INTRODUCING A DURABLE PRODUCT IN A NEW MARKET

1.1 Introduction

This chapter introduces your challenge as a responsible manager at the telecommunication company NewTel. You have to introduce a durable product in the new market 'Plutonia'. You will use the SellPhone-Simulator (described later in the chapter) that provides you with first-hand experience in dealing with your new situation. You are faced with difficult questions as the unfolding sequence of decisions that are required to manage your company unravels in a highly dynamic market with the major competitor RivTel. One hint: to manage is to convert information into decisions. In this sense, a manager is a decision maker; we will use both terms interchangeably. This book will help you to answer these questions systematically, so that you are better equipped to develop a successful strategy. After completion of the first chapter, you will have covered the following learning outcomes:

- You will have become acquainted with your decision task and the SellPhone-Simulator.
- You will know the concepts 'policy' and 'variable', which are fundamental concepts that will accompany you throughout the book.

Growth Dynamics in New Markets: Improving Decision Making through Simulation Model-based Management,
First Edition. Martin F.G. Schaffernicht and Stefan N. Groesser.

Companion website: www.wiley.com/go/Schaffernicht/growth-dynamics

- Your first attempt at growing NewTel in Plutonia will have yielded expected, and also unexpected, outcomes that require consistent explanations.
- You will have practiced the use of 'behaviour-over-time graphs' displaying the behaviours and trends of variables over time, to identify important aspects of how these variables develop.
- You will have generated questions about the factors that drive customer growth, and you will need the answers to manage NewTel's market introduction successfully.

1.2 Your briefing for the business challenge in Plutonia

It is late afternoon on a Wednesday in July. You are sitting on a plane from Boston to Frankfurt on your way to the NewTel headquarters. You have been with the company for eight months. NewTel is a major telecommunication company that is about to introduce mobile telecommunication in Plutonia, a country where this type of service does not exist yet. Your task is to manage the company's strategy for introducing your product and service into the country. The objective by which your superior will assess you is the *Accumulated profits* at the end of the first year of introduction. The market potential is estimated to be one million persons. As a first initiative, your predecessor in Plutonia distributed 5000 mobile phones to individuals for free, but then suddenly left NewTel. The free phones came with a subscription contract for nine months, which was not free: the subscription fee was initially set at $20. Also, an initial sales price for the mobile phone of $50 has been suggested to you. This is all the information you have now. No other plans exist to advance the business. Therefore, you have been appointed to take over immediately.

The market analysis available to you shows that you will have one major competitor – RivTel. The competitor is also preparing to sell mobile phone products and service bundles in Plutonia. Your market analysis team has provided you with further information informing you that the final customer can only differentiate the product and service bundles by the *sales price* of the product, the amount of the monthly *subscription rate* and the *life cycle duration* of the bundle. Hence, other factors such as quality, designs, or services are not differentiating factors for the final customers in Plutonia. However, you can also influence *Potential customers* by means of your monthly *advertising spending*.

Moreover, since Plutonia (Figure 1.1) is grateful that you are attempting to enter and, thus, develop its market, the government is willing to provide an infrastructure (e.g. telecommunication network) and other means needed (e.g. technical standards and legal regulations), so that you can concentrate on introducing the telecommunication service.

While looking out of the window as the flight enters the European area over Great Britain, you reflect on your situation: Once you have introduced the product-service bundle, how much profit would be a good result at the end of the year? What initiative should you launch to achieve good results? When should you launch it and how intensely? How will your decisions be influenced knowing that RivTel is on Plutonia's doorstep?

Figure 1.1 Map of Plutonia

Many questions are waiting to be answered. To reiterate, NewTel currently has 5000 customers in Plutonia. Your research shows that one million individuals could be interested in subscribing to a mobile telecommunication bundle. Your revenue will come from two sources. Firstly, from the sales price that new customers must pay for the initial purchase of the mobile phone and, secondly, from the monthly *subscription rate* they have to pay for the duration of the contract. The current legal situation in Plutonia, which you cannot alter, is that both the duration of the contract and the life cycle duration of the phone need to be identical. This current length is nine months; it can become shorter or longer if you decide to change it. NewTel does not produce the phones but purchases them from a long-term business partner: Samuria Technologies from Neptunia sells them to you at a fixed price of $40, which will remain the same for the next few years because NewTel recently successfully renegotiated a supplier contract with Samuria. Moreover, NewTel incurs operating costs for using the telecommunication network and government services of Plutonia, i.e. costs for routing the calls and for using the required technical equipment. These costs amount to an average of $10 per month for each customer. NewTel can influence the operating costs by process improvement spending to fund cost reduction projects.

RivTel, your rival, has the same objective of maximizing *Accumulated profits* at the end of the first year. Your opponent manager at RivTel – whom you do not know yet – must make the same type of decisions. The decisions each of you make concentrate on the following variables: the mobile phone *sales price*, the monthly *subscription rate*, the *life cycle duration* of the mobile phone bundle, the monthly *advertising spending*, and the monthly *process improvement spending*.

Toolbox 1.1: Variables, units of measure, and behaviour modes

Companies or markets are dynamic: their components and elements change over time. A variable represents relevant components and elements and is something that may change its value over time.

Relevance: why do we need variables?

Variables are relevant for the process of structuring and understanding challenging situations. In such situations, we need to think about what the situation consists of and what the options are. When reflecting on a situation, we describe the thoughts in words. Some factors are relevant because of their behaviour and their presumed influence on one another. For example, in the case of a bakery business, if one wants to understand how *revenue* is generated over a period, for instance one month, important variables might include the number of *customers purchasing* during that month, the *prices* of the products purchased, and the number of *products purchased by each customer*. One must decide which factor is relevant enough to be considered as a variable.

It is also essential that each variable in a model has a corresponding entity in reality. If a variable is only there to avoid formulation problems or erroneous model behaviours, but the modeller cannot tell which real entity is represented by the variable, then the model loses contact with the real situation it is supposed to portray. Ensuring that each variable is linked to a real entity is part of the permanent validation effort.

Endogeneity: input, output or computed?

We need variables to decompose a problem and represent its relevant aspects. If a variable is relevant depends on the model purpose and problem to be solved. This indicates that a model boundary must be defined that delimits relevant, i.e. to be considered, from non-relevant content, i.e. to be left out of a model. However, in the real situation such boundaries do not exist. Therefore, the variables inside the model boundary, for which equations will be developed, are not independent from the outside world. For this reason, we use input variables that contain estimated or approximated data instead of equations. These input variables will influence inner or endogenous variables in the model. The word 'endogenous' contains two ancient roots; 'endo' means 'inside', and is the opposite of 'exo' ('outside'), and 'genous' means 'generated'. Endogenous variables are computed by the equations inside the

model's boundary. Input variables are exogenous and nothing in the model influences them. Output variables, even though they are computed in the model, are also exogenous because they do not influence anything inside the model.

Definition: what is a variable?
When defining a variable, its attributes must be specified: name, unit of measure, and range of values.

Name: The name of a variable is substantive and should reveal the variable's meaning. For example, product price is a transparent and valid name for a variable, as involved parties can easily understand what element of the system under study is meant.

Units of measure: Each variable needs a 'unit of measure' or 'unit'. Being clear about units helps to ensure that the variables and the relationships between them are meaningful. Unit consistency, sometimes called dimensional consistency, means that the equations describing the relationships between the variables do not attempt to compare apples with oranges. Unit consistency also helps to ensure a conceptually sound model formulation, which is an important part of model validation.

For instance, the variable *temperature* can be measured in degrees Celsius, Kelvin, or Fahrenheit. Another example, *currency reserves* of the American Central Bank are measured in US Dollars ($). A bakery's *customers* are measured in numbers of individuals and the *price of bread* might be expressed in Euro/kg. In cases, such as *customers* or *workers*, sometimes we make a difference between plural and singular: the baker may have 150 *customers* (individuals), monitors weekly *sales* ($/week) and wants to know the weekly *sales per customer* ($/week/individual). Different modelling software packages, which we start using shortly, have different ways to deal with the difference between singular and plural in units. To avoid unnecessary complications, we use only singular in the following equations, but follow the rules of grammar in the written text. The units are indicated in square brackets.

