Problem 1 Operator business – financial aspects

Question 1

Calculate the numbers in order to be able to insert figures in the empty boxes.

Answer: See table below

	2008	2009	2010	2011
Subscribers	4 000 000	4 320 000	4 665 600	4 898 880
of which mobile broadband subcribers	400 000	518 400	653 184	685 843
Growth of subscriber base y-o-y		8%	8%	5%
MBB customer as a share of total	10%	12%	14%	14%
ARPU average for all customers	20	19	18	11
Revenues	960 000 000	948 480 000	970 444 800	627 625 843
Non-voice services as a share of revenues	15%	22%	25%	21%
Voice subs			4 012 416	4 213 037
Voice revenues	816 000 000	739 814 400	727 833 600	493 527 168
Voice ARPU	19	17	16	10
Non-voice revenues	144 000 000	208 665 600	242 611 200	134 098 675
SMS share of revenues	12%	14%	14%	21%
SMS revenues	115 200 000	132 787 200	135 862 272	13 586 227
SMS growth		15%	2%	-90%
MBB revenues	28 800 000	75 878 400	106 748 928	120 512 448
ARPU MBB	6	14	15,19	15,0
EBITDA total	336 000 000	331 968 000	339 655 680	157 645 958
EBITDA-margin total	35%	35%	35%	25%
EBITDA SMS	103 680 000	119 508 480	122 276 045	12 227 604
EBITDA-margin SMS	90%	90%	90%	90%
EBITDA MBB	1 440 000	3 793 920	5 337 446	7 230 747
EBITDA margin MBB	5%	5%	5%	6%
EBITDA voice	230 880 000	208 665 600	212 042 189	138 187 607
EBITDA-margin voice	28%	28%	29%	28%

Comment: In order to correctly calculate voice revenues, MBB revenues the average number of subscribers during the year has to be applied.

Question 2

a) How much was capex in absolute numbers per year during 2008-2011?
    What was capex-to-sales in 2011 for the total operation?
Answer:
Capex was 124.8 m in 2008, 132,8 m in 2009, 135.9 m in 2010 and 203.8m in 2011.
Capex-to-sales was 32% in 2011. See table below for the numbers

b) How has cash flow developed for the total business and for mobile broadband?
Answer:
EBITDA – Capex = Cash flow. This means that cash flow for the entire operation was
211.2m in 2008, 199.2 m in 2009, 203.8 in 2010 and a negative -46.1 m in 2011.
Cash flow for mobile broadband has developed negatively with -61.0 in 2008, -95.8 in
2009, -96.6 m in 2010 and – 176.2 in 2011

c) How has cash flow per mobile subscriber developed? How has cash flow per mobile broadband subscriber developed?

Answer:
Cash flow per subscriber has developed negatively during the period 2008-2011. Going from 53 in 2008, 48 in 2009, 45 in 2010 and reaching a negative -10 in 2011. Cash flow per mobile broadband subscriber has fluctuated from a negative -152 in 2008, -209 in 2009, -165 in 2010 and -263 in 2011.

The numbers are found in the following table.

	2008	2009	2010	2011
Capex	124 800 000	132 787 200	135 862 272	203 762 272
Capex-to-sales	13%	14%	14%	32%
Capex MBB	62 400 000	99 590 400	101 896 704	183 386 045
Capex MBB share of total	50%	75%	75%	90%
Cash flow	211 200 000	199 180 800	203 793 408	-46 116 314
Cash flow MBB	-60 960 000	-95 796 480	-96 559 258	-176 155 298
Cash flow per subscriber	53	48	45	-10
Cash flow per MBB subscriber	-152	-209	-165	-263

Comment: In order to correctly calculate cash flow per subscriber voice revenues, MBB revenues the average number of subscribers during the year has to be applied.

Problem 2 Telecom markets, interconnection and operator strategy

Questions:
a) What was the main driver for the TDC interconnection fee strategy?
   In what way could they benefit from the strategy? (1p)

Answer:
Since TDC had many large and public organizations as customers the incoming traffic was larger than the outgoing traffic. Hence TDC would benefit from the unbalanced system even if the other operators would have increased their interconnection charges.

b) How do you think TDC did motivate the higher prices? (1p)

Answer:
One possibility was that TDC claimed that their production cost was higher since they had fewer customers than the other operators. Hence, the other operators could benefit from "economy of scale" leading to a lower "production cost" than TDC.

c) What is meant by "SMP"?
   Provide one example from your HW1 + HW2 country.

