (17)!

(19) See (17)!

(20) See (17)!

(21) See (17)!

(22) See (17)!

(23) This comprises statistical questionnaires and forms filled by data suppliers, computer printouts made by the central and regional bureaus of Hungarian Central Statistical office. Publications, xerocopied information, statistical data on computer media of the HCSO are excluded together with its internal management documents like memos, resolutions etc. are. See (17)!

(24) See (17)!

(25) From 1970 quinqueennially, from 1980 annual data of HCSO. **[IA/II]** p. 136., col. 6. Linearly interpolated and extrapolated.

(26) From 1970 quinqueennially, from 1980 annual data of HCSO: **[IA/II]** p. 136., col. 7. Linearly interpolated and extrapolated.

(27) This is is an expert's estimate of a fellow of Országos Levéltár (Hungarian National Archives).

(28) This is an expert's estimate of a fellow of Országos Levéltár (Hungarian National Archives).

(29) **[Bod85]** found $1.5*10^6$ sheets on a 240 metre shelf. This assumes .16 mm per sheet. A good quality white paper used for xerocopying and correspondence called "Sirály" is .12 mm thick. The thickness of a hard cover may reach 1 mm.

(30) From 1970 five-annual, from 1980 annual data of HCSO: **[IA/II]** p. 136., col. 4. Linearly interpolated and extrapolated.

(31) Own estimation based on interviews with my friends.

(32) Own estimation based on interviews with my friends.

Remarks:

General remark

This class of information products extends to **government documents** and **business documents.**

The concept of "document" and "government document" has been under debate for several years in FID and other fora.

In the U.S., the concept of **government publication** has been defined by the Title 44 U.S. Code, National Publications Act of 1980 and JCP's 1984 definition .

In the freedom of information and government in sunshine matters **a government document** means "a specific identifiable segment of information produced by a Government entity which may be made available to the public upon request under law or by administrative discretion, but which is not usually considered of such broad public interest as to warrant general publication or distribution." [Her86] on pp. 2-9. writes about the lacking of a precise, yet all encompassing, definition of **government information** which has had a negative impact on the development of effective policies for addressing interagency information flow, the relationship between goverment and other stakeholders in the information sector, economics of government information and public access to government information in the United States. A similar negative impact could certainly be detected in Hungary.

In Hungary, the concept of "a document" is defined by the Law on Archives (Levéltári tvr.), by the regulation of procedures of classifying, and by internal regulation issued by the Minister of the Interior about management of documents in governmental agencies. These definitions, however, comprise such documents, which are discussed as digital media or photos and films within the frames of this study.

The concept of "**paper-based government documentation**" comprises all documents which is being or was made by one of the government agencies or a local government (formerly council/"tanács") on clear paper or forms by handwriting, typing, computer printing, xerocopying or other multiplication procedure and cannot be classified as a "book", "newspaper", "magazine" or "other printed matter", like posters etc..

The application of individual agencies as transactors and general government and central government as sectors of SNIA and of the indicators of output, supply, acquisition, input, production, consumption, use, flow and wealth allow to make subtle distinctions and a detailed description of the processes and phenomena on the area related to "government information", "governmentally distributable information", "public information", "information treated by public institutions", "information private to the government" etc.. This approach also allows an arbitrarily sophisticated regulation.

The relation of production, consumption, use, flow and wealth of business documentation to those of government documentation determines the character of state. When describing these relations, one describe the very operation of state.

Equation 2

A **general distinction between a piéce of "Government and business documents" and a mail** in our definition is simple: a document when it will be sent out by the Post Office becomes a mail. With its dispatching the document is thought to be consumed (transformed into a mail and delivered as such). What is to be furthered by envoys, legates or in any other way is thought to remain a document. Then, at the addressee, mails and documents will be stored as had been qualified earlier. Electronic mails aren't discussed as mails or documents.

Equation 2a

It is not uncommon that the piéces of documentation of courts, bureaus of investigation of police etc. contain documents of interested parties, experts or other institutions.

Furthermore, households produce applications, petitions, memorials, requests, solicitations, pleas and suits with co-operation of legal service bureaus which themselves add information to statements of their clients. These products were considered at households paper-based documents. Several copies of these documents are embedded into the dossiers of government agencies becoming their integrated part.

Offices of Tax and Audit Authority receive and embed tax returns, Customs Authority embeds customs declaration of individuals and business organizations in their files. Gross information production is measured here with summing gross volume of documents in dependently of their original producer. The information added at these organizations is considerably less than the figures shown in the tables.

Equation 3 and 4

It is not uncommon, that government and business documents move across boundaries of countries. International business correspondence, procedures of local authorities (customs documentation, permissions), activities of international organizations (like WHO, UNESCO, UNIDO, INTERPOL etc.) and the international contacts between national governmental agencies provide the frames to it. However, these documents may take the special form of a mail which will be discussed later under the appropriate heading.

The search in domestic archives by non-resident persons is considered as exports.

I assumed that imports have been equal with exports so that over all exports/imports relation shouldn't be biased so much. Exports and imports of Government and business documents will not be studied separately.

Equation 6

Active files and records make the bulk of government and business documents. These are still frequently used. The figure of the use of documents in the official archives is much less. The latter can be estimated by NBOR * ATHD * AND * IDWP / THDOC.

1.1.2.3. Mails

Equations

1. Vjan (Volume of stock as of January 1st) = Vdec of the antecedent year

2. P (Volume produced) = (NMA - NPC) * NWPM * CPW * BPC + NPC * (BPC * CPPC + BPPC) + NMA * BPPS

3. I (Volume imported) = NIMR * ((1 - NPC / NMA) * NWPM * CPW * BPC + (NPC / NMA) * (BPC * CPPC + BPPC) + NIMR * BPPS

4. E (Volume exported) = NFM * ((1 - NPC / NMA) * NWPM * CPW * BPC + (NPC / NMA) * (BPC * CPPC + BPPC) + NFM * BPPS

5. C (Volume consumed) = Vjan + I - E + P - Vdec

6. U (Volume used) = NMR * ((1 - NPC / NMA) * NWPM * CPW * BPC + (NPC / NMA) * (BPC * CPPC + BPPC) + NMR * BPPS

7. Vdec (Volume of stock as of December 31st) = NHH * PHMD * NMPH * ((1 - NPC / NMA) * NWPM * CPW * BPC + (NPC / NMA) * (BPC * CPPC + BPPC) + BPPS)

Definition of symbols:

Equation 1

Equation 2

BPC: Average number of bits per character (1)

NMA: Number of mails accepted by the offices of the Hungarian Post, in millions (2)

NWPM: Number of words per a mail (3)

CPW: Number of characters per word (4)

BPPS: Average volume of information carried by the post stamps affixed to a mail (5)

NPC: Number of post cards accepted by the offices of the Hungarian Post (6)

CPPC: Average number of characters on a post card (7)

BPPC: Average number of bits carried by a picture being on a post card (8)

Equation 3

NIMR: Number of mails arrived in the international traffic (with out transit, in millions) (9)

Equation 4

NFM: Number of mails dispatched in the international traffic less transit, in million units (10)

Equation 5

Equation 6

NMR: Number of mails received by Hungarian adressees, millions (11)

Equation 7

NHH: Number of households (12)

PHMD: Number of households where mails are stored per 100 house holds (13)

NMPH: Number of mails in a household where mails are stored (14)

Sources:

(1) Standard 17.6 bit / characters were applied.

(2) Number of all kinds of mails: ordinary, registered, air, ex press and with value declaration, less toto and lottery coupons. Source: **[IA/II]** p. 207. col. 2. and the yearbooks of the HCSO.

(3) NWPM = 400 including address. A Polish estimation gave a round 300 word per mail, which was used by Visy F. in his computations **[Vis84]**. This is significantly less

than what was published in **[DSP]**: 1052, 453, 332, 453 and 94 words for personal, government, financial, business correspondence and greeting cards, respectively.

The average area of a mail is more than a (double sided) A/4 format writing paper. Average specific weight of paper is 140 g/m^2 **[Pap80]**.

(4) See (4) of the chapter on newspapers!

(5) 9 cm^2 and the average information density of post stamps were applied. This is assumably a lower estimate.

(6) Yearly data of Hungarian Post.

(7) **[DSP]** quotes a U.S. study of 1976, which found 95 words per one "greeting card" (not known whether with or without picture) which mayn't be the same as standard "postal" or "post card" in Hungary.

A postal contains **preprinted information** as follows:

- copyright holder 20,
- producer 15,
- name of the site where the photo was taken 20.
- If the picture is a reproduction of a piéce of art, then its title and author (painter, sculptor etc.) should be added in one-four languages 40-160 (average 60) character.

Added information by the sender are:

- destination 13,
- addressee 20
- street 20
- ZIP code 4,
- number 3,
- stage, door 3,
- salutation, greeting 15,
- dating 18,
- closing formulae 18,
- subscription 15,
- contents 300 (100 for a postal with picture) .

Majority of these data were kindly transferred by fellows of the Hungarian State Population Registration Office and the Register of Corporations of the HCSO.

Added information by post offices :

- stamping and treatment information: 15 character

This altogether is 551 character / postal and 351 character for a postal with picture.

(8) Both line drawings and toned pictures are reproduced on postals. 200 bit/inch resolution, 128 grey levels and 2 colors were assumed as an average. According to oral communication of a fellow of Hungarian Post, about 10-25 of all post cards were picture post cards. The average area of post cards is about that of the standard 120 mm * 160 mm = 19200 mm^2. This results 2.38 Mbit per one post card.

(9) Yearly data of HCSO: **[IA/II]** p. 207. col. 4.

(10) Yearly data of HCSO: **[IA/II]** p. 207. col. 3.

(11) Yearly data of HCSO: **[IA/II]** p. 207. col. 6.

(12) Data of HCSO.

(13) No survey data are available for Hungary.

In 1960 450.6 million mails were delivered and 884.6 million mails in 1986. Some half of these mails were delivered to individuals. This gives in average 23 and 42 letters yearly respectively.

I assumed that two percent of those who preserve correspondence store all letters they receive. People in dependence of their age conduct correspondence for 0 60 years. 20 years was taken as an average. This gives 640 letters in average. The rest of them were assumed to store some selected - I guess twenty - letters only, important piéces as love correspondence, notification of birth, marriage or death etc.. All this altogether provides in average 32 letters.

(14) The figure 104/1000 has been taken from a survey in the early seventies. It is the number of those who positively replied the question "Let me allow to ask if there were in the property of the family old or recent written or other remembrances: particularly personal correspondence Source: F. Gereben.

Remarks:

Equations 1 to 7

In the perception level approach, post stamps represent a significant part in the volume of information carried by mails. The algorithms that have been used for the estimation provide that the figures for the volume of information carried by post stamps on mails should be proportional to the number of mails.

Equation 3 and 4

Post stamps are increasingly replaced with the prints of various franking machines. Their printing is obviously more robust and carries less information.

1.1.2.3. Photos

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the antecedent year

2. P (Volume produced) = DPIP * DPIP * ANCP * $^{2}\log$ NGL * (PPP + IPP - EPP)

3. I (Volume imported) = 0

4. E (Volume exported) = 0

5. C (Volume consumed) = (V_{jan} + P) * RC

6. U (Volume used) = V_{jan} * NUSP

7. V_{dec} (Volume of stock as of December 31st) = NHOU * NPST * PHOT * DPIP * DPIP * ANCP * $^{2}\log$ NGL

Definition of symbols:

Equation 1

Equation 2

DPIP: Average resolution of photographic papers in dots per inch (1)

ANCP: Annual average proportion of color paper used in m^2/m^2 percents (2)

NGL: Average number of grey levels (3)

PPP: Production of photographic paper, in metric tons (4)

IPP: Imports of photographic paper, in metric tons (5)

EPP: Exports of photographic paper, in metric tons (6)

Equation 3

Equation 4

Equation 5

RC: Rate of consumption, in m^2/m^2 units (7)

Equation 6

NUSP: Yearly average number of uses of a photo (8)

Equation 7

NHOU: Number of households (9)

NPST: The number of photos held in average in a household where photos are hold (10)

PHOT: Percentage of households holding photos (11)

Sources:

(1) Photographic papers are characterized with their grain size. Mean grain size of undeveloped low/high sensitivity of black and white paper is somewhere 0.3 - 1 micrometer, i.e. 500 - 1500 grains can be distinguished per one mm.

Resolution of photographic raw materials is measured in "pair of lines" units. Its usual value is between 100-400 pair of lines/mm i.e. 253 - 1012 dot per inch **[ùjf84]**.

300 dpi was chosen as a representative average. This is a lower estimate.

(2) The share of color papers in all photographic papers is not known. As an approximation I applied share of color negatives in all photonegatives sold in the country yearly, expressed as percent of rolls. For the period from 1975 through 1984 these figures were taken from an experts' study: **[Seb85]** The data for the last five years are extrapolated from a good trend.

(3) The standard 128 levels was applied.

(4) From 1976 through 1990 the annual data of the HCSO. Interpolated linearly and extrapolated.

(5) From 1976 through 1990 the annual data of the HCSO. Interpolated linearly and estimated for 1990 from data in value terms.

(6) From 1976 through 1990 the annual data of the HCSO. Interpolated linearly and estimated for 1990 from data in value terms.

(7) I have no survey data.

Average lifetime of a color photo is 10 - 15 year (i.e. 6 - 10 percent), lifetime of a black/white photo is practically unlimited. Technicolor promises 400 year **[ùjf84]**. Assumably, those are rather people's and institutions' habits than technical constraints which determine when and what they weed out photos.

As a highly speculative guestimation, 20 percent (i.e. 5 year) was applied. I assume that this figure is an upper limit. In households, photos usually are stored lifelong which is not the case at corporations and institutions.

(8) I assumed 4. This is a result of interviews with my friends. The error of the estimate is not known.

Equation 7

(9) Biannual data of HCSO and interpolated. Source: "Háztartásstatisztika".

(10) This is a guestimation based upon my interviews.

(11) Source: A. Gereben.

Remarks

Equation 2

The concept of "photoes" was understood here to include all photos made on black and white or color, paper-based substrate developed on site or in laboratories by fans or professionals and magnifying the negatives of professionals or fans. Photocopied paysages and art reproductions sometimes are sold as post cards. This causes double account.

Equation 3 and 4

These figures were assumed to be zero because no data are available. International trade statistics indicate that the error committed by doing so may not be great. Imports' top was in 1990 with 64 million HUF, and exports amounted to 214 million HUF in the same year. However, this figure included imports of slides and copies of movie-films (without royalties and videos), too. Exports were estimated for some million HUF which corresponds to no more than some terabits. A normal color 9*12 photo costed about 15 HUF. That means a 15 million HUF imports (!) would represent less than one million photos of about 36 terabit assuming 300 dpi. This is as little as some percent of production.

1.1.2.4. Telegrams

Equations:

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = BPC * CPW * ((IWTG / NATG) * NITG -IWTG + EWTG)

3. I (Volume imported) = 0

4. E (Volume exported) = 0

5. C (Volume consumed) = P

6. U (Volume used) = P

7. V_{dec} (Volume of stock as of December 31st) = 0

Definition of symbols:

Equation 1

Equation 2

BPC: Average number of bits per character. (1)

CPW: Average number of characters in a word in a telegram. (2)

NITG: Number of initiated telegrams in the year, in thousands (3)

EWTG: Number of words in telegrams sent abroad in the year, in millions (4)

NSTG: Number of telegrams sent abroad in the year, in thousands (5)

IWTG: Number of words in the telegrams received from abroad, in millions (6)

NATG: Number of telegrams arrived from abroad, in thousands (7)

Equation 3

Equation 4

Equation 5

Equation 6

Sources:

(1) Due to the technology, standard 8 bit characters were chosen.