Value range: Often, only a limited range of values makes sense for the variable in the context under study. For instance, the numbers of customers can only be positive. By specifying the minimum and

maximum value of a variable, it becomes easier to recognize flaws in one's reasoning by realizing that an unreasonable value has been generated.

Behaviour: variables vary over time – but how?

It is important, but not sufficient, to know the current value of a variable at a given point in time. For a dynamic analysis, it is essential to know how the variable is changing over time. Considering the past, the rate of change of a variable and the fact that its rate or the direction of change are changing themselves is decisive to figure out how it might behave in the future, given that other elements in the system remain unchanged. Taking these dynamic features into account allows one to make hypotheses about causes for development over time and how one could possibly influence it to our favour.

For example, for the central bank to decide on its monetary policy, it needs to know if the inflation rate is stable or not. Moreover, the bank needs to know if the behaviour of the inflation rate has responded as expected after taking monetary action. And virtually any company will not only need to know how many customers it has at the end of the current month – but it also needs to know if the customer stock is growing or shrinking and if this is occurring with an increasing or decreasing slope.

There are many different such behaviours and they are categorized in behaviour modes (Table 1.1); they can be organized in three 'atomic' behaviour modes and several composed behaviour modes (Ford, 1999). The former behaviour patterns are called atomic behaviour modes because they cannot

Table 1.1 Atomic behaviour modes

Description: the variable …	Behaviour mode
… keeps the same value over time or grows or decreases linearly	Linear behaviour
… grows or decreases at an accelerating slope	Exponential behaviour
… grows or decreases at a diminishing slope	Goal-seeking behaviour

be decomposed in simpler elements of behaviour. More complex behaviour modes, such as oscillation or S-shaped growth, can be decomposed into phases of atomic behaviour modes.

To gain an overview of the development of variables over time, graphs that show the behaviour of the variables are best to use. Such graphs are behaviour-over-time graphs (or BOTG in short). The horizontal axis represents time and the vertical axis displays the variable's values in the respective unit of measure; for instance *Accumulated profits* measured in $. In the book, we use the word 'graph' as a synonym for BOTG. Figure 1.2 illustrates graphs for the most common behaviour modes.

The first three examples in Figure 1.2 show atomic behaviour modes that cannot be decomposed further. When the amount of change per time period is constant, the behaviour is linear. A special case of this behaviour mode is 'steady state': this is when a variable has stabilized at one value and neither increases nor decreases. Another term used for steady state is equilibrium. Exponential behaviour is accelerating growth or decline. Goal-seeking behaviour is a slowing growth or decline, steadily approaching a long-term value. The second three behaviour modes are more complex but can be decomposed in phases that correspond to atomic modes. S-shaped growth is then a sequence of exponential growth followed by goal-seeking growth. Oscillation is a longer sequence of exponential and goal-seeking phases. Overshoot and collapse can be decomposed into exponential growth, then goal-seeking growth, and eventually exponential decline.

In this book, variables appear in *italics*. This helps you to remember that regardless of the form in which a variable appears – in text, diagram, or equation – it is always the same variable. In the equations, the unit of measure of the variable will appear in brackets. For example, *Current customers* [individual]. The behaviour of the variables, i.e. the type of changes that occur in a variable, will be described in underlined words. This notation helps to get acquainted with the fact that *structure* (i.e, variables and causal links) is not the same as the behaviour of this *structure*.

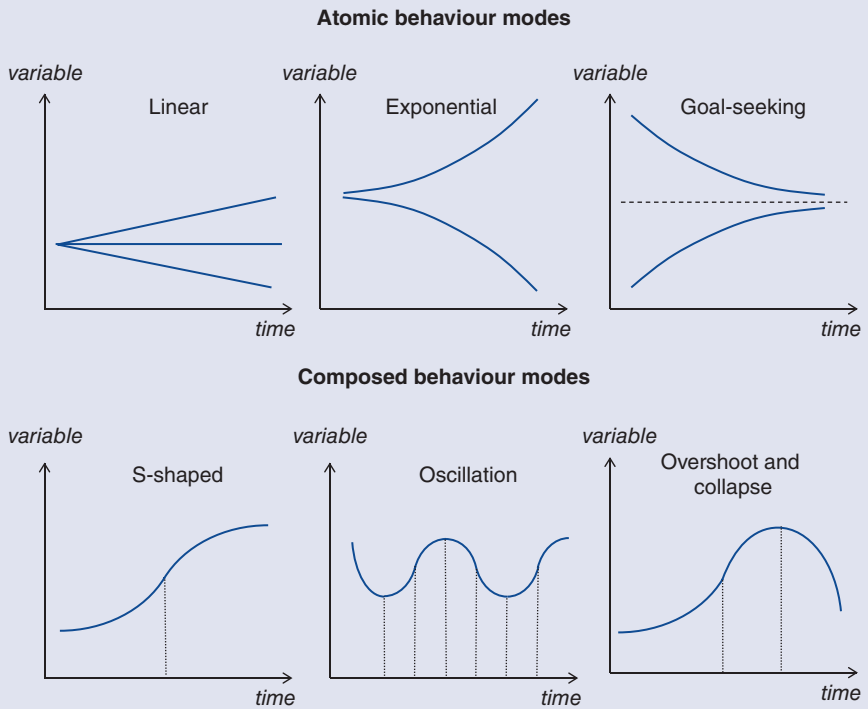

Figure 1.2 Graphs of the three atomic and three composed behaviour modes

Behaviour: reference mode versus simulated behaviour

We can partially test a model and its quality if we compare the simulated behaviour of variables to empirical data available of their behaviour over time. The term 'reference mode' refers to the empirical data. The data available may not always be statistically robust or detailed. However, if this is the case, one can attempt to obtain estimates from experts and then convert them into approximate behaviour patterns to estimate inflection points, extreme values, and value ranges. This reference mode often builds the starting point of an analysis. Most often, the behaviour of the reference mode is not fully understandable and requires further analysis.

Variables are important. Every time you reason about NewTel or something else, you use variables – explicitly or implicitly. Table 1.2 summarizes the variables you can change, i.e. the decision variables, their current values, and units of measure as well as the minimum and maximum values of the variables.

You must make your decisions once per month. You can set the *sales price* between $0 and $70. We use the $ symbol to represent US Dollars. There is only one mobile phone model available. Moreover, there is only one type of service contract, i.e. a subscription, and the service contract is acquired as an additive bundle with the mobile phone. The monthly *subscription rate* can vary between $0 and $30. Changes in the *subscription rate* are applied to all *Current customers* at the same time, i.e. all *Current customers* pay the current monthly *subscription rate*. This rate is part of the contract and legally solid in Plutonia. The initial *life cycle duration* of the subscription-and-phone-bundle is nine months. You can change it in between 6 and 18 months. Just as for the *subscription rate*, changes of the *life cycle duration* are applied to all current subscriptions and phones.

You have a monthly budget of $1 million that you can spend on *advertising* or *process improvements*. You are free to allocate the budget. If you decide not to spend that budget until the end of the year, it remains in the accounts of

Table 1.2 Your decision variables

Variable	Definition of the variable	Unit of measure	Values		
			Initial	Min	Max
Sales price	Amount paid by each customer when purchasing a mobile phone.	$	50	0	70
Subscription rate	Monthly amount paid by each *current customer* for the life cycle duration of the contract.	$/ month	20	0	30
Life cycle duration	Number of months that a phone is used.	month	9	6	18
Advertising spending	Monthly amount spent by NewTel for advertising. All advertisement channels have the same effectiveness.	$/ month	0	0	1 M
Process improvement spending	Monthly amount spent by NewTel to improve the cost efficiency of processes. This yields a reduction of operating costs.	$/ month	0	0	1 M

NewTel and, thus, will be part of the *Accumulated profits*. However, if you choose to spend some or your entire budget, the amounts spent will be costs, and they will reduce your *monthly profits* of that month. Naturally you would spend the budget only if you believe that the effects of spending it will compensate for the costs and bring a net increase of the *Accumulated profits* at the end of the year. Money spent for *advertising* provides messages on TV, radio, or social media (for details see Chapter 4). When investing in *process improvements*, e.g. improvement of equipment and personnel, the impact gained depends on the amount spent and the size of your internal service infrastructure (more details on this in Chapter 5). The *operation costs* can be reduced by up to 1% per month. In the case of NewTel, we make assumptions to provide learning experiences about market dynamics and the diffusion of new product-service bundles when facing a major competitor. Chapter 8 discusses and relaxes several of those assumptions.