Answer:
SMP = Significant Market Power is used for actors that have a dominant position at one or several telecom markets in a country.
Usually the former state owned "monopoly operator" has a SMP status at some market.
Examples are Telia in Sweden and Telenor in Norway for the fixed telephony market.
In Sweden all mobile operators have SMP status when it comes to "termination of mobile calls", the mobile operator is the only one that "can" terminate calls in the own network.

Problem 3 Deployment of mobile broadband services

Demand
Compute demand as kbps per person (4 busy hours and 20 days per month)
and total demand for all 2500 persons
Low level: 2,88 GB per month => 80 kbps per person => 0,20 Gbps in total
High level: 14,40 GB per month => 400kbps per person => 1,00 Gbps in total

What can the solutions offer?
Coverage not a problem since one WAD can cover > 1 sqkm, i.e. the total area
One WAD TRX supports a 3 sector site for bandwidths up to 20 MHz, implications:
- capacity = 3*1,67*bandwidth
- just one TRX per site since just 10 or 20 MHz of spectrum available for operator
- cost 10 k€ for TRX and 10 k€ for TRX installation
Capacity of WAD with 10 MHz: 10*1,67*3 sectors = 50 Mbps per site
Capacity of WAD with 20 MHz: 20*1,67*3 sectors = 100 Mbps per site

How many base station sites are needed?
Operator G (WAD with 20 MHz):
Low demand (0,2 Gbps) is met with 2 base station sites => 2 new sites are needed
High demand (1,0 Gbps) is met with 10 base station sites => 10 new sites are needed
Operator I (WAD with 10 MHz):
Low demand (0,2 Gbps) is met with 4 base station sites => already have 4 sites
High demand (1,0 Gbps) is met with 20 base station sites => 16 new sites are needed

Cost analysis
Deployment cost for one new macro site: 100 k€ (70k€+20k€+10k€)
Cost for one WAD TRX with installation: 20 k€ (10k€+10 k€); just one TRX per site

Solution	No sites = existing + new sites	Costs for new sites (M€)	No TRX	Costs TRX (M€)	CAPEX year 0 (M€)	OPEX year1-5 (M€)	Total cost (M€)
WAD 10 MHz Low demand	4 = 4 + 0	0	4	4*0,02 = 0,08	= 0,08	5*0,008 = 0,04	0,12
WAD 10 MHz High demand	20 = 4+16	16* 0,1 = 1,60	20	20*0,02 = 0,40	= 2,00	5*0,20 = 1,00	3,00
WAD 20 MHz Low demand	2 = 0 + 2	2* 0,1 = 0,20	2	2*0,02 = 0,04	= 0,24	5*0,024 = 0,120	0,36
WAD 20 MHz High demand	10 = 0+10	10* 0,1 = 1,00	10	10*0,02 = 0,20	= 1,20	5*0,12 = 0,60	1,80

Conclusions and recommendations
If the demand is believed to remain at the low level Operator I (with 10 MHz and 4
existing sites) can be chosen. Lowest costs since no new sites need to be built.

If the demand is believed to be close to or larger than the "high" level Operator G
(20 MHZ and 10 new sites) provides the lowest cost due to less number of new sites.

Problem 4 Deployment of voice services

Required capacity
40% of population 80 000 => 32 000 users,
Required voice capacity: 25 mErl * 32 000 = 800 Erlang

Number of base station required:
Reuse of 4, 10MHz of spectrum => 2.5MHz/cell
200kHz radio channels in GSM => 2.5/0.2 = 12.5 => 12 radio channels/cell
12 radio channels, each with 8 time slots/traffic channels=>8*12= 96 traffic channels/cell
2% blocking, 96 channels => 84 Erl (according to table)
No of cells needed: 800/84= 9.5 cells
3 cells/site => 3 sites equals 9 cells. This is not enough, but 4 sites will do!
Answer: 4 Sites=12 cells will do the job

Problem 5 – Telecom markets, spectrum and operator network strategy