(2) Standard 6 character words were assumed. This may be some less than what could be found empirically, for people tend to omit articles in telegrams.

(3) Annual data of the HCSO: **[IA/II]**, p.39., col.2.

(4) Annual data of the HCSO: **[IA/II]**, p.45., col.2.

(5) Annual data of the HCSO: **[IA/II]**, p.45., col.3.

(6) Annual data of the HCSO: **[IA/II]**, p.45., col.4.

(7) Annual data of the HCSO: **[IA/II]**, p.45., col.5.

Remarks

Equation 2

Only telegrams printed on paper sheets by post offices were taken into account here. The telegrams sent to abroad - which do not manifest as a tangible good - were considered as a telegraph service. The senders record their messages on standard preprinted forms. These forms are taken into account as forms and as business documentation.

[DSP] estimated a constant of 50 to be the average number of words per telegram. This includes the address and signature. A Polish study found 17 words for Poland in the seventies without address, signature and official communications of the Post. This was quoted and used by **[Vis83].**

The average number of words in telegrams sent to abroad was applied here as an estimate for the average number of words in all telegrams though a number of these were written in foreign languages and according to foreign communication habits. This provides a robust figure around 40 words with minor annual fluctuations. As a matter of fact, arrived from abroad telegrams are longer by 17 percent in the average of the years 1960-1990 than those that were dispatched in the country.

1.1.2.5. Telefax

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the antecedent year

2. P (Volume produced) = (PFXP - EFXP) * VFX

3. I (Volume imported) = IFXP * VFX

4. E (Volume exported) = EFXP * VFX

5. C (Volume consumed) = V_{jan} + I - E + P - V_{dec}

6. U (Volume used) = P * NUX

7. V_{dec} (Volume of stock as of December 31st) = (V_{jan} + I - E + P) * (1 - RCX / 100)

Definition of symbols:

Equation 1

Equation 2

PFXP: Yearly number of fax pages dispatched (1)

EFXP: The yearly number of fax pages sent to abroad (2)VFX: The average number of bits on a fax page (3)

Equation 3

IFXP: Yearly number of fax pages arrived from abroad (4)

Equation 4

Equation 5

Equation 6

NUX: The average number of uses of fax messages (5)

Equation 7

RCX: The rate of consumption (outsorting) in percent units (6)

Sources:

(1) Courtesy of MATÅV.

(2) Courtesy of MATÅV.

(3) VFX = 3 Mbit/sheet. 8 grey levels, 8 pixel/mm horizontal and 9 line/mm vertical resolution were assumed. The information density of good quality faxes may reach 5 Mbit/A4 sheet.

(4) Courtesy of MATÅV.

(5) NUX = 2. Own guestimation.

(6) RCX = 30%. Own guestimation.

1.2. Goods for Machine Use

1.2.1. Records

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the antecedent year

2. P (Volume produced) = 60 * IDR * NDS * TDS

3. I (Volume imported) = 60 * IDR * NRI * TDS * (NDS / (NDS + NT))

4. E (Volume exported) = 60 * IDR * NRE * TDS * (NDS / (NDS + NT))

5. C (Volume consumed) = $V_{jan} - V_{dec} + I - E + P$

6. U (Volume used) = 365 * 60 * IDR * TRT * POPS

7. V_{dec} (Volume of stock as of December 31st) = $P_i + I_i - E_i - C_i$

7a. $C_i = RCR * (V_{i-1} + (P_i + I_i - E_i) / 2)$

7b. V^s = NLIB + NPOP + NSHOP

7c. NLIB = NRLI * RVM * RRTT

7d. NSHOP = (3 / 12) * (P + I - E)

7e. NPOP = RVR * NHOU

Definition of symbols:

Equation 1

Equation 2

NDS: Number of vinyl records produced in the year (1)

TDS: Average playing time of records in minute units (2)

IDR: Number of bits per second (3)

Equation 3

NRI: Number of records and recorded tapes imported in the year (4)

NT: Number of recorded tapes produced by the corporation sector (5)

Equation 4

NRE: Number of records and recorded tapes exported in the year (6)

Equation 5

Equation 6

TRT: Average daily time spent for listening records (7)

POPS: Size of the population which listens records (8)

Equation 7

P_i: Annual production of records in the model (thousand piéces) (9)

E_i: Annual exports of records in the model (thousand piéces) (10)

I_i: Annual imports of records in the model (thousand piéces) (11)

C_i: Long-term average consumption of records in the model (thousand piéces) (12)

Equation 7a

RCR: Average yearly rate of consumption of records (13)

Equation 7b.

V^s: Empirical volume found in the 1982 and 1986 based upon survey data (14)

NLIB: Number of records in the libraries at the end of the year (15)

NPOP: Number of records altogether in the households (16)

NSHOP: Number of records in the shops (17)

Equation 7c.

RVM: Participation of gramophone records in production of voicing materials (i.e recorded tapes and gramophone records)(18)

RRTT: Participation of records in the stock of "other units" in public cultural libraries (19)

NRLI: Number of "other units" in all libraries (20)

Equation 7d.

Equation 7e

RVR: Average number of records in a household (21)

NHOU: Number of households (22)

Sources:

(1) Annual data of HCSO: **[IA/II]** p. 125., col. 2.

(2) In the long period from 1945 till 1990, technology has been changing in a radical way. Parameters reflect the revolutionary development in consumer electronics. **[DSP]** still found 7 minutes as an average for 45 rpm records and 45.5 min for 33 rpm LP records. The Hungarian figure have been computed from the sum of length and number of all works newly recorded in Hungary. Several numbers were purchased from the rest of the world and the records are issued repeatedly. Therefore this estimation may have an error which mayn't be too great.

(3) The revolutionary development of sound recording and replay can be observed in channel capacity either. Channel capacity of a normal record player is about 80 Kbit/sec. Capacity of a HIFI record player is 250-400 Kbit/sec; see e.g. **[Mar]** and **[Min75]**. A compact disc operates at 44 KHz sampling frequency with two channels and 16 bits at each channel. This provides 1.41 Mbit/sec. Although optical discs appeared on the market as early as in 1987, their participation was still low. As a consequence of the very high information density on optical disks the 1990 figure still might have been distorted.

(4) Annual data of HCSO: **[IA/II]** p. 15. col. 5.

(5) Annual data of HCSO: **[IA/II]** p. 8. col.2.

(6) Annual data of HCSO: **[IA/II]** p. 15. col. 4.

(7) The time spent for listening records and recorded tapes was observed together in 1977 and 1986: **[IA/II]** p. 201. columns 1-2 and row 21. The figures were subdivided into two parts due to proportion of records and recorded tapes in stocks.

(8) The number of inhabitants above 7 at the end of the year. Source: Courtesy of O. Nagy of the HCSO.

(9) From 1952 see (1)! For the years before 1952 this was an expert's estimation.

(10) From 1955 see (5)! For the years before 1955 this was an expert's estimation.

(11) From 1955 see (4)! For the years before 1955 this was an expert's estimation.

(12) It was assumed that in 1944/45 and 1950 households suffered a sensible 350 thousand piéce loss as a consequence of the events of World War II., violent resettlement and deportation.

(13) Empirically the rate of breaking proved to be as high as 47 percent between 1982 and 1985. This indicates the errors of the surveys and that a significant number of records should have been exported/imported through non-commercial channels.

RBR was adjusted to the sum of surveyed components of V. The best fit could be obtained at 3.8 percent yearly breaking. This is a surprisingly low value which is still robust for the pre-1952 (hypothetic) values of (8), (9) and (10).

(15) The number of records in libraries was estimated from indirect data according to the equation 7c. The estimation provided about 2.6 million records in the libraries in 1986.

(16) This was estimated with simulation of the stock and fitting of model curve to empirical data.

(17) Finally, the stock in shops was estimated as the six month total of production plus imports minus exports; 4.7 and 3.8 million records in 1982 and 1986.

(18) Computed from (1) of the present chapter and (1) of the chapter on recorded tapes.

(19) Share of voicing materials within "other units" was taken from a survey for public cultural libraries where the number of voicing materials has been surveyed yearly. Source: **[OM85]** p. col.

(20) From 1965, CSO has a quattroannual project which extends to all types of libraries. This provides data for the number of all units and particularly the number of "other units" available in the libraries. The concept of other units covers everything except of books and periodicals, especially microfiché, voicing materials, computer programs, maps, photographs etc..

(21) The surveys for households were conducted by Institute of Mass Communication in 1982 **[IA/II]** p.16. and HCSO in 1986. In 1982 the researchers found in average 43 records in a household that has at least one record. The proportion of such households was 39.3 percent. They found altogether 63.54 and 77.59 million records, respectively.

(22) Annual data of HCSO.

Remarks

Equation 7

This sophisticated and risky estimation procedure was controlled by computing the mean number of records per one record player. Number of record players is known from the independent surveys of HCSO from 1970 through 1990. As expected, this variable shows first a decreasing tendency; early (rich and enthusiastic) owners have more records than average owners. Then, after a minimum the average stock rises again following the general development of standards of living.

1.2.2. Recorded tapes

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the ante cedent year

2. P (Volume produced) = 60 * TBAL * IDR / SOP

2a. TBAL = TPROD + TIMP - TEXP

3. I (Volume imported) = 60 * TOT * NRI * (NT / (NDS + NT))

4. E (Volume exported) = 60 * TOT * NRE * (NT / (NDS + NT))

5. C (Volume consumed) = V_{jan} + I - E + P - V_{dec}

6. U (Volume used) = NPOP * TRT * IDR

7. V_{dec} (Volume of stock as of December 31st) = (VSHOP + SPOP + LATa)

7a. LATa = RC * AGGR

7b. VSHOP = 3 / 12 * NT

7c. VPOP

<u>Definition of symbols:</u>

<u>Equation 1</u>

<u>Equation 2</u>

TBAL: Balance of exports, imports and domestic production of un recorded magnetic audiotapes (million meter). (1)

IDR: Average information density of magnetic audiotapes (2)

SOP: Average playing speed (m/min) (3)

<u>Equation 2a</u>

TPROD: Annual production of unrecorded magnetic audiotapes (mil lion meter) (4)

TEXP: Annual export of unrecorded magnetic audiotapes (million meter) (5)

TIMP: Annual import of unrecorded magnetic audiotapes (million meter) (6)

<u>Equation 3</u>

NT: Number of recorded audiocassettes produced in the corporations sector in the year (7)

NRI: Number of imported records and recorded tapes in the year (8)

NDS: Number of records produced in the year (9)

TOT: Average length of a recorded tape in minute units (10)

Equation 4

NRE: Number of exported records and recorded tapes in the year (11)

Equation 5

Equation 6

NPOP: Number of individuals within the age limits of census (12)

TRT: Average time of listening audio tapes (13)

Equation 7a

TAGGR: Cumulated balance of unrecorded audiotapes (14)

LATa: Cumulated balance corrected by annual consumption (15)

RC: Rate of consumption/annihilation (16)

Equation 7b

SPOP: Number of magnetic audiocassettes/reels in the households (17)

SLIB: Number of units in public cultural libraries (18)

RVM: Estimated share of recorded audiotapes among records and recorded audiotapes (19)

RRTT: Share of records and recorded audiocassettes/reels in public cultural libraries (20)

NSHO: Estimated volume of stocks of recorded audiotapes in shops (million meter) (21)

TOT: Average duration of play of an audiocassette/reel (minute) (22)

LATb: Estimated number of recorded audiocassettes/reels in the country. (23)

Sources:

(1) The equation is not completely correct because the Hungarian production is based upon imported wide tapes being cuttted in narrow tapes and packed into cassettes. Statistics don't provide additional data to account this process in details.

(2) IDR = 44000 bit/sec.

(3) SOP = .045 meter/sec. The parameter is characteristic for an average consumer's set.

(4) Annual statistics of HCSO.

(5) Annual statistics of HCSO.

(6) Annual statistics of HCSO.

(7) Annual statistics of HCSO **[IA/II]** p. 8., col.2.

(8) Annual statistics of HCSO **[IA/II]** p. 16. col.5.

(9) Annual statistics of HCSO **[IA/II]** p. 8., col.3.

(10) [DSP] applied 45 minute.

(11) Annual statistics of HCSO **[IA/II]** p. 16., col.4.

(12) Statistics of HCSO.

(13) There are survey data for the daily time spent for listening records <u>and</u> recorded tapes. This figure has been divided into two parts due to the proportion "Volume of information of recorded tapes"/"Volume of information of recorded tapes and records". For the sources see (12) of the chapter on newspapers!

(14) TAGGR = TAGGR (antecendent year) + TBAL

(15) LATa = TAGGR * (1 - RC)

(16) RC = 2 percent. This estimation was obtained from model computations so that the model data will match actual stocks.

(17) Surveys of Mass Communication Research Institute in 1982 **[IA/II]** p. 16. table at the bottom, and CSO in 1986 (Courtesy of Mr I. Harcsa of CSO).

(18) Statistics of CSO **[IA/II]** p.

(19) Exact data are not known. According to personal communications by librarians to the author, majority of tapes in libraries are factory recorded. Therefore - as a raw estimation - share in the cumulated domestic production was applied.

(20) Statistics of HCSO.

(21) A three-month domestic production of the corporations sector was used as a raw estimate.

(22) TOT = 35 min.

(23) This was computed as sum of households' and shops' stocks: LATb = 60 * SOP * TOT * (SPOP + SLIB * RVM * RRTT) + NSHO

Remarks

Equation 2

The technology can be dated back to the forties. Up to 1958, only Hungarian Radio and some other institutions exploited some professional devices. After 1958 with serial production of cheap Hungarian made tape recorders for consumers the technology became common.

I should like to deal with rolls and cassettes of audiotapes.

Unfortunately the available data are incomplete and inaccurate. There are statistics for the production, exports and imports of magnetic tape (in metre units), but this figure mostly doesn't reflects cassettes. Production, exports and imports of unrecorded cassettes has not been surveyed in natural units of measurement. Unrecorded cassettes are produced by slicing wide magnetic tapes which is an issue in the import. There are data for production, exports and imports of recorded tapes (cassettes).

Illegal or semilegal production, exports and imports make the situation worse. In 1992, sales of illegal recorded cassettes in Hungary were estimated twice as great as that of legal cassettes and 80 percent of the illegal cassettes came from abroad **[Dupl]**

Both studio and home recordings should be considered, but no data for household recording is available. Various simulation experiments indicate that at any reasonable rate of consumption the recording at households is at least as significant as professional recording is.

<u>Equations 3 and 4</u>

See the remarks on Equation 2!

<u>Equation 7</u>

This figure doesn't cover the Archives of the Hungarian Radio, HUNGAROTON and the archives of the government agencies.