There are no other financial restrictions imposed on you; you could make losses during the months of the year. You will not go bankrupt since the parent company ensures your liquidity. This said, you are responsible for achieving superior *Accumulated profits* at the end of 12 months.

At the beginning of your year-long mission in Plutonia, you find yourself with specific initial values for each of the five decision variables. You could just stick to these initial values, but you could change them as well. As the responsible decision maker for NewTel, you have sufficient autonomy to interpret the information you receive and make decisions based on them. Of course, not all policies yield satisfying results. To maximize the *Accumulated profits* over 12 months, you must define policies that lead to the appropriate values for NewTel's *sales price*, *subscription rate*, *life cycle duration*, *advertising spending*, *process improvement spending* in the dynamic market situation you are in. At the microlevel, you must search a set of five specific policies for NewTel.

As mentioned in Toolbox 1.2, policies can be routinized or implicit, and making them explicit can be difficult. Therefore, we start with two introductory scenarios, which are introduced in Sections 1.3 and 1.4. For each of them, you are invited to simulate the scenario yourself. In the first, you will follow a simple policy; in the second, we will examine the fictitious reasoning of two decision makers following implicit policies. Thereafter, each scenario will be debriefed to uncover the relevant business structure.

Toolbox 1.2: Policies and models

Organizations must be successful or at least follow a viable course of action in their interactions with changing environments. To measure success, it must be stated firstly what the goals are. Then, a strategy is needed, meaning a general guideline about what success is. Carrying out a strategy requires the ability to sense relevant conditions and changes and to use that information to decide about the best actions. Thus, organizations design and use explicit or implicit decision rules that prescribe how input information is transformed into decisions. Such rules are called 'policies'. A policy is a course or principle of action adopted or proposed by an organization or individual (Oxford Dictionaries, 2016). Policies define what should be done when certain circumstances exist. The circumstances are represented by variables and their specific values or behaviours. The goodness of an organization's policies determines the quality and success of the organization.

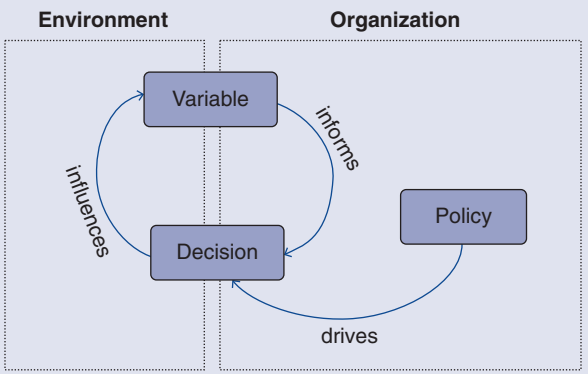

Figure 1.3 A decision is driven by a policy and informed by the behaviour or variables

A policy specifies which variables are to be monitored and which decisions will be taken in response to observing certain conditions or changes in those variables (Figure 1.3).

Figure 1.3 shows that there is a policy which influences variables via decisions. This become clear in our central bank example. Central banks are usually responsible for maintaining the value of their respective country's currency. They define an upper *limit for the inflation rate*, and if the observed *inflation rate* rises above this threshold then the central bank intervenes and sets the *interest rate* such that *inflation rate* falls below the limit hence keeping the currency's value stable. Of course, a central bank cannot fulfil this goal by simply changing one variable: there are many other factors involved. This suggests that the term 'policy' exists at two levels: specific (or single) policy and comprehensive (or combined) policy. A specific policy is a decision rule that sets the values of one specific variable. And a comprehensive policy consists of several single policies, i.e. a set of single policies, and, thereby, sets the values of several variables. For the latter, the monetary policy of a national bank involves different variables, such as the *interest rate*, the *inflation rate,* and the *unemployment rate*.

In the areas of government and business, a policy is a rule that allows organizational actors to select and interpret relevant information and decide on a course of action. The term policy should not be mixed up with business processes or procedures. Since the 1960s, the term 'policy' has gradually been replaced by other words, e.g. business policy by strategy. In this book, we use the term 'policy'.

Routinized or deliberate? Policies can be implicit or explicit. When activities are carried out intuitively because they have been routinized by repetitive execution, individuals do not usually need an explicitly stated policy, for instance answering phone calls or e-mail messages. A policy is explicit when it has been articulated and expressed in documents or verbal statements. For instance, when new situations are encountered, i.e. when there is no experience that guides decision making, a policy is often designed explicitly by discussion and reflection.

How are policies adjusted? Policies are adjusted in an iterative way, which can take the form of evolution or deliberate design. Trial and error can lead to increasingly more successful policies over time. One example is when young children learn to walk; another example is when an investment banker learns under which circumstances to sell or to buy a stock. This is an evolutionary process. Trial and error require time, and errors incur costs. When the cost of these errors becomes serious, policies are often deliberately designed. In the design process, candidate policies are specified and subjected to tests before implementation (Sterman, 2001). This can help avoid catastrophic costs and diminish the total amount of time needed to arrive at a satisfying policy. Another difference between evolutionary and deliberate policy designs is that an evolutionary process is not built, in principle, to explicate the policy and the underlying causal structure. In consequence, one does not know why a policy works or fails. In a world where things change over time, making policies explicit is insightful: policies can adjust when they are outdated. To adjust an explicit policy is easier and faster than to make an implicit policy explicit and then correct it.

What is a model in the context of policies? A typical dictionary definition of model is 'a representation, generally in miniature, to show the construction or appearance of something'. Per this definition, a model is an object in lieu of another object or entity. It is smaller than the object it represents, which means that a certain number of features of the original object are not included in the model. Car builders and aircraft builders develop and test models of their vehicles to avoid design flaws. They run crash tests and use wind channels. In the realm of business and government, there are no wind channels or crash test dummies to test policies. But we can run simulation model tests. Thus, the reason for learning to develop simulation models in this book is that modelling is explicating causal relations in the system under study and by means of simulation you can test different policies. We use simulation models to advance the development and implementation of policies. For this purpose, the models developed in the book will be specific to the context under study.

Guideline 1 (G 1): Account only for the necessary complexity
A model should be as simple as possible and as complex as necessary. Policies and the decision-making logic should be modelled in sufficient detail.

1.3 Managing NewTel's new business in the simplest scenario: business as usual

The first scenario is 'Business as Usual' (BAU). Business as usual assumes the decision variables keep their default values for all months. 'Stick to the established values of the decision variables, no matter what happens' is a simple policy prescribing 'a course or principle of action adopted'. This policy means that for each of the five decision variables, the same policy is in place. This has the advantage of saving you the time figuring out more sophisticated policies, which might consider changes in a variable you want to monitor or decisions taken by your competitor in the previous month. Despite its simplicity, it is not an unreasonable scenario: you would be right to assume that your predecessor must have put some reasoning into the current values of the decision variables, and you should know the *Accumulated profits* you could expect if both companies decide to keep these values over the entire year. The results produced by this scenario will later be used for benchmarking with other scenarios.

DIY 1.1: First simulation – business as usual (BAU)

Go and have a try at managing NewTel in the 'SellPhone simulation' (for accessing the simulator and for a tutorial about how to use it, visit the book's companion website). You can use the simulation in one-player or two-player mode. In the one-player version, the computer manages RivTel. In the two-player mode, you play against a colleague.

