Alessandro Capocchi

Economic Value and Revenue Management Systems

An Integrated Business Management Model

Economic Value and Revenue Management Systems

Alessandro Capocchi

Economic Value and Revenue Management Systems

An Integrated Business Management Model

palgrave
macmillan

Alessandro Capocchi
University of Milano-Bicocca
Milan, Italy

I would like to dedicate this book to my father, Umberto (1946–2015): model, guide, and companion during many personal and professional adventures.

Preface

This book is the result of intensive research carried out over the last ten years in order to analyze and observe a complex business phenomenon in both Italian and international contexts. The last decade has seen a profound change in economic dynamics, thanks to the growing diffusion of web-based technologies. The spread of new technologies has been accompanied by the emergence of new forms of entrepreneurship, which have changed the paradigms of doing business. Today, while on the one hand the complexity of doing business has increased, on the other hand new technologies represent not only threats, but also important opportunities for all who are able to grasp them. For example, think of the potential for sharing and disseminating information via the Web; think of the new forms of access to credit and capital-raising with the use of international crowdfunding platforms. The change in economic dynamics also has an impact on how new generations approach entrepreneurship, on the role of universities, and on where new entrepreneurs are born or should be born: it is evident that the Web is replacing the factories, and the new entrepreneur is no longer born in the factory.

Hence, there is a need to reread some fundamental studies of Italian business-economics science in which it is stated that the company is a lasting phenomenon over time, separated from the life of the founder and aimed at achieving conditions of lasting economic equilibrium. The economics and business literature has focused on the systemic nature of the

company and on the opening of the system to the surrounding environment to grasp the dynamic drives that will guide the company in adapting to changes in the environment and, preferably, in anticipating these changes.

The vision of the company as an open and dynamic system is even more real and relevant today, thanks to the phenomena that characterize the sharing economy and the nascent contamination economy.

Within this vision it is important to recapture some fundamental elements of the business phenomenon. These include continuity over time and the need to achieve and maintain conditions of lasting economic equilibrium. Only by maintaining such conditions can the company create social value and contribute to the satisfaction of human needs.

The issue of economic equilibrium also assumes a central role today in the analysis of various business phenomena. Such equilibrium has to be associated with the theme of continuity of the business phenomenon over time. Hence, it is important to understand how, with the increasing complexity of competitive dynamics, the conditions of economic equilibrium have undergone changes over the years. These changes have guided companies to read non-accounting data associated with accounting data that make up financial statements and company reports. The changes have driven companies toward attempts to better understand the habits of their customers and potential customers through customer relation management tools and through the implementation of managerial tools that are increasingly based on mathematical-statistical models on which corporate strategic policies and marketing policies are based. Finally, the changes have brought the customer to the center of competitive systems by attributing increasing relativism to other variables, such as the technical characteristics of the product/service and the price.

In this new competitive context, the price is no longer tied to the market (i.e., the relationship between supply and demand) or to the company's economic constraints (i.e., the costs that the company sustains for production). The price, according to the theory of value creation by M. E. Porter, is increasingly linked to the satisfaction of the client or potential customer, their ability to pay increasing prices, and their willingness to pay. Companies today cannot produce to sell, but must sell at the maximum price that the individual customer, at a given moment and

in a particular place, is willing to pay to buy a unit of product/service. In this new context, the price is not static, but is strongly dynamic. The dynamism of price concerns not only service companies, whose output is intangible, but also manufacturing companies, and more generally the entire economic sector.

The dynamism of the price is consistent with the centrality of the customer. However, this does not detract from the issue of technical efficiency that must guide any business phenomenon. For many years, the issue of sustainable economic equilibrium has been studied only from a financial and economic point of view, neglecting aspects of corporate productivity. Today, thanks to the greater dynamism of the markets, technical efficiency has become more important as it is a necessary, though not sufficient, condition to guarantee maximization of the company's profitability.

The links between technical efficiency and profitability, and between profitability intended as value creation for continuity of the business phenomenon and price dynamism, are summarized in modern revenue management systems.