1.2.3. Videocassettes

<u>Equations</u>

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the antecedent year

2. P (Volume produced) = IDV * BVT

2a. BVT = PVT + IVT - EVT

3. I (Volume imported) = V_{dec} - V_{jan} - P + E + C

4. E (Volume exported) = IDV * ERVT

5. C (Volume consumed) = V_{jan} * RCV

6. U (Volume used) = $V_{dec} * 3$

7. Vdec (Volume of stock as of December 31st) = IDV * VSTO

7a. VSTO = NHOU * NVID * NTAP * TOT * IDV

Definition of symbols:

Equation 1

Equation 2

BVT: Balance of unrecorded videotapes (metre) (1)

ID: Average number of bits per one meter of recorded videotapes (2)

Equation 2a

PVT: Production of unrecorded videotapes, in metre units (3)

EVT: Exports of unrecorded videotapes (4)

IVT: Imports of unrecorded videotapes (5)

Equation 3

IRVT: Imports of recorded videotapes (6)

Equation 4

ERVT: Exports of recorded videotapes (7)

Equation 5

RCV: Rate of consumption (8)

<u>Equation 6</u>

<u>Equation 7</u>

IDV: Average number of bits on a standard videocassette (9)

VSTO: Volume of stocks (thousand meter) (10)

<u>Equation 7a</u>

TOT: Average minutes per single videocassette (11)

LOT: Average length of tape in a videocassette (in metres) (12)

NTAP: Number of videocassettes per one player (13)

NVID: Number of videosets per 100 households (14)

<u>Sources:</u>

(1) BVT was computed with the Equation 2a.

(2) An 1200 bit/inch tape was assumed as an average. Source: **[Vid]**

(3) Annual statistics of HCSO.

(4) Annual statistics of HCSO.

(5) Annual statistics of HCSO.

(6) Annual statistics of HCSO

(7) Annual statistics of HCSO

(8) No data are available. Technical lifespan of a tape is about 15 years, and usually at least 1000 uses are guaranteed. I assume that rate of consumption of records, audiocassettes and videocassettes show similar regularities and their numeric values may prove to be similar. That means rate of consumption should be between 2 and 5 percent yearly. As far as video has been a relatively new and expensive technique in the eighties, probably videocassettes as more expensive tools have been handled with more care which favors 2 percent.

(9) IDV = LOT * ID

(10) First for each year i, the year j was found when households were as saturated with record players as were saturated with videos in the year i. Then the number of records per one record player in j has been used as an estimation for the number of videos in i. This has been multiplied by the number of households.

(11) There is a choice of unrecorded cassettes. Shops are offering mainly 120, 135, 180, 195, and 240 minute cassettes. The average of unrecorded cassettes seems to be longer than that of recorded.

The figure, applied here, is an average of a small sample of recorded cassettes taken by me in a middle size shop in Budapest. The following classes (shelves) were sampled: Western, horror, thriller, drama, Hungarian cassettes. The sampling provided 122 minute with 21 % error. The dispersion is mainly due to class differences. For instance, coefficient of variation of "westerns" is lower than 7 percent. This is thought to be a lower estimate.

A constant of 135 minutes, which includes time of trailers and shorts as well as a feature movie, was estimated by J.G. Alterman [DSP]. This is in a reasonably good agreement with my estimation.

(12) Standard unrecorded cassettes contain 172-286 metre of magnetic tape. The best selling 120 minute (172 metre) cassette was taken as a representative average.

(13) In accordance with (10), audiocassette/set figures were applied as estimators of videocassette/videoset. For audiocassettes see the chapter on audiocassettes!

(14) From 1986 biannual survey of HCSO, the missing values were linearly interpolated. Courtesy of Ms P. Salamin of HCSO.

Remarks

Equation 2

I should like to deal with rolls and various types of recorded cassettes of videotapes.

Unfortunately, the available data are incomplete and inaccurate. There are statistics for the production, exports and imports of unrecorded magnetic tape (in metre units), but this figure mostly doesn't reflects videocassettes. Up to 1989 due to the limitations of freedom of press a small number of producers have been authorized to publish videocassettes. However, no official statistical data are available for the number of videocassettes published, produced, exported and imported. Production, exports and imports of unrecorded cassettes has not been surveyed in natural units of measurement. Henceforth balance of unrecorded tapes was applied to estimate the volume of information on recorded videotapes.

Equation 3 and 4

Illegal import may be important from the end of the eighties.

Equation 7

Stock of videotapes consists of those of households, libraries and shops. There is no survey of HCSO which covered videocassettes in households, in libraries and in videoshops. Thus I had to apply a sophisticated and uncertain estimation procedure.

1.2 .4. Digital information goods

Equations

1. Vjan (Volume of stock as of January 1st) = Vdec of the antecedent year

2. P (Volume produced) = NMD1 * CMD1 + NMD2 * CMD2 + NFD * CFD + NMT * CMT + NMC * CMC + COD * OD

3. I (Volume imported) = 0

4. E (Volume exported) = 0

5. C (Volume consumed) = Vjan + P + I - E - Vdec

6. U (Volume used) = NUMD * (Vjan + Vdec) / 2

7. Vdec (Volume of stock as of December 31st) = Pi

<u>Definition of symbols:</u>

<u>Equation 1</u>

<u>Equation 2</u>

NMD1: Number of magnetic disks with capacity 1-60 Mbyte, purchased (in thousands) (1)

CMD1: Average volume of information stored on a magnetic disk of capacity 1-60 Mbyte (2)

NMD2: Number of magnetic disks with capacity 61-100 Mbyte, purchased (in thousands) (3)

CMD2: Average volume of information stored on a magnetic disk of capacity 61-100 Mbyte (4)

NFD: Number of floppy disks, purchased (in thousands) (5)

CFD: Average volume of information stored on a floppy disk purchased in the year (6)

NMT: Number of rolls of magnetic tapes, purchased (in thousands of standard 360 m/ 1200 feet rolls) (7)

CMT: Average volume of information stored on a standard roll of magnetic tape (8)

NMC: Number of cassettes of magnetic tape, purchased (in thousands) (9)

CMC: Average volume of information stored on a cassette of magnetic tape (10)

NPIC: Number of magnetic disks produced (11)

IIC: Number of magnetic disks imported (12)

EIC: Number of magnetic disks exported (13)

BIC: Margin of magnetic disks produced, exported and imported (14)

COD: Average capacity of an optical disk (15)

OD: Number of optical disks sold (16)

Equation 3

Equation 4

Equation 5

Equation 6

Equation 7

Sources:

(1) For the period between 1981 - 1987 yearly statistics of HCSO: **[IA/II]**, p. 73. line 4. For 1965 - 1980 **[IA/II]** p. 72., table at the bottom, line 4.

(2) CMD1 has been estimated from an empirical study: **[Fej86]** CMD1 = 5.12 Mbyte/disk for the disks of standard 27.5 Mbyte nominal capacity.

(3) For the period between 1981 - 1987 yearly statistics of HCSO: **[IA/II],** p. 73. line 5. For 1965 - 1980 NMD2 = 0. No big computers were available in Hungary at that time.

(4) CMD2 is a variable on time. As far as no data were available, it has been estimated as a constant from an empirical study: **[Tan85]**. This study provided 83 Mbyte/disk and 52 Mbyte/disk for 200 and 100 Mbyte disk drives, respectively.

Nominal capacity of a 100 Mbyte drive is about 61000 little link, i.e. 88 million byte what corresponds 117 million characters. Average saturation is 39 percent wrt characters (p. 4/1).

(5) For the period between 1981 - 1987 Yearly statistics of HCSO: **[IA/II]**, p. 73. line 3. Prior to 1981 and after 1987; extrapolated.

(6) In the whole period up to 1990 5 1/2" diskettes dominated the market (oral communication by the representatives of the largest distributors in Hungary) Sales of HD diskettes became dominant over DD about 1990. As a consequence of these processes the average maximum storage capacity of the disks sold in the year and also the volume of per diskette information that has been factually stored on these diskettes has grown continuously.

A standard 5 1/2" DS DD diskette may contain 500 Kbyte unformatted and 360 Kbyte formatted data. Nominal storage capacity of a DS HD diskette is 1.2 Mbyte. A standard 3 1/4" diskette may store 1.44 Mbyte.

I assumed that half of the formatted nominal capacity is filled with information. The saturation index of my diskettes fluctuates about 72 percent (related to formatted maximum).

(7) For the period between 1981 - 1987 yearly statistics of HCSO: **[IA/II]**, p. 73. line 1. For 1965 - 1980 **[IA/II]** p. 72., table at the bottom, line 3.

(8) An estimation for CMT has been made from the studies mentioned in (2) and (4). **[Tan85]** found that a major government computer centre received 3753 (each 1200 metre) tapes of which 1244 with 800 bpi and dispatched 3733 tapes of which 1296 with 800 bpi, in October 1985. Average density of tapes was .46 in both cases.

The maximum information storage capacity of 800 bpi magnetic tapes was found as follows (Encl. 1/10):

Record length	Length of tape		
(char)	600 feet	1200 feet	2400 feet
20	210 Kchar	430 Kchar	880 Kchar
80	720 Kchar	1400 Kchar	2880 Kchar
600	3000 Kchar	6090 Kchar	12300 Kchar

The same for 1600 bpi tapes was (Encl. 4/2):

Record length	Length of tape
(char)	2400 feet
96	24000 Kchar
190	38000 Kchar

During the same period, an average input and output record (on magnetic tapes) contained 170 character. All this provides a 2212 Kbyte/tape estimation for a completely filled tape and 1018 Kbyte/tape for "real" tape.

[Fej86] found 1868 and 4620 Kbytes/tape for the 45 tapes used in two representative corporation management systems. This gives 2843 Kbyte/tape as a weighted average.

Taking the mean of these figures 1981 Kbyte/tape has been applied in the computations.

(9) For the period between 1981 - 1987 yearly statistics of HCSO: **[IA/II]**, p. 73. line 2.

(1o) In the seventies and early eighties magnetic cassettes were used for data recording. In the eighties various devices were offered as backup. In the nineties, their contribution became so low to overall P that one can say they lost their importance. The parameters of a standard audiocassette were applied since these cassettes were used in the recording devices.

(11) Annual data of HCSO. This is "Magnetic media for computers and controlling devices". The label covers floppies, because no other types of the kind were produced in Hungary.

(12) Annual data of HCSO.

(13) Annual data of HCSO.

(14) BIC = NPIC + IIC - EIC. C.f. with figures for (5)!

(15) Industry offers various drives with rewritable or ROM cartridges from 120 Mbyte up to 21 Gigabyte each. An average 2 Gbyte/cartridge was applied.

(16) Hungarian Academy of Sciences installed first optical disks in its library in 1989.

Remarks:

Equation 2

Digital information goods are not produced in a traditional production cycle, with succeeding phases of use and consumption. In many cases, production, use and consumption are enacted contemporaneously.

However in some cases like with packaged software and first filling up of floppies, it is obvious that a new piéce of digital information goods will form. Volume of information carried by these goods can be estimated.

As a matter of fact, it is gross production of new digital information goods rather than true gross production that can be estimated in this way. Unfortunately, volume of transcriptions, updatings, mergings, expansions and extensions have never been recorded. The studies by **[Tan85]** and **[Fej86]** contain some hints to the estimation of gross information production in an IBM 370 mainframe environment.

Quantity of purchased (unrecorded) magnetic information carriers was matched with production, export and import data of CSO and no contradictions were found considering that the survey of imports of diskettes started in 1985. See figures for (5) and (14)!

1.2.5. Films

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the antecedent year

2. P (Volume produced) = $IDF * IDF * {}^{2}\log NGL * VBP * (3 * ANC / 100 + 1 * (1 - ANC / 100)) * 100 * 100 / (2.54 * 2.54)$

2a. VBP = VPP + VIP - VEP for the years after 1975 and

$VBP_i = VBP_{i+1} * ROG$ for the years before 1976.

3. I (Volume imported) = $IDF * IDF * {}^{2}\log NGL * VIP * (3 * ANC / 100 + 1 * (1 - ANC / 100)) * 100 * 100 / (2.54 * 2.54)$

4. E (Volume exported) = $IDF * IDF * {}^{2}\log NGL * VEP * (3 * ANC / 100 + 1 * (1 - ANC / 100)) * 100 * 100 / (2.54 * 2.54)$

5. C (Volume consumed) = $V_{jan} + I - E + P - V_{dec}$

6. U (Volume used) = $NUS * (V_{dec} + V_{jan}) / 2$

7. V_{dec} (Volume of stock as of December 31st) = $(V_{jan} + P + I - E) * (1 - ROC)$

Definition of symbols:

Equation 1

Equation 2

IDF: Average scanning resolution of films in dpi units (1)

NGL: Average number of grey levels (2)

VBP: Margin of production, exports and imports of films (in thousand m^2) (3)

ANC: Average proportion of color films as percent of areas (4)

Equation 2a

VPP: Annual production of films in thousand m^2 units (5)

VIP: Annual imports of films in thousand m^2 units (6)

VEP: Annual exports of films in thousand m^2 units (7)

ROG: Long-term averaged annual rate of growth of domestic use of films unexposed (8)

Equation 3

Equation 4

Equation 5

Equation 6

NUS: Number of uses annually (11)

Equation 7

ROC: Annual rate of consumption of films (12)

Sources:

(1) Various flat-bed and drum digitizers work at 2400 - 6000 dpi. 2500 dpi was chosen as an average.

(2) NGL = 128.

(3) For the problems see (5), (6) and (7)!

(4) Average proportion of color films as percent of areas is not known. As an estimation the proportion of color negatives in all photonegatives sold in the country yearly, expressed as percent of rolls, was applied. For the period from 1975 through 1984 these figures were taken from an experts' study: **[Seb85].** The data for the last five years are extrapolated from a good trend.

I assume this is an upper estimate. Some kinds of professional sheet films as X-ray films, printing films remain black/white.

(5) Annual industrial statistics of HCSO from 1976 and interpolated linearly. This figure covers the production of unexposed cinematographic, photographic, industrial registrating and printing films. Hungary has one factory, the figures can be viewed complete and correct.

(6) Annual international trade statistics of HCSO from 1976 and interpolated linearly. The figures cover imports of unexposed roll and sheet films.

(7) Annual international trade statistics of HCSO from 1976 and interpolated linearly. The figures cover exports of unexposed roll and sheet films.

(8) This is a guestimation made in an informal way on the basis of the number of cameras at households, and sales of photographic materials and services. The auxiliary data were taken from household statistics of HCSO and manuscripts by T. Sebestyén.

(9) See Equation 3 of the chapter on cinematographic films!

(10) See Equation 4 of the chapter on cinematographic films!

(11) Own guestimation: NUS = 3.

(12) Maximum lifetime of a color slide is 25 - 50 year, that of an exposed and developed negative film is 10 - 20 year. Lifetime of a developed positive cinematographic film is not more than 1/2 - 5 year. ROC = 40%

Remarks

Those are exposed and developed films only - i.e. films that carry information - which will be dealt here, although figures for unexposed films will also be used here as auxiliary data. The term "film" covers a wide range of goods like photographic positive and negative, black/white and color roll films, x-ray sheet films, air-photogrammetric films, infrared films etc. **[ùjf84]**

All kinds of films will be considered here except cinematographic, dubbed, subtitled films and TV-films.

Equation 7

The input arguments of the equation 7 are hypothetic for the years before l976. These figures will be used only for computing the stock of the years after 1975.