Use the simulation to work through the BAU scenario. In this scenario, the values of the decision variables remain constant, just stay on the control panel and click on the button 'next month'. After each click, observe the graph beneath the buttons: it shows how the *total population* of one million individuals is distributed between *Potential customers* (yellow), your *Current customers* (green) and *RivTel's customers* (maroon) at the end of each month. To advance 12 months in the simulation, you have to click the button 'next month' 12 times. When the year is over, the button will be displayed in grey.

Click on the 'Decisions NewTel' option and you arrive at a view where you can inspect how different variables have developed over time. The view contains different sheets showing variables related to customers and another one showing information concerning financial flows. Also, inspect the corresponding information concerning RivTel (on the page 'Decisions RivTel').

Prepare to describe important features of what happened during the simulation to a colleague by telephone (no visual contact, therefore words are the only way to transmit information). You will need to identify the variable you refer to and the important aspects of its behaviour: Does it increase or decrease? Is the slope constant or does it decrease or increase? Can you identify specific behaviour modes? Write the information you would like to give to your colleague on a piece of paper. Use the worksheet at the end of the chapter.

Assume that your predecessor had good reasons to set the current *sales price*, *subscription rate*, *life cycle duration*, and financial resources spent on *advertising* and *process improvements* at the values as they currently are in the SellPhone simulation. Let us also assume that these values are also reasonable decision values for RivTel. How successful would you be in 12 months, if you followed the course defined by your predecessor?

Figure 1.4 shows the graph of *Potential customers* and the *Current customers* of each company.

Let us now examine the BAU scenario. At the beginning, 990 000 *Potential customers* had not bought a mobile phone yet. NewTel and RivTel have 5000 *Current customers* each. This situation quickly changes. *Potential customers* dramatically decline until they stabilize at around 113 000 towards the end of the year. This means that after little more than half of the year, nearly every Plutonian has acquired a mobile phone bundle either from NewTel or RivTel. Note that not all individuals in the *population* are using the services of one of the companies, and this has not changed over the last six months of the year. This is an important aspect of the customers' behaviour: there is always a certain fraction of the *population* who are not *Current customers*. You may wonder why this is the case. Chapter 4 explains the reasons.

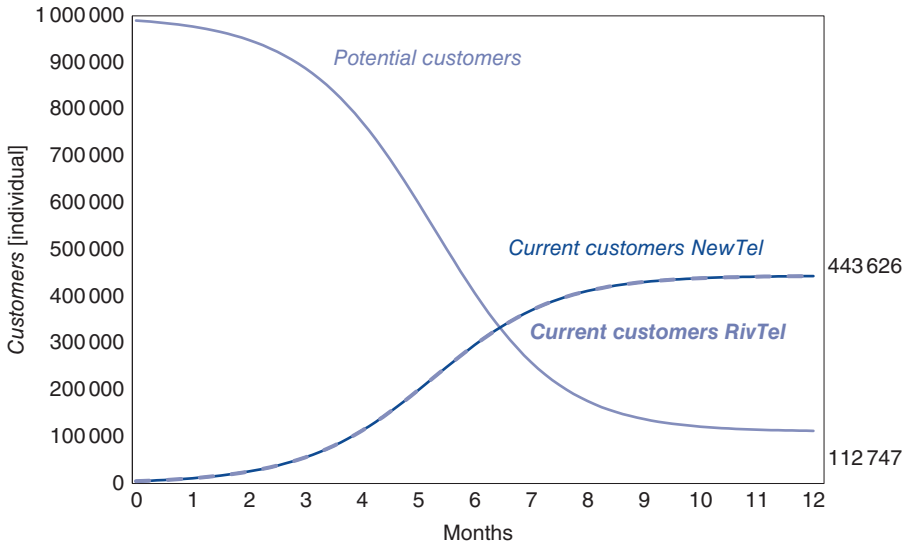

Figure 1.4 Dynamics of customers in the BAU scenario

In the simulation, both companies make the same decisions. Hence, both companies have equal *customer market shares* and equal *monthly profits* during and at the end of the simulation. The *monthly profits* grow exponentially until the end of the first quarter and then peak at approximately $6 million. Then, they slightly decrease and stabilize at approximately $5.24 million per month (Figure 1.5):

Monthly profits grow with a shape similar to the behaviour of *Current customers* and stabilize slightly under $5 million. Detecting this behaviour leads to the discovery of a relevant aspect of the system's behaviour: Plutonia's mobile telecommunication market has developed through different phases. An initial phase of exponential growth is followed by a phase of stability. You may wonder why this is the case and think about factors that determine the difference between the peak in *monthly profits* and the lower and stable *monthly profits* achieved in the remaining months of the year. Chapter 5 provides the details.

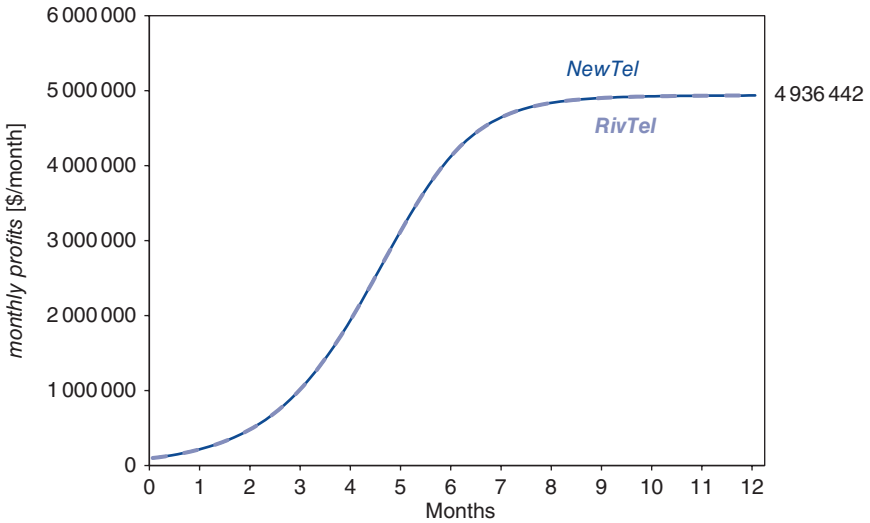

Figure 1.5 *Monthly profits* for both companies in the BAU scenario

Monthly profits accumulate over 12 months. We can differentiate the behaviour of *Accumulated profits* (Figure 1.6) in phases, too. The first phase lasts from the beginning until month 6 and shows an increasing slope of *Accumulated profits*. Afterwards *Accumulated profits* grow in a linear way until the end of the year. Note that the transition from the first to the second phase occurs at the same time when the level of *monthly profits* reaches its local peak and the transition to the third phase initiates a phase of stability which lasts until the end of the simulation. The *Accumulated profits* at the end of the 12 months amount to $37.7 million for both companies.

1.4 A competitive scenario: compete for customers

In some business areas, performing *better than* direct competitors is a desirable objective. And you with NewTel want to be better than RivTel. To manage this, you can choose relative performance objectives. For instance, *customer market share*, i.e. the company's share of all *Current customers* in the market, or *revenue share*, i.e. the company's share of the *total revenues* from mobile phones sold and used each month.

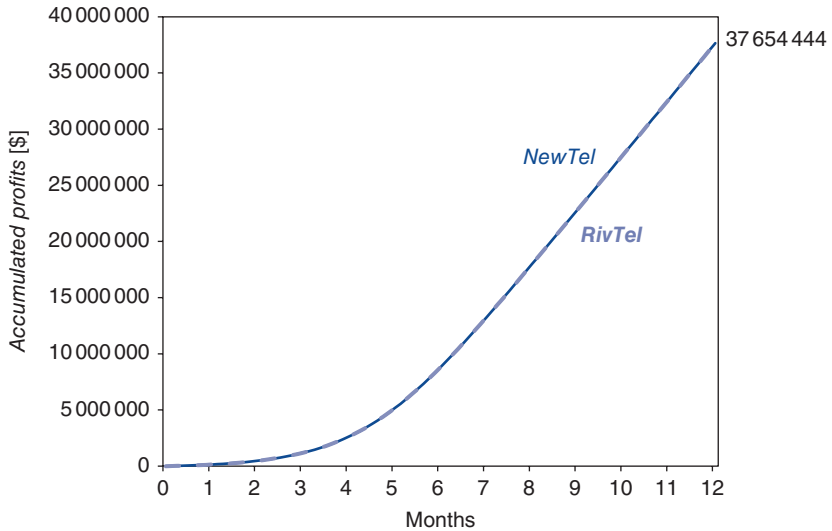

Figure 1.6 *Accumulated profits* for both companies in the BAU scenario

DIY 1.2: Second simulation – compete for customers (CFC)

Try to outperform your competitor in the SellPhone simulation by winning more customers than RivTel.