It is for these reasons I decided to write this book. I wanted to show that, in the greater competitive context, companies—*all* companies—must develop integrated management systems that are able to respond to the logic and principles of revenue management. In fact, revenue management systems are the only ones capable of leading the company toward greater technical efficiency and maximization of profitability based on management of the available production capacity and on the dynamism of the price lever.

This book aims to help the new generations in understanding the essence of the business phenomenon; explain how the continuity of the business phenomenon is closely linked to the ability to create and maintain long-lasting equilibrium conditions; reveal how the creation and maintenance of the conditions of lasting equilibrium are linked to the implementation of complex management systems in which accounting data are added to non-accounting data related to company productivity and knowledge of the customer and potential customer; make it clear how competitiveness today is strictly linked to "customer ownership"—that is, the ability of companies to acquire, maintain, and manipulate

their customers, pushing them to maximize their willingness to pay at any time; explain how complex and integrated management systems must respond to the logic and principles of revenue management; and, finally, facilitate an understanding of revenue management from a management point of view, and not as a mere tool based on mathematical-statistical models.

The business-economics reality is very dynamic, and when this book comes out, the reality will probably already have moved on. This is why I have committed to continuing my clinical analysis of the complex business phenomenology and to guiding and orienting new generations to the dimension of entrepreneurship.

Milan, Italy   Alessandro Capocchi

Acknowledgments

Writing this book involved ten years of work, but also ten years of relationships with people I was lucky enough to meet and get to know, and from whom I had the good fortune and the ability to learn. I cannot thank everyone by name, but I want to underline the many phases of my professional life. Each phase was accompanied by someone who taught me. I have been lucky to encounter so many masters, and my hope is to continue to meet people from whom I can learn.

I also hope to be able to pass on my love of learning to my three sons, Edoardo, Giorgio, and Vittoria Luisa, and my students.

Learning is a demanding, time-consuming activity, at the base of which there must be curiosity, listening, observation, and passion. You learn always and everywhere. Personally, I have also learned a lot in my travels by train, during which I have met different people with very different stories.

Curiosity has always guided me throughout the years, and will continue to guide me in future. I hope that the new generations grow increasingly curious and are not content with limiting their quest for answers to the screen of their smartphone.

Contents

List of Figures

List of Tables

1

Starting and Running a Business

From a Sharing to a Contamination Economy

The last few years have seen the emergence of what might be called a "contamination economy." The term describes the profound change that can be seen today in how business is done, both with regard to the confines of the factory in the traditional sense and with reference to the complexities of business resulting from the implementation of new technologies and the change of the time variable, as well as with reference to the phenomena that have seen the birth, growth, and proliferation of new entrepreneurship, many of the manifestations of which relate to the Web (e.g., Facebook, Amazon, Spotify, Netflix). These nascent forms of entrepreneurship have helped to change the approach to business through new generations, and to raise the levels of complexity, generating threats on the one hand but opportunities on the other.

The contamination economy is the evolution of the "sharing economy," which was born in the 2000s with the creation of various digital platforms on which different subjects are aggregated, breaking down the roles that distinguish them in the traditional economy. This aggregation on shared platforms determines the creation of a virtual space within

which the aggregated subjects can operate and implement acts as well as relationships of a commercial nature. Aggregation on platforms in this way shortens the distances that exist between the different operators in the real economy and favors the circulation of tangible and intangible resources. The phenomenon of a sharing economy over the years has taken on different connotations, from sharing in the literal sense of the term to crowding, bartering, and making.

Examples of "sharing" in the literal, first form of the phenomenon can be found in the world of transport, such as bike sharing and car sharing, and the creation of marketplace platforms such as BlaBlaCar, founded in September 2006 in Paris by Frédéric Mazzella, Nicolas Brusson, and Francis Nappez as a carpooling platform now present in 21 countries and with 25 million registered users. Other examples of sharing are represented by Wikipedia or platforms originating in tourism and based on the sharing of houses for holiday periods or short stays: in 2004, Casey Fenton, Daniel Hoffer, Leonardo Bassani da Silveira, Sebastian Le Tuan, and Daniel Hoffer founded in the United States CouchSurfing, a platform for the exchange of hospitality and a social network service. There are numerous other case studies, from portals for the sale of used items to those for finding professional figures, from babysitters to artisans, to Airbnb, which launched in 2008 as an online portal that connects people looking for accommodation for short periods with people who have extra space to rent (usually privately).