1.2.6. TV-films

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the previous year

2. P (Volume produced) = ((IDTVB * (1 - ANC / 100) + IDTVC * ANC / 100)) * PRODHOUR + E

3. I (Volume imported) = IMPHOUR *

4. E (Volume exported) = EXPHOUR *

5. C (Volume consumed) = V_{jan} * ROC

6. U (Volume used) = P + I

7. V_{dec} (Volume of stock as of December 31st) = Vjan + P + I

Definition of symbols:

Equation 1

Equation 2

IDTVB: Information density of color TV broadcasting (1)

IDTVC: Information density of color TV broadcasting. (2)

ANC: Annual rate of color TV-films (3)

PRODHOUR: Length of produced TV-films in hour units (4)

Equation 3

IMPHOUR: (5) Length of imported or received as exchange (from Eurovision and Intervision) TV-films (5)

Equation 4

EXPHOUR: Length of exported or transferred (to Intervision or Eurovision) TV-films in hour units (6)

Equation 5

ROC: Annual rate of consumption (hour/hour*100) (7)

Equation 6

Sources:

(1) IDTVB = 46 megabit/sec This figure was suggested for the black and white broadcasting and/or receiving.

(2) IDTVC = 92 megabit/sec. This figure was suggested by Hungarian Telecommunication Company for the purposes of this study for the SECAM color broadcasting and receiving.

(3) ANC: This is assumed to be the same as that of films. See the chapter on cinematographic films.

(4) **[IA/II]** p. 129.

(5) **[IA/II]** p. 139.

(6) **[IA/II]** p. 139.

(7) 40% was assumed for the copies (not for works). This is a guestimation after a consultation with Hungarian TV (MTV).

Remark: "TV-films" covers films that were produced by the studios of the Hungarian TV. These films were made with videocameras from the eighties and so will not be considered here.

1.2.7. Dubbed films

Equations

1. V_{jan} (Volume of stock as of January 1st) = V_{dec} of the previous year

2. P (Volume produced) = DPIF * DPIF * $^{2}\log$ NGL * (3 * ANC / 100 + 1 * (1 - ANC / 100)) * (1000 * PCD) * 100 * 100 / (2.54 * 2.54)

3. I (Volume imported) = 0

4. E (Volume exported) = 0

5. C (Volume consumed) = (V_{jan} + (I – E + P / 2) * ROCF

6. U (Volume used) = DPIF * DPIF * $^{2}\log$ NGL * (3 * ANC / 100 + 1 * (1 - ANC / 100)) * (1000 * 90MIN * PROPDUB) * 100 * 100 / (2.54 * 2.54)
6a PROPDUB = P_{dub} / (P_{cin} + P_{dub} + P_{sub})

7. V_{dec} (Volume of stock as of December 31st) = V_{jan} + I - E + P - C

Definition of symbols:

Equation 1

Equation 2

DPIF: Average scanning resolution of cinematographic films in dpi units (1)

NGL: Average number of grey levels (2)

ANC: Average proportion of color films as percent of areas (3)

PCD: Annual production of dubbed films, in thousand metres (4)

Equation 3

Equation 4

Equation 5

ROCF: Annual rate of consumption m/m (5)

Equation 6

PROPDUB: Proportion of Hungarian films in the films of the year (6)

P_{cin}: Volume of production of Hungarian cinematographic films (7)

P_{dub}: Volume of production of dubbed films (8)

P_{sub} : Volume of production of subtitled films (9)

Sources:

(1) DPIF = 2500 dpi

(2) NGL= 128. Color films are multiplied by 3.

(3) ANC Annual statistics of HCSO

(4) PCD: Calculated from annual statistics of HCSO.

(5) See ROC of cinematographic films!

(6) Calculated according to the formula 6a.

(7) See Equation 2. of the chapter on cinematographic fils!

(8) See Equation 2 of the present chapter!

(9) See Equation 2 of the chapter on subtitled films!

Remarks:

Export and import is assumed to be zero,which with rare exceptions when dubbed films were exported mostly to the neighboring countries, which have a significant Hungarian minority.

The estimation for stocks may contain significant error. Even the algorithm to calculate stocks is not well founded.

1.2.8. Subtitled films

Equations

1. V_{jan} (Volume of stock as of January 1st) =

2. P (Volume produced) = $DPIF * DPIF * {}^{2}\log NGL * (3 * ANC / 100 + 1 * (1 - ANC / 100)) * (1000 * PCS) * 100 * 100 / (2.54 * 2.54)$

3. I (Volume imported) = 0

4. E (Volume exported) = 0

5. C (Volume consumed) = $(V_{jan} + (I - E + P)/2) * ROCF$

$$U \text{ (Volume used)} = DPIF * DPIF * {}^{2}\log NGL * (3 * ANC / 100 + 1 * (1 - ANC / 100)) * (1000 * 90MIN * PROPSUB) * 100 * 100 / (2.54 * 2.54)$$

6a $PROPSUB = P_{sub} / (P_{cin} + P_{dub} + P_{sub})$

7. V_{dec} (Volume of stock as of December 31st) = $V_{jan} + I - E + P - C$

<u>Definition of symbols:</u>

<u>Equation 1</u>

<u>Equation 2</u>

DPIF: Average scanning resolution of cinematographic films in dpi units (1)

NGL: Average number of grey levels (2)

ANC: Average proportion of color films as percent of areas (3)

PCS: Annual production of subtitled films, in thousand metres (4)

<u>Equation 3</u>

<u>Equation 4</u>

<u>Equation 5</u>

ROC: Rate of consumption of subtitled films (5)

<u>Equation 6</u>

PROPSUB: Proportion of subtitled films in the films of the year (6)

P_{cin}: Production of Hungarian cinematographic films (7)

P_{dub}: Production of dubbed cinematographic films (8)

P_{sub} : Production of subtitled cinematographic films (9)

Equation 7.

Sources:

(1) DPIF = 2500 dpi

(2) NGL= 128. Color films are multiplied by 3.

(3) ANC Annual statistics of HCSO

(4) PCS: Calculated from annual statistics of HCSO.

(5) See ROC of the cinematographic films!

(6) Calculated according to the formula 6a.

(7) See Equation 2. of the chapter on cinematographic films!

(8) See Equation 2 of the chapter of the dubbed films!

(9) See Equation 2 of the present chapter!!

Remark:

The estimation for stocks may contain significant error. Even the algorithm to calculate stocks is not well founded.

1.2.10. Cinematographic films

Equations

1. V_{jan} (Volume of stock as of January 1st) =

2. P (Volume produced) = $DPIF * DPIF * {}^{2}\log NGL * (3 * ANC / 100 + 1 * (1 - ANC / 100)) * (1000 * PCF) * 100 * 100 / (2.54 * 2.54) + E$

3. I (Volume imported) = $DPIF * DPIF * {}^{2}\log NGL * (3 * ANC / 100 + 1 * (1 - ANC / 100)) * (IFF * LFF + ISF * LSF) * 100 * 100 / (2.54 * 2.54)$

4. E (Volume exported) = $DPIF * DPIF * {}^{2}\log NGL * (3 * ANC / 100 + 1 * (1 - ANC / 100)) * (EFF * LFF + ESF * LSF) * 100 * 100 / (2.54 * 2.54)$

5. C (Volume consumed) = $(V_{jan} + (I - E + P)/2) * ROCF$

6. U (Volume used) = $DPIF * DPIF * {}^{2}\log NGL * (3 * ANC / 100 + 1 * (1 - ANC / 100)) * (1000 * 90MIN * PROPCIN) * 100 * 100 / (2.54 * 2.54)$

6a $PROPCIN = P_{cin} / (P_{cin} + P_{dub} + P_{sub})$

7. V_{dec} (Volume of stock as of December 31st) = $V_{jan} + I - E + P - C$

Definition of symbols:

Equation 1

Equation 2

DPIF: Average scanning resolution of cinematographic films in dpi units (1)

NGL: Average number of grey levels (2)

ANC: Average proportion of color films as percent of areas (3)

PCF: Annual production of new original feature and short films, in thousand metres.Dubbed and subtitled films and amateur films of 8, 2*8mm and other technique are excluded. These techniques – due to their expensiveness and legal limitations - were not widespread before 1990. (4)

Equation 3

IFF: Annual number of feature films imported. Dubbed and subtitled films are conceptually excluded (5)

LFF: Average length of feature films produced in the year in meter units (6)

ISF: Annual number of short films imported (7)

LSF: Average length of short films produced in the year in meter units (8)

Equation 4

EFF: Annual number of feature films exported. If a film was exported n times, each exportation (copy) was considered here. Dubbed and subtitled films are conceptualy excluded. (9)

ESF: Annual number of short films exported (10)

Equation 5

ROC: Rate of consumption (11)

Equation 6

NOOFPRO: Annual number of projections (12)

90MIN: Length of 120 minute normal film, in meters (13).

PROPCIN: Proportion of Hungarian films in the films of the year (14)

P_{cin}: Production of Hungarian cinematographic films (15)

P_{dub}: Production of dubbed cinematographic films (16)

P_{sub} : Production of subtitled cinematographic films (17)

<u>Equation 7.</u>

<u>Sources:</u>

(1) DPIF = 2500 dpi

(2) NGL= 128. Color films are multiplied by 3.

(3) ANC Annual statistics of HCSO

(4) PCF: Annual statistics of HCSO **[I-A/II]** p.138

(5) IFF: Annual statistics of HCSO **[I-A/II]** p.138

(6) Calculated from annual statistics of HCSO.

(7) Annual statistics of HCSO **[I-A/II]** p.138

(8) Calculated from annual statistics of HCSO

(9) Annual statistics of HCSO.

(10) Annual statistics of HCSO.

(12) Annual statistics of HCSO.

(13) Calculated from [Hev27]

(14) Calculated according to the formula 6a.

(15) See Equation 2. of the present chapter!

(16) See Equation 2 of the chapter of the dubbed films!

(17) See Equation 2 of the chapter on subtitled films!

Remarks

Only finished exposed and developed cinematographic films will be taken into account in this chapter.

Equation 7

This is a poor way of estimation. Actually, MOKÉP, in the frames of a monopolistic film distributing system, maintained an archive of copies of foreign films. Film studios, which produced films also had archives. There are no data about copy-management. This estimation doesn't take into account the stocks of Hungarian Archive of Films, the Archive of Hungarian Television and other deposits.

S E R V I C E S

2.1. Services for Human Consumption

2.1.1. Education

Equations

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = NDS * IDE * 60 * 60 (NPRP * ANHB + NPR * ANHC + NH * ANHD + NSW * ANHE + NMS * ANHF + NTY * ANHG + NSS * ANHH + NHIG * ANHI + NPRE * ANHJ + NSE * ANHK + NHE * ANHL) + 365 * IDE * TT * NPOP

3. I (Volume imported) = NDS * IDE * NSA * HSA

4. E (Volume exported) = NDS * IDE * NFS * HFS

5. C (Volume consumed) = P - E + I

6. U (Volume used) = C

7. V_{dec} (Volume of stock as of December 31st) = 0

Definition of symbols:

Equation 1

Equation 2

IDE: Average number of bits communicated per second in education. (1)

NDS: The average number of days in the semesters, when lectures are given. (2)

NPRP: Number of children enrolled in the preprimary schools. (3)

ANHB: Average number of hours spent by education in the preprimary schools per day and per child. (4)

NPR: Number of students enrolled in the primary schools. (5)

ANHC: Average number of hours spent by education in the primary schools per day and per student. (6)

NHA: Number of students enrolled in the schools for handicapped. (7)

ANHD: Average number of hours spent by education in the schools for handicapped per day and per student. (8)

NSW: Number of students enrolled in the vocational schools. (9)

ANHE: Average number of hours spent by education in vocational schools per day and per student. (10)

NMS: Number of students enrolled in the schools for nurses. (11)

ANHF: Average number of hours spent by education in the schools for nurses per day and per student. (12)

NTY: Number of students enrolled in the shorthand and typing schools. (13)

ANHG: Average number of hours spent by education in the shorthand and typing schools per day and per student. (14)

NSS: Number of students enrolled in the secondary day-schools. (15)

ANHH: Average number of hours spent by education in the secondary schools per day and per student. (16)

NHIG: Number of students enrolled in the high-schools and universities. (17)

ANHI: Average number of hours spent in the high-schools and universities per day and per student. (18)

NPRE: Number of students enrolled in the evening and corresponding faculties of the primary schools. (19)

ANHJ: Average number of hours spent in the evening and corresponding faculties of the primary schools per day and per student. (20)

NSE: Number of students enrolled in the evening and corresponding faculties of the secondary schools. (21)

ANHK: Average number of hours spent in the evening and corresponding faculties of the secondary schools per day and per student. (22)

NHE: Number of students enrolled in the evening and corresponding faculties of the high-schools and universities. (23)

ANHL: Average number of hours spent in the evening and corresponding faculties of high-schools and universities per day and per one student. (24)

NSC: Number of participant passing the final examination of a vocational or professional course. (25)

NHCO: Average number of hours received during a vocational or professional course. (26)

TT: Minutes spent for "Learning with children, help children to learn". (27)

NPOP: Size of population above 18. (28)

Equation 3

NSA: Number of Hungarian students learning in abroad. (29)

HSA: Average number of hours spent in the foreign schools visited by Hungarian students per day and per one student. (30)

Equation 4

NFS: Number of foreign students in Hungarian schools. (31)

HFS: Average number of hours spent by foreign students in Hungarian schools per day and per one student. (32)

Equation 5

Equation 6

Equation 7

Sources:

(1) Information density in the classroom-education can be estimated in various ways.

There is a way **to use parameters of the human information input**. These have been measured by various tests in the past decades. The fundamental problem of the measure is to define the interface to be measured. Channel capacity of a human **at the level of sensory receptors** can be estimated from the number of retinal and audial neurons and the 100 msec average firing frequency. This should be well above 10^9 bit/sec. This approach can be criticized, emphasizing that it is no elementary neural signals are produced and used in education, but ideas, facts, skills expressed as words, pictures etc.

However, the channel capacity of conceptual interface in the brain (i.e. that of inner verbal/conceptual information transfer) is surprisingly low: 10-30 bit/sec This figure is probably reliable, since several repeated tests made by different researchers have provided the very same results. However, there are no good models and solid theoretical background behind the measurements, so we can measure accurately something – of which we do not know what is it.

Information density of the education could be approximated by the **number of words delivered by the teacher**, too. This is also evidently a lower estimate not considering visual impressions and other experience supplied by the teacher. Average speech rate in a natural language dialog is 12.89 voice/sec **[FónMa]**. **[Szen73]** found 79399 voices in 18000 words in a collection of records of spontaneous speech. Registered length was 214 min. This gives 4.41 voice/word, 84.11 word/min and 371.02 voice/min. My average is 111 word/min. Still this raw lower estimate seems to be more than the channel capacity of the inner conceptual interface.

Last but not least, **according to our working definition**, volume of information of any non durable signals is equal to the volume of information of digital signals obtained by their digital recording/reproducing. That means a digital camera scanning the classroom at a viewing angle of a human and a digital audio recorder represents a student and all information is assumed to come from "school". In this approach students are interpreted as if they were "perceiving automata" with two sensory inputs. IDE = 92000000 bit/sec, the constant for color TV broadcasting was applied. This is a lower estimate.

(2) The length of the semesters has been subject to change. In the 50's, the period of extensification of production, semesters were in principle long, but the lack of heating material caused extraordinary vacations. University semesters have been shorter than those in primary and secondary schools and particularly in nurseries. In the late seventies, schools went on to five-day weeks.