In the simulator's interface, you can see the number of *Current customers* NewTel and *Current customers* of RivTel at the end of the month.

For this challenge, use only the *sales price* and the *subscription rate* to gain an advantage over RivTel. You are free to set the *sales price* and the *subscription rate* as best you can to achieve the

objective. The value ranges for the variables are: *sales price* between $0 and $70, and *subscription rate* between $0 and $30 per month (Table 1.1). For each month, you need to decide the value for each of the two variables.

On a sheet of paper, write down what the purpose of each decision each month is. For instance, if you decide to lower the *sales price* and maintain the *subscription rate* at its current level, what effect are you trying to achieve by doing so?

When you reach the end of the year, use the data from the graphs or the tables to analyse the development of NewTel's and RivTel's *Current customers*. For each month, assess if the decisions taken by both companies in the previous month resulted in winning more *new customers*. How many *Current customers* does each company have at the end of the simulation?

Then, turn your attention to *monthly profits*. Were the companies' monthly decisions followed by a rise or a fall in their respective *monthly profits*? What was your *Accumulated profit* at the end of the year? Was it better than RivTel's? Was it higher than the *Accumulated profits* achieved in the BAU scenario? Use the worksheet at the end of the chapter.

Let us analyse a sequence of possible competitive moves between NewTel and RivTel in the CFC scenario. For simplicity, in the scenario you only use the *sales price* and the *subscription rate* to influence the *new customers* and hence your *customer market share*. Obviously, in both companies the monthly decisions are taken without knowing what the other company has decided. Each company's pricing decisions become visible for the respective competitor in the month after the decision: if you want to know RivTel's prices, all you need to do is look at its website – and, of course, they look at yours. The following description narrates the typical reasoning and decisions of a competitive situation between a symbolic NewTel and RivTel. In DIY 1.2, you have written down your own reasoning. As you read the following paragraphs, compare the reasoning described to your own, paying attention to similarities and differences.

The competition begins…

At the beginning of month 1, NewTel thinks: 'We start with an important discount on the *sales price* to attract *new customers* and maybe get ahead of RivTel'. Decision: *Sales price* reduced to $20. At the same time, RivTel's reasoning is: 'We start with a strong discount on the *sales price* to attract *new customers*'. Their decision: *Sales price* reduced to $30. Both decisions are implemented.

When preparing for month 2, NewTel's thoughts are: 'reports from the end of month 1 tell us we now have 27 246 *Current customers*, this has worked well: we are ahead of RivTel.' Decision: 'We follow the same course and keep everything as it is'. RivTel perceives the current situation in the following way: 'We now have 25 249 *Current customers*. Not bad. But NewTel made a larger discount on its *sales price* and it has attracted more *new customers*.' Its decision reveals a competitive attitude: 'We will respond: match their *sales price* and lower the *subscription rate* to $15 per month: *Sales price* reduced to $20 and *subscription rate* reduced to $15'.

When month 2 is over and the decisions for month 3 must be made, both decision makers look at what they perceive to be the current situation. NewTel: 'Our *Current customers* increased to 127 585 and we believe we are still ahead of RivTel despite their discount on the *subscription rate*. Again, we follow the same course'. And RivTel: 'Our *Current customers* increased to 109 706 – we need to continue the discount for at least one more month. No changes made.'

Again, one month later, NewTel's decision maker reflects over their course of action: 'Currently, we have 268 147 *customers*. Market research believes RivTel has outpaced us. We need to turn this around and send a message to RivTel'. The new decisions: '*Sales price* reduced to $0 and *subscription rate* reduced to $15'. In parallel to this, RivTel decides not to move: 'We increased *customer* count to 378 908. Market research believes we are well ahead of NewTel. We will keep to the current values and expect to dominate the market soon. No changes made.'

For month 5, neither company decides to change anything. NewTel: 'Our *customers* count has hardly increased (278 317); we need to keep the current *prices* as low as they are. No changes made'. And RivTel: 'As of the end of month 4, we have 613 788 *customers*. One more month and we can raise *prices* again. No changes made'.

Later, NewTel prepares for month 6 '*Customers* were at 370 878. An encouraging development. We can increase the *sales price*'; *sales price* raised to $20. RivTel's reasoning is: 'NewTel's discounts have made us lose many *customers*, we fell to 567 087. We need to protect our *market share*; therefore, we will reduce our *subscription rate*: *subscription rate* to $10.'

For month 7, NewTel keeps to its current prices: 'Reports show a good tendency (442 685 *customers*). We need to advance, thus no changes'. The same for RivTel: 'We kept losing *customers* (reports state 501 002), but are still ahead of NewTel. No changes made'.

But by the end of month 7, NewTel revises its decision: '*Customer* count is down to 291 105. RivTel's discounts have hurt us. We will not let them get away with this': *Sales price* reduced to $0, *subscription rate* reduced to $10. At the same time, RivTel has its thoughts: 'Reports suggest we are back on track (653 252 *customers* as of the end of month 7). We can raise the *subscription rate* a bit: *Subscription rate* increased to $15.'

Here is what NewTel's decision maker thinks about the upcoming month 8: 'We kept losing *customers*, now arriving at 191 301. But we cannot reduce *prices* anymore. No changes made'. His opponent at RivTel thinks: 'The trend has shifted, we won back *customers* (753 133). Let us keep to the current values to consolidate: no changes made.'

By now three-quarters of the year are over, and both decision makers are getting ready for the tenth month. NewTel: '*Customer* count is back up to 454 884 for the end of month 9. We should raise *prices* a bit, but try to stay attractive': *Sales price* increased to $20; *Subscription rate* increased to $20. RivTel: 'NewTel's discount attack has cost us many *customers*; we are back down to 489 560. This must be turned around: *sales prices* reduced to $0!'

For month 11, NewTel analyses: '*Customer* count has continued to increase, now counting 626 219. Let us consolidate the position: no changes'. In its own way, RivTel arrives at a similar decision: '*Customers* have dropped to 318 226, but we cannot make any substantial discounts. Let us keep fighting with the current values'.

Now, both companies are getting ready for the final month of the year. NewTel is considering its latest developments: '*Customers* started to decrease again (now 381 122). Should we try to send a peace signal to RivTel? We will not reduce *prices* this time'. RivTel's reasoning is somewhat different, unbeknown to NewTel of course: '*Customers* are up to 563 322. Good trend, but we will keep *prices* down a little longer'.

Closing a year of severe competitive action, NewTel concludes, 'We have dropped to 231 954 *customers*, have a very low *market share*, and RivTel has not responded to our collaborative signal'. In its local headquarters, RivTel is reasoning: 'We now dominate the market with 712 490 *customers*. Now we can respond to NewTel's signal of last month'.

We as external and omniscient observers have a chance to detect a pattern here, and maybe feel that it is bad luck for both companies that RivTel's decision to respond to NewTel's 'signal of collaboration' appears to have come too late. Anyway, we now have sufficient data and insights to analyse what has happened during the 12 months. The reasoning behind each of the companies was focused on winning *customers*, and the *sales price* and *subscription rate* were used to change the stock of *Current customers* and, occasionally, to send a competitive or cooperative signal to the other company. A narrative in the form of a free text contains much information but does not make it particularly easy to detect patterns of behaviour. As a complementary kind of representation, a graph helps to focus on the relevant behaviours. Figure 1.7 provides an overview of the sequence.