The phenomenon of "crowding" demonstrates the same modalities—that is, the aggregation of people around platforms in which a form of sharing is the objective; in the crowding context, this often comprises entrepreneurial ideas or projects that sometimes offer beneficial purposes, social and cultural. The scope of crowding has progressively widened, and today it can be seen to have profoundly changed the methods of access to credit and the search for financial resources. Increasingly, people and small innovative start-ups that wish to validate their business ideas are turning to such platforms to raise finance. There are two types of crowdfunding: in the first type, an idea and/or project is presented with a request for support through contributions of small amounts that together can be used to implement the project. In this typology, the focus is on the visibility of the platform and its ability to attract the interest of people

from all over the world. The second type consists of a search for capital that enters as equity in the company property. With this typology, not only is a structure of financial resources created as capital for the newly born or nascent company, but the social structure of the same is also constructed through the process.

Worldwide, the two most important crowdfunding platforms are Kickstarter and Indiegogo. Kickstarter was created in 2009 as a website of collective financing for creative projects where it is not possible to draw wealth from the investment in projects—it is only possible to lend support to them. Indiegogo is an international collective funding site founded in 2008 by Danae Ringelmann, Slava Rubin, and Eric Schell. In Italy, there have been many platforms founded in recent years, although with volumes lower than these two American examples. Among the most significant Italian examples is DeRev. According to a report by the European Commission, DeRev, an all-Italian project, is among the five best crowdfunding platforms in Europe. Launched in 2013, it holds the record for the most financed crowdfunding campaign in Italy: € 1.5 million for the reconstruction of the Città della Scienza museum in Naples, which had been destroyed by fire in 2013. DeRev proposes three formulas, two of which refer to time limits and one that doesn't: for the first, collect all or nothing within a maximum of 90 days; the second is fundraising that incorporates the instant crediting of funds without minimum objectives; the third is reserved for non-profit associations or bodies that intend to finance ongoing activities.

Eppela, like DeRev, is a wholly Italian platform. It was founded in 2011, and by 2017 it had raised almost € 6.5 million. It utilizes a reward-based model, which provides a reward for the donor who made the donation and sets time limits within which the funds must be raised, ranging from a minimum of 15 days to a maximum of 40. Eppela charges a 5% commission on the sum collected in cases in which goals are met. A platform open to equity-based support, Eppela offers the opportunity for companies, foundations, and institutions to co-finance projects, up to a maximum of 50% of the budget. Similarly, Mamacrowd is a pure equity crowdfunding platform that allows a donor to become a shareholder of the funded project. For this reason, not everyone can apply for a project; the Mamacrowd team, through analysis of quantitative and qualitative

criteria, evaluates an application and looks for the existence of certain prerequisites, such as registration in the special section of the business register. Mamacrowd is a relatively young company, founded by SiamoSoci in 2016 and authorized by Italian Companies and Exchange Commission (CONSOB), that favors and facilitates investment in innovative Italian projects launched by start-ups and small- and medium-sized enterprises (SMEs). StarsUp was the first project that CONSOB authorized to collect online venture capital from innovative companies and operate under the equity crowdfunding regime, and it too was designed for start-ups and SMEs. In addition to its fundraising platform, StarsUp also provides people with the advice of its professionals and it only charges a fee, which varies according to the offer subscribed, if the predefined economic objective is reached. Since 2014, the Livorno-based company has raised almost € 3 million. StarsUp also provides information on benefits for companies and investors. Productions From Below is probably among the best-known crowdfunding platforms, and was the first in Italy. Founded in 2005, it favors a mixed model: donation-based and reward-based. It proposes four rules for fundraising: collect everything (reward for the donor, maximum deadline of one year, commission of 5% on each transaction), simple donation (maximum deadline of one year, commission of 3% on each transaction, funds immediately available), recurring donation (no expiration, only PayPal, automatic monthly renewal of the donation), and all or nothing (maximum deadline of 120 days, commission of 5% on each transaction).