(3) Yearly survey of HCSO. Children above 3 were considered only. Source: **[IA/II]** p. 114. col. 2., **[OM92]** p. 59. col.2.

(4) ANHB = 3 hour. Own estimation. Duration of daily stay of children is longer than 6 hours per day. Average education time was considered only.

(5) Yearly survey of HCSO. There is an eight class primary education system in Hungary from 6 to 14. Source: **[IA/II]** p. 114. col. 3., **[OM92]** p. 63. col.2.

(6) ANHC = 4. Own estimation.

(7) Yearly survey of HCSO. There is an eight class system from 6 to 14 in Hungary for handicapped. Source: **[IA/II]** p. 114. col. 4., **[OM92]** p. 72. col. 2.

(8) ANHD = 4 hour. Own estimation.

(9) Yearly survey of HCSO. Education has been organized under the Ministry of Labor, and a number of other ministries. Around 1990, there was a two to four class system after 14 in Hungary in the vocational schools. Source: **[Kua]** p. 38-39., col.10., **[IA/II]** p. 114. col. 5., **[OM92]** p. 75. col. 2.

(10) ANHE = 5 hour. Own estimation.

(11) Yearly survey of HCSO. There is a four class system for the students 14 and more in Hungary in the nursery schools. Source: **[IA/II]** p. 114. col. 6., **[OM92]** p. 80., Table 2., col. 4.

(12) ANHF = 5 hour. Own estimation.

(13) Yearly survey of HCSO. There is a two class system for the students 14 and more in Hungary in the shorthand and typing schools. Source: **[IA/II]** p. 114. col. 7., **[OM92]** p. 80. Table 1., col.4.

(14) ANHG = 5 hour. Own estimation.

(15) Secondary day-schools include secondary grammar schools and other kinds of secondary schools. Yearly survey of HCSO. There is a four class system for the students 14 and more in Hungary in the secondary schools. Source: **[IA/II]** p. 114. col. 8., **[OM92]** p. 83. Table 5. col. 3.

(16) ANHH = 5 hour. Own estimation.

(17) Yearly survey of HCSO. This is the number of students enrolled in the day-education. There is a three to six year system for the students 18 and more in Hungary in high-schools and universities. Source: **[IA/II]** p. 114., col. 9., **[OM92]** p. 98. Table 2., col. 6..

(18) ANHI = 6 hour. Own estimation.

(19) Yearly survey of HCSO. Source: **[IA/II]** p. 112. col. 2., **[OM92]** p. 69. col.2 + col.3 + col.4..

(20) ANHJ = 6 hour. Own estimation.

(21) Yearly survey of HCSO. Source: **[IA/II]** p. 112. col. 3., **[OM92]** Table 5., p. 83., col. 2..

(22) ANHK = 1 hour. Own estimation.

(23) Yearly survey of HCSO. Source: **[IA/II]** p. 112. col. 4., **[OM92]** Table 2. p. 98. col. 2. - col. 6..

(24) ANHL = 2 hour. Own estimation.

(25) Those who passed the final examination at the courses which were held outside the frames of the schooling system accounted in the text above. Source: **[OM86]** p. 102., line 13 "Mindösszesen". The number of participants should have been more than this figures because some participants attended two- or three-year courses and some of them couldn't pass the exam. This may cause an error as great or greater than 100 %. In the latter worst case this induces 4 percent error in gross production of education.

(26) ANCO = 200. Own estimation.

(27) **[IA/II]** p. 201., line 5.

(28) **[Demo85]** p.20-21. and interpolated.

(29) ANHL = 1 hour. Estimation of the present author.

(30) Yearly survey of HCSO. Source: **[OM92]** p. 109., Table 13., col.14..

(31) ANHM = 1 hour. Estimation of the present author.

(32) Yearly survey of HCSO. Source: **[OM92]** p. 109., Table 14., col.14.

2.1.2. Movies's Services

Equations

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = N * MS * IDM * 60 * 60

3. I (Volume imported) = 0

4. E (Volume exported) = 0

5. C (Volume consumed) = P

6. U (Volume used) = P

7. V_{dec} (Volume of stock as of December 31st) = 0

Definition of symbols:

Equation 1

Equation 2

N: Total number of admissions to movies per year. (1)

MS: Average length of one movie in hours. (2)

IDM: Average volume of information carried by a movie performance during one second to a visitor. (3)

Equation 3

Equation 4

Equation 5

Equation 6

Equation 7

Sources:

(1) Yearly statistics of HCSO **[IA/II]** p. col.

(2) MS = 1.5. This was a standard figure for normal length pres entations in Hungary. As a rule, newsreels were presented first, which was followed by a one-part main film. Two part movies were shown with a short intermission between the parts and the visi tors of the two-part films were counted twice in (1).

(3) IDM = 92000000 bit/sec.

Remarks:

Equation 3 and 4

Foreign tourists in domestic cinemas and domestic tourists in foreign cinemas were neglected. I assume that the number of Hungarian resident visitors in foreign cinemas may not be more than some thousandth of Hungarian tourists. Accordingly the number of foreign visitors in Hungarian cinemas may not be more than some hundredth percent of all visitors. This introduces an error of the similar magnitude. As far as the contribution of movies services to gross information production, consumption and use is low this factor may cause insignificant errors in the national figures.

2.1.3. Theatres's services

Equations

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = NTV * DT * IDT * 60 * 60

3. I (Volume imported) = 0

4. E (Volume exported) = 0

5. C (Volume consumed) = P

6. U (Volume used) = P

7. V_{dec} (Volume of stock as of December 31st) = 0

Definition of symbols:

Equation 1

Equation 2

NTV: Number of admissions to theatres in the year. (1)

DT: Average length of a theatre performance. (2)

IDT: Average volume of information carried by a theatre's performance for a visitor per second. (3)

Equation 3

Equation 4

Equation 5

Equation 6

Equation 7

Sources:

(1) **[IA/II]** p. 146. col.3.

(2) MS = 2.5 hour. Own estimate, which is held valid till the end of the eighties. Since then it has been shortening.

(3) Mutatis mutandi, much of that what has been said in (2) of the chapter on education can be repeated here. Information density in the theatres' services could be estimated in various ways.

There are ways **to use parameters of the human information input at the level of sensory receptors or at the level of conceptual interface** in the brain. Information density of the theatres' services could be approximated by the **number of words delivered by the actors/actresses**, too.

According to our working definition, volume of information of any non durable signals is equal to the volume of information of digital signals obtained by their digital recording/reproducing. That means a digital camera scanning the scene at a viewing angle of a human and a digital audio recorder represent a visitor and all information is assumed to come from "theatre". In this approach visitors are interpreted as if they were perceiving automata with two sensory inputs. IDE = 92000000 bit/sec, the constant for color TV broadcasting was applied. This is a lower estimate.

Remarks:

Equation 3 and 4:

Foreign visitors in Hungarian theatres and Hungarian visitors in foreign theatres were neglected.

Equation 6:

This is open to criticism. One feels that due to several factors some information may be lost. However, I couldn't find a better equation.

2.1.4. Concert Performances

Equations

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = NCC * DCC * IDCC * 60 * 60

3. I (Volume imported) = 0

4. E (Volume exported) = P * (PCFV / 100)

5. C (Volume consumed) = P - E + I

6. U (Volume used) = P

7. V_{dec} (Volume of stock as of December 31st) = 0

Definition of symbols:

Equation 1

Equation 2

NCC: Number of admissions to concerts in the year. (1)

DCC: Average length of a concert in minutes. (2)

IDCC: Average volume of information carried by a concert for a visitor per second. (3)

Equation 3

Equation 4

PCFV: Percent of foreign citizens in the audience of concerts. (4)

Equation 5

Equation 6

Equation 7

Sources:

(1) Yearly data of HCSO: **[IA/II]** p. 146. col. 4., **[OM92]** p. 209., col. 11.

The concerts and dance performances organized by the Hungarian Philharmonical Society, State Folk Dance Ensemble, Budapest Dance Ensemble, and the cultural agency ORI. ORI is engaged mainly in pop-concerts, shows and happenings. These organizations provided the most programs of the kind by in the late 80's, but their role has been loosing importance thereafter with new competitive agencies. The figures also don't reflect the "non-public" concerts which were held with less than 10/20 participants at families, churches, schools or local communities. That means, contribution of the household sector to the production of concerts and its consumption, use etc. is lacking from the accounts.

(2) DCC = 1.5 hour. The author is a frequent visitor at concerts of classicals. This is his own subjective estimate which - as an average and as a trend - is held valid till the end of the eighties. Concerts with world-famous pop-stars held in stadiums or in open air theatres raise difficulties in the estimation. Due to dimensions of Hungary, no more than one six-hour-long superconcert in "Népstadion" which attracts 80000 audience may influence considerably the average length of concerts of that year.

(3) Information density of concerts could be estimated on the basis of the orchestral score (partiture) and average pace. How ever, I believe concerts supply not only audial information. In formation density IDC = 92000000 bps was accepted.

(4) PCFV = 2 for the eighties and PCFV = 1 before. This is a guestimation based upon observations of the author during several concerts in the seventies and eighties. This is a variable indeed, whose value is assumed to be more than this figure which should be a lower estimate for the eighties. Both the concerts when classicals are on program and big pop events attracted several foreigners, though the former mainly students, members of the diplomatic bodies and the latter youngsters from the neighboring countries. For the sixties this value may be too high.

Remarks:

Equation 3 and 4:

See the remarks on Equation 3 and 4 in the chapter on movies' services!

Equation 6

This is a weak assumption.

2.1.5. Circus Performances

Equations

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = NVC * DC * IDC * 60 * 60

3. I (Volume imported) = 0

4. E (Volume exported) = 0

5. C (Volume consumed) = P

6. U (Volume used) = P

7. V_{dec} (Volume of stock as of December 31st) = 0

Definition of symbols:

Equation 1

Equation 2

NVCP: Annual number of all visitors of circus performances. (1)

DCP: Average length of one circus performance in hours. (2)

IDCP: Average volume of information carried for a visitor of a circus performance per second. (3)

Equation 3

Equation 4

Equation 5

Equation 6

Equation 7

Sources:

(1) Annual figures of HCSO: **[IA/II]**, p. 146. col. 5. The figures contain the number of visitors of circuses, vaudeville theatres and music halls.

(2) DCP = 2 hour. Own guestimation. I assume that this figure mayn't contain more than 20% error.

(3) See (3) of the chapter on theatres' services!

Remarks:

Equation 3 and 4:

See the remarks on Equation 3 and 4 in the chapter on movies' services!

Equation 6:

See the remarks on Equation 6 of the chapter on theatres!

2.1.6. Popular Science Programs

Equations

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = NVPS * DPS * IDPS * 60 * 60

3. I (Volume imported) = 0

4. E (Volume exported) = 0

5. C (Volume consumed) = P

6. U (Volume used) = P

7. V_{dec} (Volume of stock as of December 31st) = 0

Definition of symbols:

Equation 1

Equation 2

NVPS: Annual number of visitors of popular science programs. (1)

DPS: Average length of a popular science program. (2)

IDPS: Average volume of information carried by a popular science program per second, per visitor. (3)

Equation 3

Equation 4

Equation 5

Equation 6

Equation 7

Sources:

(1) Annual data of HCSO. The figure reflects those programs that were held under the auspices or in the community centres or houses of culture of municipal authorities plus the programs that were financed by trade unions. **[KA]** p.279. col.3. Headings: "Tanács", "szakszervezet", "Egyéb szerv", **[IA/II]**, p. 146. col. 6., **[OM92]** p. 221., col. 3.. After 1986, only those programs of trade unions are included that were organized by their houses of culture. This causes a 15 percent cut in the figures. Due to the joint organization and the definitions, the very same program may appear twice, which was a typical phenomena in the fifties. Many of the programs in the 50's were held on direct political issues but the subjects involved natural and social sciences either.

(2) DPS = 1.5 hour. Own guestimation.

(3) IDPS = 92000000 bit/sec. See (3) of the chapter on theatres' services!

Remarks:

Equation 3 and 4:

See the remarks on Equation 3 and 4 in the chapter on movies' services!

Equation 6:

See the remarks on Equation 6 of the chapter on theatres!

2.1.7. Museums' Services

Equations

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = NVM * DMV * IDMS * 60 * 60

3. I (Volume imported) = IDMS * 60 * 60 * TOUKI * ((ER * NMV) / TOUBE)

4. E (Volume exported) = ER * P

5. C (Volume consumed) = P

6. U (Volume used) = P

7. V_{dec} (Volume of stock as of December 31st) = 0

Definition of symbols:

Equation 1

Equation 2

NVM: Annual number of visitors in Hungarian museums. (1)

DMV: Average length of a visit to a museum. (2)

IDMS: Average volume of information supplied to a visitor of a museum per second. (3)

Equation 3

TOUKI: The number of exits from Hungary, in thousands. (4)

TOUBE: The number of entrances into Hungary, in thousands. (5)

ER: Participation of foreigners among the visitors of Hungarian museums. (6)

Equation 4

Equation 5

Equation 6

Equation 7

Sources:

(1) Annual data of HCSO: **[IA/II]** p. 146. col. 8., **[OM92]** p. 234. col. 6.

(2) DPS = 1 hour. Own guestimation.

(3) See (3) of the chapter on Theatres' services!

(4) Survey of HCSO. Courtesy of J. Kovács.

(5) Survey of HCSO. Courtesy of J. Kovács.

(6) This figure is an average of the numbers provided in 1992 by officials of three major museums, Magyar Nemzeti Múzeum, Magyar Nemzeti Galéria and Szépmûvészeti Múzeum for 1992. These museums are representing ten to twenty percent of all visitors. Minor museums in remote places host much less foreign visitors, but the share of these little museums is low. Regional, "county" museums attract almost as many visitors as the capital's museums.

In 1972, the patriotic Dobó István Múzeum (Eger) lead the toplist with 408 thousand visitors, which was followed by Szépmûvészeti Múzeum (Museum of Fine Arts) with 364, the Museum of the Matthias Church with 356 and Magyar Nemzeti Galéria (Hungarian National Gallery) with 293 thousand visitors of the 2586 visitors of the museums in Budapest, and of some 8 million visitors in all museums of the country.

Remarks:

Equation 3 and 4:

Imports could have been estimated from the number of Hungarian tourists. For instance in 1985, some ten million tourists visited Hungary. (6) gives an estimate for the number of museum visitings per 100 foreign tourists in Hungary. This is 20, which is a honorable rate. The same figure for 1975 is 24. This gives a clue to the rate of visits made by Hungarian tourists in abroad. Assuming that the rate is the same, this suggests some 2 million visits by Hungarians in museums abroad which is ten percent of the all visits paid in Hungarian museums. This would be done by as many Hungarian tourists as the fifty percent of the population. However, these estimates are most uncertain. The number of shopping tourists should be taken out. There may be great differences in habits of tourists of different countries. I applied these highly hypothetic figures, because the magnitude of the phenomenon requires some kind of treatment.

Equation 6:

See the remarks on Equation 6 of the chapter on theatres!