Let us now analyse what is happening in the graphs. During the first month, the vast majority of Plutonians still are *Potential customers*. The initial discounts of NewTel are somewhat larger than RivTel's and, therefore, NewTel gains a small advantage in number of *Current customers*. The graph of *Current customers* seems to suggest that the benefit in absolute numbers is not significant, but you should keep in mind that for the decisions taken in month 2, RivTel had only the reports from month 1. RivTel detects that NewTel's *sales price* discount was larger and that NewTel's customer uptake (*new customers*) seems to be quicker. Therefore, RivTel reduces both *sales price* and *subscription rate*. And, indeed, until the end of month 4, RivTel appears to be winning the race for *customers*.

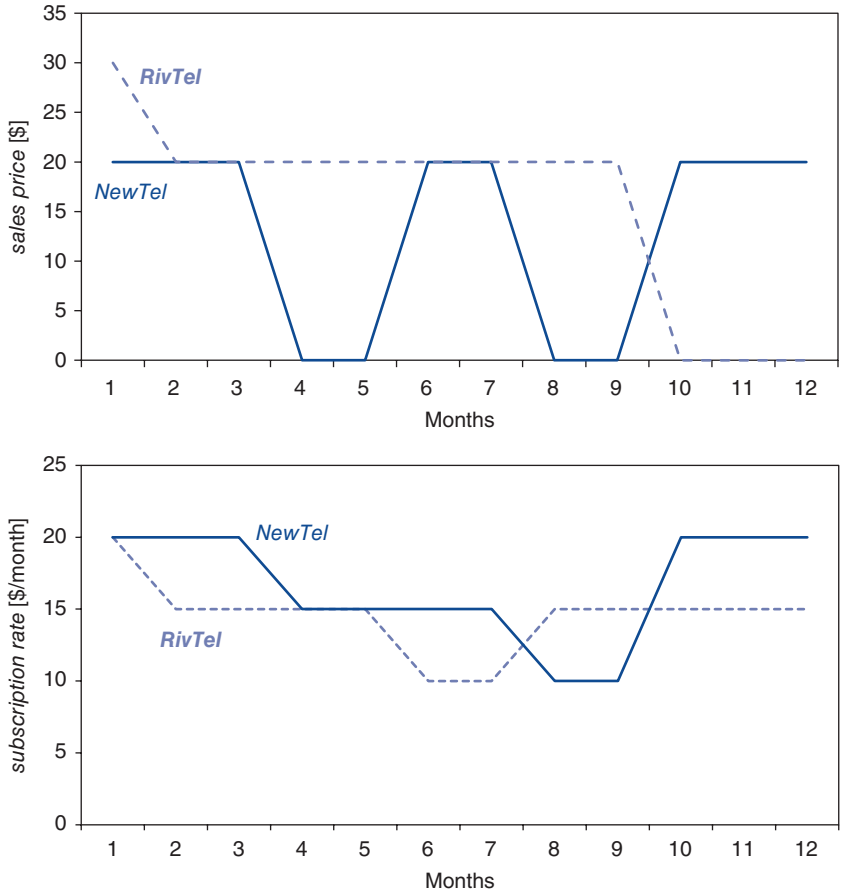

Figure 1.7 Changes to *sales price*, *subscription rate*, and the behaviour of *customers* in the CFC scenario

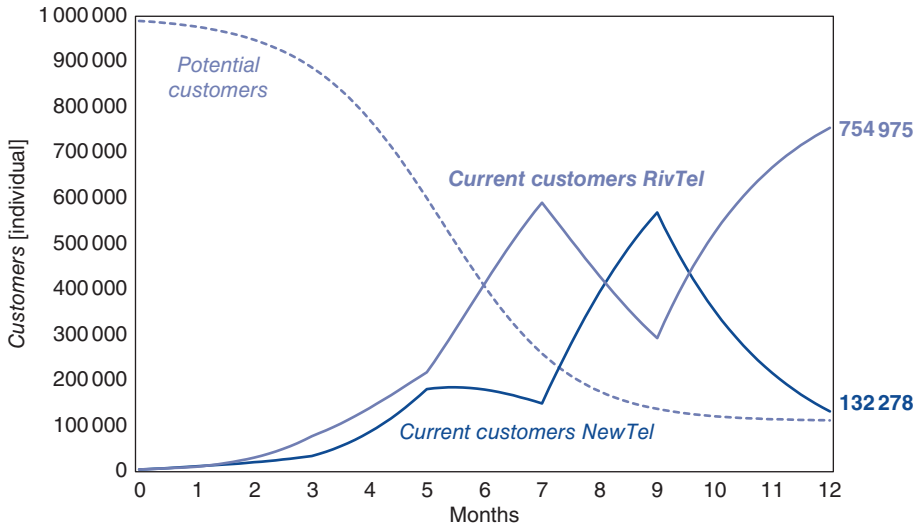

Figure 1.7 (Continued)

NewTel attributes the relative slowness of its *Current customers* growth to RivTel's discounts; as a reaction, it reinforces its own discounts, which results in winning more *Current customers* and pushes RivTel to lose *Current customers* until the end of month 6. Then, it is RivTel's turn to lower its own *prices* and expand its *customer* base, inflicting a larger loss in *customers* to NewTel until the end of month 8. NewTel counterattacks by cutting its *sales price* and, by the end of month 10, the *customers* base of NewTel quickly increases – again at the expense of RivTel. During the last months, RivTel strikes back and wins back most *customers*. A classical price war has unfolded.

Clearly, both NewTel and RivTel have taken decisions driven by similar policies and these policies are different from the one in the BAU scenario. Each company observes its own *new customers* and *Current customers* as well as the respective competitor's *sales price* and *subscription rate*. Based on the behaviour of these variables and the

respective policies, each company modifies or ceases to modify its *sales price* and *subscription rate*. We can tentatively state that their policies were 'if our *new customers* or *Current customers* grow less than the one of the competitor, then set our *prices* a little lower than the competitor price.'

DIY 1.3:
The behaviour of *Potential customers*

Note that the behaviour of *Potential customers* has not changed between the BAU scenario (Figure 1.4) and the CFC scenario (Figure 1.7). Why?

At the end of the twelve months, NewTel serves a little more than 230 000 *customers* and RivTel more than twice this number, with more than 770 000 *customers*. And at the end of month 12, RivTel wins in terms of *customer market share*. The competition for *customers* has sometimes favoured NewTel, and at other times RivTel. Since month 6, almost the entire *population* had been using a mobile phone from either NewTel or RivTel. Therefore, a growth in *Current customers* of one company almost always meant a loss in *Current customer* of the other company. Competing for *customers* had adverse consequences on *profits* (Figure 1.8).

Figure 1.8 displays the unfolding of *Accumulated profits* of both companies over the 12 months. During the first 3–4 months, losses increased quickly (that is, *profits* decreased); this was due to massively reducing *sales prices* and *subscription rates* while the costs of buying the devices and serving *customers* remained unchanged. Starting at month 4, losses decreased, then increased and decreased again. Note that losses are negative *profits*; if losses decrease, that means that your *profits* are negative, but less than before. Your *profits* increase, even if it is only in a relative manner. When RivTel has many *customers* (months 4–6), their losses decrease, but after deciding to lower the *subscription rate* to a monthly $10 (equalling the monthly *Service costs*, which amount to $10 per *Current*

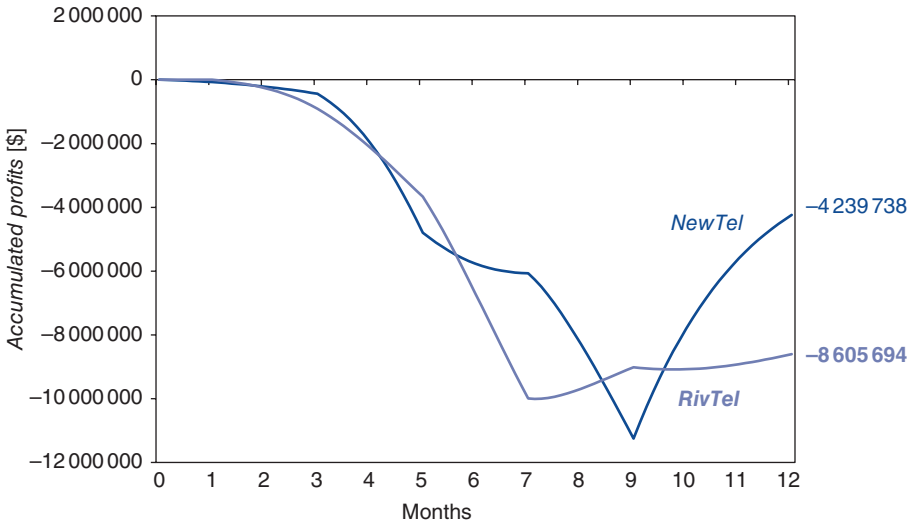

Figure 1.8 Development of *Accumulated profits*

customer), the situation worsens again. NewTel's profit took a dive when it decided to reduce the *sales price* to an extreme $0 and the *subscription rate* to $10 at month 8, but then losses were reduced when in month 10 both *prices* were raised back to $20.

1.5 Outcomes of both scenarios in terms of key performance indicators

Since your objectives, as well as RivTel's, are to achieve the highest possible *Accumulated profits* at the end of the year, it is likely that both of you use *Accumulated profits* as a 'key performance indicator' (KPI). The term 'performance' refers to how well an activity is carried out as compared to a standard or predefined level of accomplishment. Naturally, this means KPIs convey the information that should give you a clear idea of how well the organization is performing. In your case, *Accumulated profits* is one of them; however, it is not necessarily the only one. In the CFC scenario, the fictitious managers of NewTel and RivTel also considered their respective

market share. *Market share* can be expressed as the percentage of all *Current customers* who are your *Current customers*; this then is called the *customer market share*. Of course, you need *Current customers* to gain *revenues from sales* and *revenues from subscriptions*; the fact that you have a high *customer market share* would then indicate that you fulfil at least one necessary condition for building up *Accumulated profits*. Additionally, your *profit market share* indicates the percentage of your *Accumulated profits* relative to all *Accumulated profits*. This will allow you to better understand whether a given amount of *Accumulated profits* is a strong result or not.

How do these three KPIs look for each of the two scenarios? At the end of the year, NewTel achieved *Accumulated profits* of $75 106 and RivTel had negative *Accumulated profits.* In fact, its losses amounted to $2 718 392. As far as *customer market share* and *profit market share* are concerned, Table 1.3 summarizes the values for the two scenarios.

In the BAU scenario, neither company outperforms the other. Both complete the first year with a *customer market share* of 47%, since 6% of the *population* does not use a mobile phone at the end of the year. The *profit share* for each company is 50%, which corresponds to about $38 million for each company. In the CFC scenario, RivTel is the clear winner when considering the *customer market share* as a performance indicator. When considering the *Accumulated profit*, both companies performed poorly: RivTel incurs losses of almost $3 million and NewTel barely gets away without any losses. Of course, when comparing the absolute *Accumulated profits*, NewTel has performed better than RivTel. However, each of the companies significantly lost compared to the $53 million profit in the BAU scenario.

Table 1.3 Key performance indicators for both scenarios

	Business as Usual (BAU)		Compete for Customers (CFC)	
Key Performance Indicator (KPI)	**NewTel**	**RivTel**	**NewTel**	**RivTel**
Customer market share [dimensionless]	47	47	23	71
Profit market share [dimensionless]	50	50	n.a.	n.a.
Accumulated profits [million $]	37.7	37.7	0.08	−2.72

You will be evaluated for *Accumulated profit* after 12 months and, in the CFC scenario, NewTel's *Accumulated profits* were below the BAU results. But then again, to make profits, you needed to acquire *customers*; when RivTel outpaced you by lowering *prices*, did you also not have the right to compete for *customers* by lowering *prices*? Was it wrong that you paid attention to *customer* market share as an indicator of your current situation?

DIY 1.4: From *customers* to *profits*

Specify the ways in which *Current customers* have an influence on *profits*. Draw a diagram using variables, e.g. *Current customers*, *customer market share,* and *monthly profits*. Use arrows to represent the relationships between the variables. Use the worksheet at the end of the chapter.

In retrospect, you might wonder: When is your performance good? Is it good when your performance is better than RivTel's performance or when it is the best result you can achieve? When comparing the results from Table 1.3, you suspect that NewTel's board will not regard your performance as good only because it is higher than RivTel's performance. How much *Accumulated profit* could it be then? Was $38 million a strong performance or could it be even higher?

Since RivTel's decisions influence what happens in the market, you cannot determine how much *profit* is possible without considering RivTel's goals and policies. In such a setting: What policy should you implement to achieve the best result? Since you are trying to improve the *Accumulated profits* for NewTel, you could ask yourself the following questions:

- In which ways are the *sales price* and the *subscription rate* connected to *Current customers* and *monthly profits*. How do *Current customers* influence *monthly profits*? Reducing the *sales price* influenced *Current customers* and *monthly profits* changed in response to it. But how exactly are these variables linked?

- What will the results be when I increase or decrease the *sales price* compared to when I increase or decrease the *subscription rate*?
- How can I capture *customers* quickly without *advertising spending*?
- What happens to *monthly profits* if I spend money for *advertising*?
- What would be the impact if I change the *life cycle duration* of the mobile phones?

In principle, you ask yourself: How are the elements and decision variables related to the business system?

Your airplane is approaching Frankfurt and these questions on your mind make it clear that you need to understand the complexities of your business system. Since you are responsible for succeeding, you tell yourself that you must uncover the structures and behaviour of the business system or you need to leave NewTel.

1.6 Chapter summary

In the chapter, you made two attempts to steer NewTel through twelve months after the product introduction while RivTel strives to do the same. An initial simulation with the SellPhone simulation showed that under the given circumstances, each company could expect to make around $38 million *Accumulated profits*. We have also seen that competing for customers by reducing *prices* may be successful at attracting *customers*, but it substantially reduces *Accumulated profits* over the twelve months. We have concluded that with no more than this information, important questions arise and need to be answered before deciding on policies for NewTel.

1.7 Questions and challenges

Questions

1. Define 'variable'.
2. Why is it important to define the variables' units of measure?
3. What is a behaviour-over-time graph? For what is it used?
4. What atomic behaviour modes are discussed in this chapter?

5. Explain how the composed behaviour modes can be decomposed into atomic behaviour modes.
6. What is a policy? What types of policies can you name?
7. What problems can arise when a model is too simple or too complex?
8. What are NewTel's key performance indicators? Why is it important to define and used key performance indicators?
9. How can you be satisfied that your performance as manager is sufficient?
10. How are the decision variables related to one another?
11. How can different scenarios be defined?

Challenges

Based on your annotations from DIY 1.2, formulate policies for setting the *sales price* and the *subscription rate* for NewTel. As an example, this can be a phrase like 'If the competitor has won more *new customers* than I did, then I will lower the *sales price*'. Now assume that RivTel would apply the same policy and use the SellPhone simulation to play through the 12 months. What was your performance regarding *Accumulated profits* and of *customer market share* this time, as compared to the BAU and the CFC scenarios?

You can use worksheet 1.5 from the companion website for that challenge to write down your policies, produce the graphs and write up the essentials of your scenario comparison.