2.1.8. Cultural Services NEC

Equations

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = NVCS * DCS * IDCS * 60 * 60

3. I (Volume imported) = 0

4. E (Volume exported) = 0

5. C (Volume consumed) = P

6. U (Volume used) = P

7. V_{dec} (Volume of stock as of December 31st) = 0

Definition of symbols:

Equation 1

Equation 2

NVCS: Number of visitors at performances of cultural services NEC. (1)

DCS: Length of a performance of a cultural service NEC. (2)

IDCS: Average volume of information carried by a cultural service NEC per second per visitor. (3)

Equation 3

Equation 4

Equation 5

Equation 6

Equation 7

Sources:

(1) Annual data of HCSO: **[KA]** p. 189. col. 5., **[IA/II]** p. 146. col. 7., **[OM92]** p. 223. col. 5. This includes the number of visitors of various evening programs, like performances of humorists, of groups of artists, meetings with known personalities etc. The survey extended to the programs that were held under the auspices or in the community centres or houses of culture of municipal authorities plus the programs that were financed by trade unions. The number of attendants at meetings of amateur dancing, and fine arts groups are not included, since their way of account is doubtful. This may cause a ten percent error. See the data on p. 223. of **[OM92]**! After 1986, only those programs of trade unions are included that were organized by their houses of culture. This causes a 15 percent cut in the figures.

(2) DCS = 1.5 hour. Own guestimation.

(3) See (3) of the chapter on Theatres' services!

Remarks:

Equation 3 and 4:

See the remarks on Equation 3 and 4 in the chapter on movies' services!

Equation 6:

See the remarks on Equation 6 of the chapter on theatres!

2.1.9. TV shows/watching

Equations

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = 1000 * 365 * 60 * LYT * PLT * (IDTVC * NRUC / NRU + (IDTVB * (NRU - NRUC) / NRU) * 1.05

3. I (Volume imported) = 0

4. E (Volume exported) = 0

5. C (Volume consumed) = P

6. U (Volume used) = 1000 * 365 * 60 * LYT * PLT * (IDTVC * NRUC / NRU + (IDTVB * (NRU - NRUC) / NRU)

7. V_{dec} (Volume of stock as of December 31st) = 0

Definition of symbols:

Equation 1

Equation 2

LYT: Average daily per capita watching time. (1)

PLT: Size of population (in thousands). (2)

IDTVC: Information density of color TV broadcasting. (3)

IDTVB: Information density of black/white TV broadcasting. (4)

NRU: Number of sets in use. (5)

NRUC: Number of color sets in use. (6)

Equation 3

Equation 4

Equation 5

Equation 6

Sources:

(1) See (12) of the chapter on TV broadcasting! Background watching (5%) hasn't been qualified as use of TV show/watch. Both cable TV and TV broadcasting driven shows were taken into account here.

(2) Number of population in Hungary as of January 1st. See (13) of the chapter on TV broadcasting!

(3) See (1) of the chapter on TV broadcasting!

(4) See (2) of the chapter on TV broadcasting!

(5) See (5) of the chapter on TV broadcasting!

(6) See (3) of the chapter on TV broadcasting!

Remarks:

Equation 3 and 4:

Foreign visitors consume and use a significant volume of TV shows in hotels, and in resident households. Both is qualified as export. Also Hungarian visitors in abroad watch TV and this makes a considerable volume of import. No survey data are available for time use habits of people in abroad. I assume tourists watch less TV than in their home. Anyway, this is a significant, but unkown volume of information.

2.1.10. Radio program supply/listening

Equations

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = 365 * 60 * PLT * LRB * (IDBR * (1 - (URH / STR) * (NSRIU / NRIU)) + IDSBR * (URH / STR) * (NSRIU / NRIU))

3. I (Volume imported) = 0

4. E (Volume exported) = 0

5. C (Volume consumed) = P

6. U (Volume used) = 365 * 60 * PLT * LTRB * (IDBR * (1 - (URH / STR) * (NSRIU / NRIU)) + IDSBR * (URH / STR) * (NSRIU / NRIU))

7. V_{dec} (Volume of stock as of December 31st) = 0

Definition of symbols:

Equation 1

Equation 2

PLT: Size of resident population. (1)

LRB: Time spent for listening to radio broadcasting as a primary or background activity, in minute units. (2)

IDBR: Volume of information conveyed by normal radio broadcasting per second, per receiver. (3)

IDSBR: Volume of information conveyed by stereo radio broadcasting per second, per receiver. (4)

NSRIU: Number of stereophonic sets in use. (5)

NRIU: Number of radio broadcasting receiver sets in use. (6)

STR: Average number of domestic stations receivable. (7)

URH: Average number of domestic frequency-modulated stations receivable. (8)

Equation 3

Equation 4

Equation 5

Equation 6

LTRB: Time spent for listening to radio broadcasting as a primary activity, in minutes. (9)

Equation 7

Sources:

(1) Practically everybody, including infants, listens to radio broadcasting. Henceforth, the **number of Hungarian citizens** should be used in the account, which wasn't available. The size of **population "de facto" present** as of January 1st was used instead. Two other indicators are **resident population**; those who have a registered residency at a settlement disregarding their actual stay and **living population**; those who lived

at a settlement disregarding their registered residency. The figure includes those who were present in the country at the time of survey: Hungarian citizens and civile foreigners. It doesn't include the number of Hungarian citizens in abroad. The error made is not significant. Even in 1990, the number of Hungarian tourists, diplomats or employees completing a task in abroad should have been lower than 30000 a day, estimated from the yearly number of re-entrant Hungarian citizens. Up to the end of the 70's, this figure should have been as low as 3000. The number of foreign citizens staying in Hungary at the time of the survey should have been less, than three times as much. This is well within the error of survey. Sources for the period 1941-1984 are: p. 5. of [Stat84] and later issues of statistical yearbooks and pocket books for the years after 1984.

(2) The data were taken from Szalai's book: **[Szal]** p. 498. and from the 1977 and 1986 surveys of HCSO.

(3) See (1) of the chapter on radio broadcasting!

(4) See (2) of the chapter on radio broadcasting!

(5) See (5) of the chapter on radio broadcasting!

(6) See (6) of the chapter on radio broadcasting!

(7) See (3) of the chapter on radio broadcasting!

(8) See (4) of the chapter on radio broadcasting!

(7) See (2) of this chapter!

2.1.11. Oral communications

Equations

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = 60 * 365 * IDC * PLT3 * LRB

3. I (Volume imported) = 60 * (TOUBE * TBE + NECBE * NBE) * IDC * LRB

4. E (Volume exported) = 60 * (TOUKI * TKI + NECKI * NKI) * IDC * LRB

5. C (Volume consumed) = P + I - E

6. U (Volume used) = P

7. V_{dec} (Volume of stock as of December 31st) = 0

Definition of symbols:

Equation 1

Equation 2

IDC: Volume of information carried by an alive speaker while speaking. (1)

PLT3: Size of speaking population. (2)

LRB: Average time spent with conversation as a primary or secondary activity. (3)

Equation 3

TOUBE: Yearly number of exits of foreign tourists from Hungary. (4)

TBE: Average number of days spent in Hungary before one exit from the country by a foreign tourist. (5)

NECBE: Yearly number of exits of foreign visitors NEC from Hungary. (6)

NBE: Average number of days spent by a foreign visitor NEC before one exit from Hungary. (7)

Equation 4

TOUKI: Yearly number of re-entrances of Hungarian tourists into Hungary. (8)

TKI: Average number of days spent by a Hungarian tourist in abroad, before one re-entrance. (9)

NECKI: Yearly number of re-entrances of Hungarian visitors NEC into Hungary. (10)

NKI: Average number of days spent by a Hungarian visitor NEC in abroad before one re-entrance into Hungary. (11)

Equation 5

Equation 6

Equation 7

Sources:

(1) In the chapter on newspapers I discussed some problems of speech rate. Speech rate could be applied here. In conversations, however, metacomunication channels, gestures play an important role. It is not speech - a succession of spoken words in an abstract form - but the man who expresses is perceived and all the information on him/her is consumed. That's why IDV = 92000000 bps was applied. This approach is similar to that which I chose at phone talks where channel capacity of the lines was applied instead of speech rate.

(2) The population over 3. Some children can speak as early as 20 months and the bulk of them can speak by the end their second year. However, children's language capabilities are very limited what inclined me to work with the population over three. The data were taken from p. 20. of **[Demo85]** and later issues of Statisztikai évkönyv of HCSO.

(3) The time spent for conversation, discourse and chat in family or at public places. . The data were taken from Szalai's book: **[Szal]** p. 498. and from the 1977 and 1986 surveys of HCSO.

(4) From 1970 annual data of HCSO and interpolated. Courtesy of Å. Probáld and J. Kovács. A tourist is one who spent more than 24 hours in the country. After 1987 a

number of new types of visitors/travelers as illegal traders, refugees etc. appeared among traditional visitors.

(5) From 1970 annual data of HCSO and interpolated. Courtesy of Å. Probáld and J. Kovács.

(6) Business travelers, members of diplomatic body, foreign students. Excluded are drivers of foreign trains, foreign customs officers and similar people. The figure doesn't contain those non-residents who entered or left the country while have been serving at military forces of Warsaw alliance. Corps of the united armed forces accomplished significant regroupings and regular annual fluctuation wasn't ignorable. From 1970 annual data of HCSO and interpolated. Courtesy of Å. Probáld.

(7) As it can be seen from (6), this is a heterogeneous category. I assume that the average duration of a visit tended to shorten, but no data are available. As a guestimation 5 days was assumed which is kept a lower estimate till 1987. For the period after it the extrapolation is completely uncertain. Even the direction of changes is uncertain.

(8) From 1970 annual data of HCSO and interpolated. Courtesy of Å. Probáld. After 1987 all re-entrants.

(9) From 1970 annual data of HCSO interpolated and extrapolated. Courtesy of Å. Probáld. Extrapolation is completely uncertain. The amount of hard currency available for a tourist, transport and accommodation prices, the objectives of the voyages; all were subject to radical changes and these should have changed the habits of tourists.

(10) From 1970 annual data of HCSO and interpolated. Courtesy of Å. Probáld.

(11) See (7) of this chapter!

<u>Remarks:</u>

<u>Equation 3</u>

The information flow within and from the country should have essentially been influenced by the round 100 thousand Soviet troops deployed throughout Hungary and withdrawn in 1991. I did not make an effort to explore this subject area and the Soviet army contingent was left out of all computations, which might cause errors in estimating of indicators of TV show/watch, oral communications, phone, telegrams, newspapers, books, and some other services.

2.2. Services for Machine Consumption

2.2.1. Radio broadcasting

Equations

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = 365 * 24 * 60 * 60 * RIU * (IDRB * (STR - URH) + IDSBR * URH * PSR / 100) + E

3. I (Volume imported) = 60 * 60 * (IDRB * (IRBR - IFM) + IDSBR * IFM)

4. E (Volume exported) = 60 * 60 * (IDRB * (ERBR - EFM) + IDSBR * IFM)

5. C (Volume consumed) = P - E + I

6. U (Volume used) = 365 * 60 * PLR * SWIT * ((URH / STR) * (PSR / 100) * IDSBR + (1 - (URH / STR) * (PSR / 100) *) * IDBR)

6a. SWIT = (LTBR + BGLT) / Q

7. V_{dec} (Volume of stock as of December 31st) = 0

Definition of symbols:

Equation 1

Equation 2

IDRB: Average volume of information carried by a mono radio broadcasting per second, per receiver. (1)

IDSR: Average volume of information carried by a stereo radio broadcasting per second, per receiver. (2)

STR: Average number of domestic stations receivable. (3)

URH: Average number of domestic frequency-modulated stations receivable. (4)

RIU: Number of radio receiver sets in use. (5)

PSR: Stereophonic sets in use as percent of all sets. (6)

Equation 3

IRBR: Imports of radio broadcasting including longwave, mediumwave, shortwave, microwave and frequency modulation in tera receiver-hour units. (7)

IFM: Imports of frequency-modulated broadcasting in tera receiver-hour units. (8)

Equation 4

ERBR: Exports of radio broadcasting including longwave, mediumwave (AM), shortwave, microwave and frequency modulation. (9)

EFM: Exports of frequency modulation broadcasting. (10)

Equation 5

Equation 6

SWIT: Average per capita switch-on time of radios. (11)

Equation 6a

LTRB: Time spent for listening radio broadcasting as a primary activity. (12)

BGLT: Time spent for listening radio broadcasting as a secondary (background) activity. (13)

Q: Average number of listeners. (14)

Equation 7

Sources:

(1) IDRB = 80000 bit/sec. Average channel capacity of radio broadcasting. Source: **[Min75]** p. 192.

(2) IDSR = 400000 bit/sec. Average channel capacity of stereo radio broadcasting. Source: **[Min75]** p. 192.

(3) Broadcasting of the two/three Hungarian domestic programs has been made on some MW and FM bands. SW was used to Hungarian international broadcasting. Three approaches were chosen to estimate STR and URH.

a/ **Annual broadcasting time** and **areal receivability of each** of the two/three domestic programs are published yearly by CSO. Cross product of these figures divided by 365*24 provides an estimation for STR. This is a lower estimation because doesn't consider the fact that more than one bands are available to receive a program.

b/ Receivable stations were determined along the whole scale according to **technical standards** of CCIR in 1980 and 1991 **[ERK91]**. Within this study also STR were determined for each band.

c/ A non-representative survey was also made in 1986 by the present author when on four days the complete scale receivable on a VIDEOTON set was scanned four times and number of stations "**hearable**" was counted in Budapest, not far from geometric centre of the country. This indicated that majority of practically hearable stations is qualified non-receivable by technical standards. However, listeners don't stick themselves to standard quality if they are interested in the program. Standards define requirements for the service suppliers.

(4) The aforementioned ways were available for estimating this parameter, too.

(5) [WCR88] distinguishes number of sets in use and number of licenses issued. In this study the number of licenses was used for the period to 1965 and the number of sets in use for the period after it. There were 2,223.741 and 2,484.248 subscribers and 2,247.670 and 2454800 sets were surveyed in HCSO's (family) household statistics of 1960 and 1965 respectively. This indicates the errors of the households survey. For 1985 and 1990 an own estimate was made for the number of sets in institutional households (hospitals, offices, jails, schools, military barracks etc.).

Many stations technically receivable or practically hearable can not be received on average sets whose scale is limited.

No detailed study is available for the extent of the scale on an "average" Hungarian set. In a governmental program of the fifties, a great number of "folk-receivers", cheap AM sets were sold. As for now, obviously most sets belong to the pocket and hand-hold categories. AM an LW is widespread on these receivers, but SW and FM is not common. Receivability of SW significantly influences imports. Sources: **[KA73]** p. 178. col. 5.

(6) Biannual data of HCSO, published in "Háztartásstatisztika".

(7) This was measured in a problem oriented study **[ERK91].**

(8) This was measured in a problem oriented study **[ERK91]**.

(9) This is to be measured in a problem oriented study **[ERK92]**.

(10) This is to be measured in a problem oriented study **[ERK92]**.

(11) Switch-in time and per capita switch-in time were not regularly measured. Average time of listening can be used in model-calculations to estimate switch-in time, hypothesizing the size distribution of listeners' groups.

Various size-distributions of listeners' communities were hypothesized and a number of model computations were completed to get to a good estimation of average switched-on time.

If it were assumed that the **distribution matches with that of family sizes**, then we would obtain that the per capita switched-in time fell from 29 minute to 20 minute between 1963 and 1990.

The size distribution of listeners' communities was also computed on the more realistic assumption that it is such, as if **all but one members of families** would constitute them. On this condition, the average per capita switched-on time falls from 38 minute to 27 minute.

Furthermore, one may assume that **the members of one-member households listen to the radio alone and the members of households with more than one member listen in communities which consist of all but one members of the household**. Under such an assumption, switched-on time is 42 and 29 minute in 1963 and 1990, respectively. Inasmuch we assume that individual listening is much more frequent than the percentage of the one-member households, for instance 66 percent, the switched-on time might have climbed up to 36 minute by 1990, after a minimum of 30 percent in 1976. Realistic estimations provide figures between 36-42 percents for 1963 and 27-36 percent for 1990, which indicates a probable decreasing.

Per capita switch-in time and switch-in time can be calculated, if average number of audience is known.

(12) See the chapter on radio program supply/listening!

(13) See the chapter on radio program supply/listening!

(14) Since the 20's, there was an **obligatory subscription system** in Hungary. Law allowed the subscriber to operate one or more sets. The system provided statistical data for the number of subscribers. **Households statistics** of HCSO supplied yearly data for the total number of sets and number of households with at least one sets.

In 1950, round one tenth of the households had sets (mostly one), there were 619 thousand subscribers. Listening was a more or less but never completely collective activity, for timetables of different generations of households have been different.

In 1960, there were 3079 thousand households of which 2223 thousand had subscription. The one family - one set system with collective listening persisted till 1965 when hand-hold and pocket radios appeared on the market.

In 1970, there were 3412 thousand sets in 3378 households of which 2530 thousand had subscriptions. This indicates that a significant number of households had already more than one set.

According to official statistics, in 1979 3694 thousand households had 2607 thousand subscriptions and 5135 thousand sets. That means, a third of the households still wouldn't have sets, but there were in average almost two sets in the rest of the households. According to households statistics of 1976, however, 92 percent of households had at least one set. This indicates that a great number of households operated sets without subscription. In 1979 the subscription system (and statistics respectively) was even terminated. Anyway, individual listening should have gained ground.

By 1986 the participation of households with at least one set rose over 90 percent and by 1990 might have got to 98 percent. At that time there were 3783 households with 7377 sets in Hungary. Average size of audience was estimated as the average size of households around 1950 and 1 in 1990.

Remarks:

Equation 3 and 4

Exports, imports and externalities of domestic and foreign TV broadcasting are taken into account here together.

Equation 6

The "active time of sets", i.e. the aggregated duration of time when sets were switched on, would be needed for the computation of figure of use of radio broadcasting. This parameter, which will be called **switched-in time** and denoted by T, isn't surveyed. It was estimated according to Equation 6a.

Equation 6a

If the known number of sets in use is multiplied with known average per capita time spent by an individual with listening to radio, this will deviate from that what is needed, for **collective listening** and presence of non-listeners distort the account. A ten minute switch of a set provides twenty minute listening for the two listeners of a two-member household.

The table illustrates the relations in two hypothetic households, particularly a **traditional, large, five member family** with mainly collective listening and a small **modern family** with mainly **individual listening**.

The dimensions of **background listening of employees**, i.e. that of use of broadcasting in institutional households, aren't known, but the phenomenon has been widespread in Hungary. The table is invariant for dividing by the number of units in the period (e.g. days). The number of sets doesn't influence switch-on time directly, but favors to individual listening.

Table. Volume of the services of the broadcaster and the set-owner in two hypothetic households in a three-day period, in minute units.

	Household 1					Household 2				
	Day 1	Day 2	Day 3	**Average daily watch (min)**	Output, of the set-owner and use of its service (min)	Day 1	Day 2	Day 3	**Average daily watch (min)**	Output, of the set-owner and use of its service (min)
Use of the broadcast: Switch-in time (min)	**120**	**110**	**100**	**110**		**120**	**110**	**100**	**110**	
Person 1	110	100	90	100	300	60	30	30	40	120
Person 2	80	90	100	90	270	60	70	80	70	210
Person 3	80	90	70	80	240					
Person 4	110	100	60	90	270					
Person 5	100	110	0	70	210					
Total	**480**	**490**	**300**	**86**	**1290**	**120**	**100**	**110**	**55**	**330**

Output of broadcaster to the setowner,and the consumption of setowner is 3*24*60= 4320(min) for both households, if assuming one channel.

Table. Output, consumption and use of services of broadcaster and set-owner on one day by hours in a hypothetic five-member household of Smiths during one day.

Time from to (hour)	Person 1	Person 2	Person 3	Person4	Person 5	Time spent with the set altogether: output o the set owner (min)	Number of listeners in front of the set: size of audience
16-17				Listens		60	1
17-18	Listens					60	1
18-19	Listens				Listens	120	2
19-20	Listens	Listens	Listens		Listens	240	4
20-21			Listens		Listens	120	2

21-22		Listens	Listens		Listens	180	3
22-23					Listens	60	1
Total output by users (min)	180	120	180	60	300	840	14

The daily broadcast time 1440 min is the measure of the output and consumption of the broadcaster's service. Switched-in time (time of operation) of the set is 420 min, which is the measure of the use of the broadcaster's serviceby the set owner, Mr Smith. The output and consumption of the set-owner is characterized with time of listening. Average per capita listening is 840/5=168 min, per capita switch-in time is 420/5 = 84 min, average number of audience 14/7=2 persons.

Table. Time spent with the set by persons and by size of audience in the Smiths' household

	Size of audience					
	1	2	3	4	5	**Average for the person**
Person 1	60	60	60	0	0	**2**
Person 2	0	60	60	0	0	**2.5**
Person 3	0	60	60	60	0	**3**
Person 4	60	0	0	0	0	**1**
Person 5	60	120	60	60	0	**2,4**
Total (min)	**180**	**240**	**240**	**120**	**0**	**2**

Table.Explanation of notations.

Size of household (person)	Number of house-holds	Size of population in households	Audience						**Time of listening , total**	**Switch-on time total (min) T_i**
			1	2	3	4	5	more		
			Spent minutes with listening							
1	N_1	P_1	M_{11}						$\mathbf{M_{1.}}$	$\mathbf{T_1}$
2	N_2	P_2	M_{21}	M_{22}					$\mathbf{M_{2.}}$	$\mathbf{T_2}$
3	N_3	P_3	M_{31}	M_{32}	M_{33}				$\mathbf{M_{3.}}$	$\mathbf{T_3}$
4	N_4	P_4	M_{41}	M_{42}	M_{43}	M_{44}			$\mathbf{M_{4.}}$	$\mathbf{T_4}$
5	N_5	P_5	M_{51}	M_{52}	M_{53}	M_{54}	M_{55}		$\mathbf{M_{5.}}$	$\mathbf{T_5}$
More	N_m	P_m	M_{m1}	M_{m2}	M_{m3}	M_{m4}	M_{m5}	M_{mm}	$\mathbf{M_{m.}}$	$\mathbf{T_m}$
Total time of listening	**N**	**P**	$\mathbf{M_{.1}}$	$\mathbf{M_{.2}}$	$\mathbf{M_{.3}}$	$\mathbf{M_{.4}}$	$\mathbf{M_{.5}}$	$\mathbf{M_{.m}}$	$\mathbf{M_{..}}$	$\mathbf{T_i}$
Switch-on time , total			$\mathbf{T_{.1}}$	$\mathbf{T_{.2}}$	$\mathbf{T_{.3}}$	$\mathbf{T_{.4}}$	$\mathbf{T_{.5}}$	$\mathbf{T_{.6}}$		

The following **general conclusions** can be drawn from tables and model computations.

In a household with one set and with several individual listeners, average per capita time of listening may differ greatly from the switched-on time of the set. In a household with more sets and mainly individual listeners, the average number of listeners may be as low as 1.0x and the average per capita time of listening approaches the average per capita switched-on time of all sets. In a society of collective listening, the average per capita time spent for listening should be multiplied with the number of households to obtain total switch-on time.

Let n be the **total number of minutes spent with listening** to the radio as a main or background activity yearly in the country and n_{ijk} the number of minutes spent with listening in the k-th j-member group of an i-member household. If guests or visitors are ignored, then j < i. Let P be the **size of population** in the country, N the number of households and $N_{i.}$ the number of households with i members. Then $N_i * i$ is the **size of population living in households of i members**. Let $M_{ij} = \sum m_{ijk}$, the number of minutes spent with listening in j-member groups of i-member households. $\{M_{ij}\}$ is a triangle matrix, because $M_{ij} = 0$ whenever j > i.

The switched-on time in the k-th i-member household $T_{i.k}$ is

$$T_{i.k} = \sum m_{ijk} / j \quad \text{(a)}$$

Taking the sum of T_{ik} for all k we obtain for switch-in time of households with i members:

$$T_{i.} = \sum M_{ij} / j \quad \text{(b)}$$

and dividing by $N_{i.}$ the average switched-on time per an i-member household $\underline{T_i}$ is:

$$\underline{T_i} = M_{ij} / j / N_{i.} \quad \text{(c)}$$

Similarly the **average per capita switched-on time of j-member groups** is

$$\underline{T_{.j}} = M_{ij} / j / N_{.j} \quad \text{(d)}$$

where $N_{.j}$ is the **number of j-member groups** in all households.

Let

$$q_j = T_{.j} / T \quad \text{(e)}$$

be the **percentage of switched-in time when j listeners were present**.

Then the **average number of listeners** (audience) per household over time, Q is equal

$$Q = \Sigma \; j * q_j \quad \text{(f)}$$

Then it can be proved that total time spent altogether for listening divided by the average number of listeners provides total switched-in time:

$$T = t / Q. \quad (g)$$

Obviously, the same is true for the appropriate per-capita and per-household indicators.

2.2.2. Television broadcasting

Equations

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = (IDTVB * (1 - PCS / 100) + IDTVC * PCS / 100) * STT * 365 * 24 * 3600 * NSIU + E (Volume exported)

3. I (Volume imported) = (IDTVB * (1 - PCS / 100) + IDTVC * PCS / 100) * TVBRI * NSIU

4. E (Volume exported) = (IDTVB * (1 - PCSA / 100) + IDTVC * PCSA / 100) * TBRP * 365 * 24 * 3600 * NSA

5. C (Volume consumed) = P - E + I

6. U (Volume used) = (IDTVB * (1 - PCS / 100) + IDTVC * PCS / 100) * SWOT * 60 * PLT - U (Cable TV)

6a. SWOT = LYT / Q

7. V_{dec} (Volume of stock as of December 31st) = 0

Definition of symbols:

Equation 1

Equation 2

IDTVC: Information density of the color TV broadcasting service. (1)

IDTVB: Information density of the black and white TV broadcasting service. (2)

PCS: Proportion of color TV sets as percent of all TV sets in use in Hungary. (3)

STT: Average number of domestic TV broadcasting programs available. (4)

NSIU: Number of TV sets in use in Hungary. (5)

Equation 3

TVBRI: Average number of foreign earth and satellite TV broadcasting stations receivable per set. (6)

SAT: Average number of satellite programs available with parabola antennas per set. (7)

ANTE: Percentage of receivers directly coupled with parabola antennas suitable for receiving or replaying direct satellite broadcasting. (8)

Equation 4

NSA: Number of TV sets in use in abroad where receiving of Hungarian TV broadcasting is technically possible. (9)

PCSA: Share of color sets as percent of all TV sets in use in abroad where receiving of Hungarian TV broadcasting is technically possible. (10)

TBRP: Average number of directly imported Hungarian programs available. (11)

Equation 5

Equation 6

SWOT: Average daily per capita switch-on time of TV. (12)

PLT: Size of population as of January 1st. (13)

Equation 6a

LYT: Average daily per capita time spent for watching TV (minutes). (14)

Q: Average number of viewers per set. (15)

Sources:

(1) IDTVC = 92 megabit/sec. Channel capacity of color TV broad casting. This figure was suggested by Hungarian Telecommunication Company for the purposes of this study for the SECAM color broadcasting and receiving. High definition TV's channel capacity will be as high as 1000 megabit/sec.

(2) IDTVB = 46 megabit/sec. This figure was suggested for the black and white broadcasting and/or receiving.

(3) There are various sources for the share of color sets within all TV sets in use. From households statistics of the HCSO, the numbers of households where at least one TV set exists and also the number of households where at least one color TV set can be found are known. An estimation can be obtained, dividing the latter by the former. This was an upper estimate when the second, third etc. sets were black and white and will be a lower estimate when the second, third etc. sets will be color sets. These estimates can be matched with the yearly figures of sales of color and black/white sets.

(4) This was computed from the yearly broadcasting time of domestic programs multiplied by the areal availability of the programs on UHF and VHF channels, both published yearly (**[IA/II]** p. 126. col. 3., and **[Tény91]** , p.852. lines 11-12.). Domestic broadcasting includes broadcasting of stations Budapest I, Budapest II, replaying of Moscow I and local TV broadcasting in the environment of Pécs, Miskolc, Gyôr, Debrecen and Szeged. Gross broadcast time was divided by 365 * 24.

(5) The number of TV sets in use has been taken from household statistics of CSO for the period after 1965. From 1955 through 1965 the number of subscribers was applied, since these figures were kept more precise than the data of household statistics. For

1990, the data were taken from a detailed study by **[ERK91]** where the data for institutional households were estimated from the number of schools, internates, colleges, hospitals, jails etc. The figures after 1965 are considerably greater than those of subscribers (**[IA/II]** p. 126. col. 5.) indicating that several households hold more than one sets. Eventually in 1985, 26 per cent of Hungarian households had more than one sets **[Tény88]** p.520. The rest of the data were inter-and extrapolated using the biannual data from household statistics of HCSO.

(6) In the frames of a greater study **[ERK91]**, a reception area was contoured for each program within which it could have been received in a quality which satisfies the standards of CCIR in an electromagnetic frequency domain at the time of census. Then the number of sets on that area was surveyed. Multiplying the length of broadcasting/reception time and the number of sets, the volume of import of the program was obtained in hour units. Then these figures were summed up through all frequency domains to obtain gross broadcasting import in hour units. Average number of broad casting stations receivable was determined as gross broadcasting import divided by gross number of sets in use, 365 and 24.

(7) Surveys of Magyar Közvéleménykutató Intézet and its predecessor in 1985, 1988 and 1990.

(8) Surveys of Magyar Közvéleménykutató Intézet and predecessor in 1985, 1988 and 1990.

(9) This figure was computed for a number of countries and regions in the frames of a greater study **[ERK92]**.

(10) This figure was computed for a number of countries and regions in the frames of a greater study **[ERK92]**.

(11) This figure was computed for a number of countries and regions in the frames of a greater study **[ERK92]**.

(12) The "active time of sets", i.e. the aggregated duration of time when sets were switched on, would be needed for the computation of figure of use of TV broadcasting. This parameter, which will be called **switched-on time** and denoted by T, isn't available. The considerations applied to obtain good estimates agree with those described in details in the chapter on radio broadcasting.

This indicator was estimated from the **average daily per capita time spent for watching TV** in the age group 18-60 in minutes and from the **average per household number of viewers**.

Several households are supplied with wall-sockets of cable TV networks while several programs can be received with a simple room antenna, too. For these flats both broadcasting and cable TV service were assumed to be consumed. As a rule, the inhabitants in such flats prefer cable services to broadcasting and only scarcely disconnect the cable. Therefore these inhabitants were assumed to use cable TV services rather than TV broadcasting. Hence, the volume of use of cable TV services was subtracted according to the equation (6).