References

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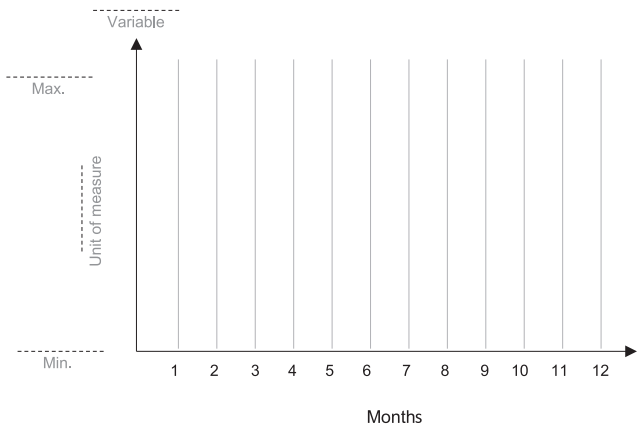
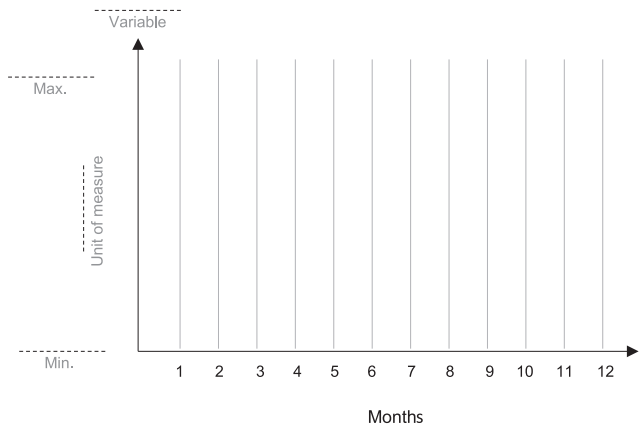
Sterman, J.D. 2001. System dynamics modeling: tools for learning in a complex world. *California Management Review*, **43**(4): 8–24.

Oxford Dictionaries. 2016. Policy. http://www.oxforddictionaries.com/definition/english/policy (last accessed 1 November 2017).

Worksheet DIY 1.1:
First simulation - business as usual (BAU)

Identify the two most relevant variables and write their names on top of the vertical axes of the graphs. Next identify their respective units of measure and indicate them next to "Unit of measure" on the vertical axes. Then identify the range of observed values and inscribe them in "Max" and "Min" for each graph. Eventually, draw the variables' respective behaviours in the graphs.





Description of behaviour

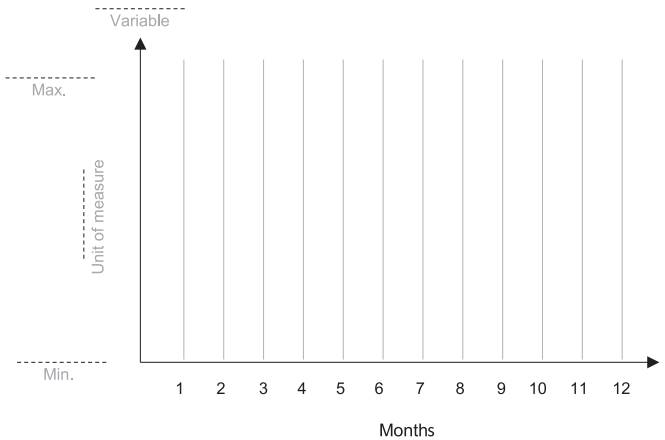
Description of behaviour

Worksheet DIY 1.2:
Second simulation – compete for customers (CFC) (Sheet 1 of 3)

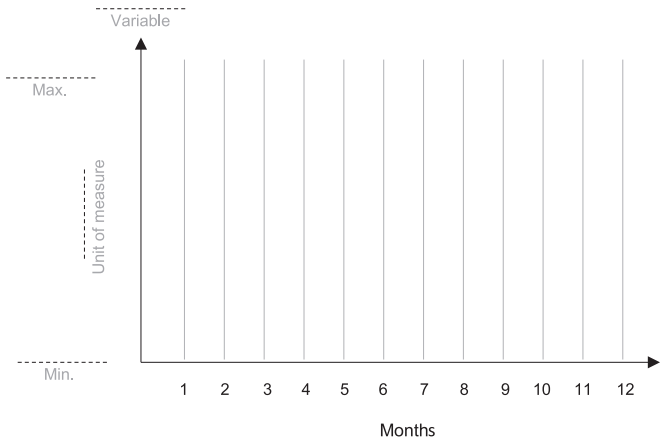
Month	Decisions				What effect do you want to achieve with each decisión?	Consequences			
	sales price		*subscription rate*			*Current customers*		*monthly profits*	
	NewTel	RivTel	NewTel	RivTel		NewTel	RivTel	NewTel	RivTel
1						○↗ ○↘	○↗ ○↘	○↗ ○↘	○↗ ○↘
2						○↗ ○↘	○↗ ○↘	○↗ ○↘	○↗ ○↘
3						○↗ ○↘	○↗ ○↘	○↗ ○↘	○↗ ○↘
4						○↗ ○↘	○↗ ○↘	○↗ ○↘	○↗ ○↘
5						○↗ ○↘	○↗ ○↘	○↗ ○↘	○↗ ○↘
6						○↗ ○↘	○↗ ○↘	○↗ ○↘	○↗ ○↘
7						○↗ ○↘	○↗ ○↘	○↗ ○↘	○↗ ○↘
8						○↗ ○↘	○↗ ○↘	○↗ ○↘	○↗ ○↘
9						○↗ ○↘	○↗ ○↘	○↗ ○↘	○↗ ○↘
10						○↗ ○↘	○↗ ○↘	○↗ ○↘	○↗ ○↘
11						○↗ ○↘	○↗ ○↘	○↗ ○↘	○↗ ○↘
12						○↗ ○↘	○↗ ○↘	○↗ ○↘	○↗ ○↘
					Final values	**CFC**			
						BAU			

Worksheet DIY 1.2:
Second simulation – compete for customers (CFC) (Sheet 2 of 3)

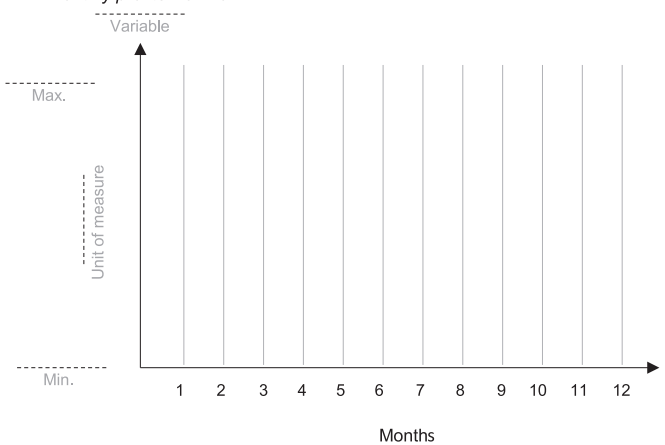
Current customers NewTel



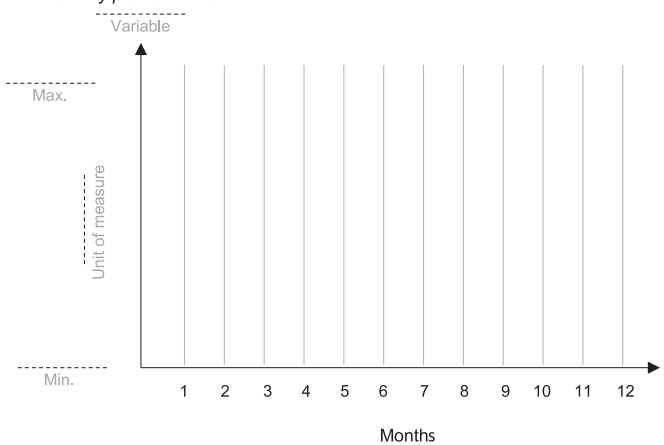
Current customers RivTel



monthly profits NewTel



monthly profits RivTel



Worksheet DIY 1.2:
Second simulation – compete for customers (CFC) (Sheet 3 of 3)

For each month, assess if the decisions taken by both companies in the previous month resulted in winning more *new customers*. How many *Current customers* does each company have at the end of the simulation? Were the companies' monthly decisions followed by a rise or a fall of their respective *monthly profits*? What was your *Accumulated profit* at the end of the year? Was it better than RivTel's? Was it higher than the *Accumulated profits* achieved in the BAU scenario?

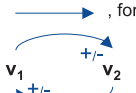
Worksheet DIY 1.4:
From *customers* to *profits*

A cause-effect relationship between two variables v_1 and v_2 is represented by an arrow from v_1 to v_2: 

A causal link has a polarity: positive or negative.

For positive cause-effect relationships, use 

, for negative cause-effect relationships, use 

Sometimes causal relationships are circular: 

Do not hesitate to draw such relationships if you perceive they exist.