(13) **[Demo85]** and later publications of HCSO.

(14) The data for average daily time for 1966 were taken from **[Szal73]**. The same data for 1972 were published in **[Tom]** . The data for 1977 and 1986 were taken from **[IA/II]** p..

The same average watching time was assumed for the age groups 0-17 and 61--. I suppose that this is a lower estimate.

The data in these sources don't reflect background watching. 5% background watching was found in **[Szal73]** in 1966 and this figure has been assumed for the rest of years and added. This is certainly a lower estimate, since background watching became common with the proliferation of sets. Background watching was also con sidered as use of TV broadcasting.

(15) **The average per set, per household number of viewers** was understood as average number of individuals being present while a set was switched-on in the room. This figure was evidently diminishing.

Since 1958, a subscription system exists in Hungary. The figures of household statistics suggest that in 1990 there was a round 8 year lag in the saturation with TV sets of households when compared with radios. Watching TV is still a collective activity. The figures have been estimated from model computations in a way which has been described in the chapter on radio broadcasting. Various assumptions were made in the simulations which had aimed to obtain reasonable estimates of average per household switch-in time of TV sets. In 1958 the average number of members of households plus 2 viewers, and 1.2 in 1990 was adopted.

Remarks:

Equation 3 and 4

Exports, imports and externalities of domestic and foreign TV broadcasting are taken into account here together.

2.2.3. Cable television

Equations

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = (IDCATVB * (1 - PCSIUN / 100) + IDCATVC * PCSIUN / 100) * (HCPR + HLST + CCH + TFB) * 3600

3. I (Volume imported) = 0

4. E (Volume exported) = 0

5. C (Volume consumed) = P

6. U (Volume used) = PL * (IDCATVB * (1 - PCSIUN / 100) + IDCATVC * PCSIUN / 100) * TWCT / AUDIEN * 365 * 60

7. V_{dec} (Volume of stock as of December 31st) = 0

Definition of symbols:

Equation 1

Equation 2

IDCATVC: Average volume of information carried by color TV broad casting per second, per receiver. (1)

IDCATVB: Average volume of information carried by color TV broad casting per second, per receiver. (2)

HCPR: Transmission of the central Hungarian programs in giga-receiverhours. (3)

HLST: Volume of program supplied by local and regional TV studios in giga-receiverhour units. (4)

CCH: Volume of program supplied by local cinema channels in giga-receiverhours. (5)

TFB: Transmission of foreign earth based and satellite programs in giga-receiverhours. (6)

PCSIUN: Percent of color sets within all sets in use in cable networks. (7)

Equation 2a

NP_i: Number of plugs joined to the i-th cable TV network. (8)

NLP_i: Number of hours (altogether on all channels) when the i-th cable TV service played a local studio program. (9)

NLC_i: Number of hours (altogether on all channels) when the i-th cable TV service played a local movies program. (10)

NTI_i: Number of hours (altogether on all channels) when the i-th cable Tv service transmitted a central Hungarian station. (11)

NFT_i: Number of hours (altogether on all channels) when the i-th cable TV service transmitted a foreign satellite or ground station. (12)

Equation 3

Equation 4

Equation 5

Equation 6

TWCT: Average time spent for watching cable-TV programs as a main or background activity (in minutes). (13)

PL: Total number of cable TV subscribers. (14)

AUDIEN: Average size of audience (person) in cable homes (15)

Sources:

(1) See (1) of the chapter on TV broadcasting!

(2) See (2) of the chapter on TV broadcasting!

(3) Transmission of the central Hungarian programs by cable-TV networks has been measured in a special study **[ERK91]**.

(4) Volume of program supplied by local and regional TV studios has been measured in a special study **[ERK91]**.

(5) Volume of program supplied by local cinema channels has been measured in a special study **[ERK91]**.

(6) Transmission of foreign earth based and satellite programs has been measured in a special study **[ERK91]**.

(7) It was assumed that the share of color sets is the same in cabled households as in the non-connected households.

(8) For 1989 see **[Tény90]** p. 851. For 1985 and 1990 **[ERK91]**.

(9) For 1989, **[Tény90]** p. 851. For 1985 and 1990 **[ERK91]**.

(10) A daily l.5 hour was assumed.

(11) It was assumed that all networks transmitted the central Hungarian programs, i.e Budapest I. and II..

(12) For 1989, **[Tény91]** p. 851. For 1985 and 1990 **[ERK91]**.

(13) It was assumed that cable-TV subscribers' viewing habits match those of TV-viewers on average. See (12) of the chapter on TV broadcasting!

(14) Those who are joined to cable TV networks mostly watch cable programs and only sometimes switch the cable off. Thus all house holds with operating cable sockets were considered as exclusive cable users. Source of data is SONDA-IPSOS and **[ERK91]**.

(15) In 1958 the average number of members of households plus 2, and 1,2 in 1990 was adopted.

2.2.4. Phone

<u>Equations</u>

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = BPS * ((MSDTA * MPIC + ASDTA * MPIC / IPPIC + MSFC * MPIC + ASFC * MPIC / IPPIC) + (MSLC * MPLC + ASLC * MPLC / IPPLC) + (MSIU * MPIUC + ASIU * MPIUC / IPPIUC))

2a. ASFC = (ASDTA / MSDTA) * MSFC

3. I (Volume imported) = 0.5 * BPS * (MSDTA * MPIC + ASDTA * MPIC / IPPIC + MSFC * MPIC + ASFC * MPIC / IPPIC)

4. E (Volume exported) = 0.5 * BPS * (MSDTA * MPIC + ASDTA * MPIC / IPPIC + MSFC * MPIC + ASFC * MPIC / IPPIC)

5. C (Volume consumed) = P - E + I

6. U (Volume used) = C

7. V_{dec} (Volume of stock as of December 31st) = 0

Definition of symbols:

Equation 2

BPS: Average number of transmitted bits per second. (1)

MSDTA: Overall number of the manually switched domestic calls to abroad. (2)

MPIC: Average length of an international call (in minutes). (3)

ASDTA: Overall number of automatically switched domestic calls to abroad (in thousands). (4)

IPPIC: Average number of impulses of an international call. (5)

MSFC: Overall number of manually switched foreign calls (in thousands). (6)

MSLC: Overall number of manually switched local calls (in millions). (7)

MPLC: Average length of a local call (in minutes). (8)

ASLC: Number of impulses in automatically switched local calls (in millions). (9)

IPLC: Average number of impulses of a local call. (10)

MSIU: Overall time of manually switched domestic interurban calls (in millions). (11)

MPIUC: Average length of a domestic interurban call in minutes. (12)

ASIU: Overall number of impulses of automatically switched domestic interurban calls (in millions). (13)

IPPIUC: Average number of impulses in an automatically switched domestic interurban call. (14)

Equation 3

Equation 4

Equation 5

Equation 6

Sources:

(1) When phoning, complete human discourses are transmitted with text, intonation, pronunciation, tone, specific individual voice patterns of the speakers. Therefore channel capacity of the line was applied instead of speech rate.

Channel capacity may vary widely in dependence of line quality from 300 bps to 256 Kbit per second. Hungarian Telecommunication Company advised to apply 64 Kbit per second as an average figure. Martin **[Mar 78]** applied the same figure. Minerva Enciklopédia IV, Bp, 1975 p. 192. offers 60000 bps. Speech rate, which doesn't pay attention to individual features in the speech of speakers, pro vides a considerably lower value about 8 Kbit/sec.

(2) Annual data of HCSO: **[IA/II]** p. 44., col.2.

(3) Statisztikai fogalmak: Vezetékes távközlés. Postavezéri gazgatóság, Bp. 1981. 5.6 min.

(4) Annual data of HCSO: **[IA/II]** p. 44., col.3..

(5) Statisztikai fogalmak: Vezetékes távközlés. Postavezéri gazgatóság, Bp. 1981. IPPIC = 75 imp.

(6) Annual data of HCSO: **[IA/II]** p. 44., col.4..

(7) Annual data of HCSO: **[IA/II]**, p. 34. col. 4.

(8) Statisztikai fogalmak: Vezetékes távközlés. Postavezéri gazgatóság, Bp. 1981. MPLC = 4 min. This is in a good agreement with the US average 4.15 minutes for residence calls and 3. 48 minutes for local business calls in 1977 [DSP].

(9) Annual data of HCSO: **[IA/II]**, p. 34. col. 7.

(10) Statisztikai fogalmak: Vezetékes távközlés. Postavezéri gazgatóság, Bp. 1981. 1.35 impulses.

(11) Annual data of HCSO: **[IA/II]**, p. 36. col. 2.

(12) Statisztikai fogalmak: Vezetékes távközlés. Postavezéri gazgatóság, Bp. 1981. MPIUC = 3.44 min. **[DSP]** applied 6.55 minutes found in New England in the seventies. The Hungarian figure is significantly lower.

(13) Annual data of HCSO: **[IA/II]**, p. 35. col. 7.

(14) Statisztikai fogalmak: Vezetékes távközlés. Postavezérigazgatóság, Bp. 1981. IPPIUC = 12.

Remarks:

Equation 2

The number of automatically switched foreign calls (ASFC) is not known. Therefore it has been estimated by formula 2a.

Equation 3 and 4

Actually it is the domestic speaker's communications which is exported. No statistics are available on the share of caller and telephonee from the holding time. In the lack of data I assumed that the participation of the parties is the same 50 percent. Also the sides can speak simultaneously but this effect is thought to be overbalanced by the breaks in the discourse.

2.2.5. Telex

Equations

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = UE * ATRX * TXTF

3. I (Volume imported) = E

4. E (Volume exported) = 60 * ATRX * TXE

5. C (Volume consumed) = P + I - E

6. U (Volume used) =

7. V_{dec} (Volume of stock as of December 31st) =

Definition of symbols:

Equation 1

Equation 2

ATRX: Average transmission rate of telex. (1)

TXTF: Volume of gross traffic in millions of F.61 traffic units. (2)

TXTT: Volume of domestic traffic in million traffic units. (3)

UE: Average number of bits per a traffic unit. (4)

Equation 3

Equation 4

TXE: Volume of transferred to abroad telex messages in thousand minutes. (5)

Equation 5

Equation 6

Sources:

(1) Communicatons of the Hungarian Post.

(2) Data of HCSO: **[IA/II]** p. 39. col. 8.. Till 1980.

(3) Data of HCSO: **[IA/II]** p. 39. col. 8. After 1980.

(4) Communications of the Hungarian Post.

(5) Data of HCSO: **[IA/II]** p. 45. col. 7.

Remarks:

Equation 3:

Volumen of received telex messages is not surveyed. In lack of data I assumed that exports and imports are equaling to each other. This is a rude assumption which was made to avoid systematic bias in gross imports.

2.2.6. Telegraph services

Equations

1. V_{jan} (Volume of stock as of January 1st) = 0

2. P (Volume produced) = BPC * CPW * EWTG

3. I (Volume imported) = BPC * CPW * IWTG

4. E (Volume exported) = BPC * CPW * EWTG

5. C (Volume consumed) = I

6. U (Volume used) = I

7. V_{dec} (Volume of stock as of December 31st) = 0

Definition of symbols:

Equation 1

Equation 2

BPC: Average number of bits per character. (1)

CPW: Average number of characters in a word in a telegram. (2)

EWTG: Number of words in telegrams sent abroad in the year. (3)

NSTG: Number of telegrams sent abroad in the year. (4)

Equation 3

IWTG: Number of words in telegrams arrived from abroad in the year. (5)

NATG: Number of telegrams arrived from abroad in the year. (6)

Equation 4

Equation 5

Equation 6

Sources:

(1) Due to technology, standard 8 bit characters were chosen.

(2) Standard 6 character words were assumed. This may be some less than what could be found empirically, for people tend to omit articles in telegrams.

(3) Annual data of HCSO: **[IA/II]**, p.45., col.2.

(4) Annual data of HCSO: **[IA/II]**, p.45., col.3.

(5) Annual data of HCSO: **[IA/II]**, p.45., col.4.

(6) Annual data of HCSO: **[IA/II]**, p.45., col.5.

Remarks

Equation 2

Only telegrams sent to abroad which manifest as non-durable signals were considered as a telegraph service. Telegrams printed on paper sheets by post offices were taken into account as a good. The senders record their messages on standard pre printed forms. These forms are taken into account as forms and as business documentation.

3. HUMAN KNOWLEDGE

Equations

1. V_{jan} (Volume of stock as of January 1st) = HUKN * SRP

2. P (Volume produced) = HUKN * NB

3. I (Volume imported) = HUKN * IMMIG

4. E (Volume exported) = HUKN * EMIG

5. C (Volume consumed) = HUKN * NE

6. U (Volume used) = FREQ * (Vjan + Vdec) / 2

7. V_{dec} (Volume of stock as of December 31st) = V_{jan} + P + I - E

<u>Definition of symbols:</u>

<u>Equation 1</u>

HUKN: Average volume of knowledge of a man. (1)

SRP: Size of resident population. (2)

<u>Equation 2</u>

NB: Number of births. (3)

<u>Equation 3</u>

IMMIG: Yearly number of immigrations. (4)

<u>Equation 4</u>

EMIG: Yearly number of emigrations. (5)

<u>Equation 5</u>

NE: Yearly number of deaths. (6)

Equation 6

FREQ: Cycle time of nervous impulses. (7)

Equation 7

Sources:

(1) There are no solid estimations for this variable. One petabit – as an arbitrary unit - was assumed which should be a lower estimate considering 10^{14} neurons in the brain, and the 10^{3} connections each in average has: **[Neu59]** and **[Hun88]**.

(2) Size of population as of January 1st. Source for the period 1941-1984 : p. 5. col. 2. of **[Stat84]** and later issues of statistical yearbooks and pocket books for the years after 1984.

(3) Live births and perinatal mortality. Data of HCSO. Source: Statistical yearbooks, pocket books and demographic yearbooks of HCSO.

(4) Data of HCSO. Courtesy of J. Kovács and Ms J. Juhász..

(5) Data of HCSO. Till 1984 the number of submitted applications, after 1984 approved and authorized applications. Courtesy of J. Kovács.

(6) Source for the period 1941-1984 : p. 5. col. 5. of **[Stat84]** and later is sues of statistical yearbooks and pocket books for the years after 1984.

(7) This is about 100 millisec which coincides with the cycle time of alpha waves of the brain: **[Pri68].**

Remarks:

Equation 6

Similarly to the concept human information input, the concept of use of human knowledge (i.e. of brain) can be interpreted in several ways.

The brain is an ever working organ which can be viewed as a **systolic machine** where number of uses is defined as **number of accesses** to its elements. Under this condition the number of uses of brain can be obtained by multiplying number of neurons by number of cycles. This provides a figure of 10^{15} petabit, which contains all activities of the brain including self reverberating memory cycles. This is use of neurons of the brain.

I decided to measure number of uses of the brain with the number of alpha cycles (i.e. number of accesses to the brain as a whole. This should be multiplied by the volume of the brain.

Due to technical difficulties, embedded knowledge in machines is neglected in this study. Use of built-in machine knowledge may amount to a significant value. A rapid jackknife estimate shows that the 200 thousand computers in Hungary with their at least 10 MHz frequency represent more than 100 000 petabit information use.

R e f e r e n c e s

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