Another form of the sharing economy concerns the sharing of platforms for the exchange of goods through a bartering tool. Compared to other forms of sharing, "barter" represents a comparatively minor element, but it does offer valuable support and has gone on to revolutionize the digital economy. One example of a start-up founded on bartering is Armadio Verde, launched through the A11 Venture Investment Fund. Armadio Verde is a community marketplace for the exchange of dresses for women and for children aged between 0 and 16 years.

"Making" is also a relatively less relevant aspect of the sharing economy, but more and more people are sharing their availability to carry out services or their offerings as a small business on such platforms. Examples include platforms on which people can find small commissions at public

offices or carry out shopping at the supermarket. In making, the shared resource is represented by the time each member makes available to the community.

The different connotations that the sharing economy assumes lead us to observe how the implementation of technologies and the creation of platforms aimed at supporting the digital aggregation of subjects and players have pushed the system to a growing and almost total search for sharing by modifying in a sensitive way some dynamics of doing business.

Business and Entrepreneurship

In this context, it can be easy to confuse the concept of doing business with the concept of creating a company. A company requires a business, as business is the basis of its activity—but business alone is not sufficient. However, it is possible to do business without needing to set up a company. For example, a few years ago, I met an Italian past student of mine in a big hotel in London. He was working for the hotel. One evening, he asked for a chat and explained to me that, in addition to the work in the hotel, he bought high-quality branded watches in Italy and sold them to British retailers, obtaining a good margin. This activity was a good business for the student, but, at that level, it did not require any setting up of a company.

It is very important to highlight the differences between business and company—in particular for the younger generations. When students ask for information concerning a new business idea or business opportunities, the first question in reply should be, "Are you going to create a new business, or you want to become an entrepreneur?" The reasoning behind the question is clear: if someone wants just to create or run a business, they do not need to create a company (as was the case with the student who sold branded watches in London). Considered another way, though, running a business means creating a structure that needs organization—and structure and organization are the pillars of a new company.

A business with no company can be stopped at any moment. It is easy to manage, is generally low risk, and offers a good balance between

revenue and costs. A business with a company entails an organization that can be more or less complex, represents more risk, and has a question mark over the balance between revenue and costs. Running a business without a structure means not being an entrepreneur; running a business with a stable structure means being an entrepreneur.

The presence of a structure is a key point in the current economic system. In some sectors, there are players with a highly developed structure who are in competition with other players with no structure. An example is the hospitality market. Airbnb changed, at the local level, the market and the competition in the hospitality sector. At the local level, there are hotels—independents and others—that require a high level of complexity due to their organization, but there are also B&Bs (bed and breakfasts) with a low level of complexity—and now there are also players like Airbnb that sell rooms or flats just using new IT platforms: diverse players, differing business models, and dissimilar organization models with different implications.

The case of hospitality is a great example of a market in which, in the same place and at the same time, there exist in competition different players with different models and roles. TripAdvisor shows in Milan the presence of 430 hotels, 292 B&Bs and guesthouses, and 295 other kinds of accommodation. These players apparently are running the same business because they are part of the same sector: the hospitality market. But they are playing with different business models, rates of complexity, levels of risk, and organization models. So, in the end, they are not running the same business, or, if they do, it plays a different role.

The heterogeneity in a market depends on the nature of the market itself and on the effects that the same determines on the economies of scale of the actors involved. Sometimes, is not possible to run a business in a market without having a structure with which to compete with other players. In other cases, in the same market, there can be spaces for players with no structure, as is the case in the hospitality sector. In a market in which there are several kinds of player, there is a higher segmentation in terms of customers—that is, different customer segments for different players.

The Entrepreneur

Generally, there are two definitions of "entrepreneurship." The first frames the concept in terms of the creation of new business, a process accompanied by risk-taking and uncertainty. The second definition includes elements of discovery, evaluation, the use of opportunities, and of maximizing value resulting from the process.

Preliminary interest in the notion of entrepreneurship was expressed by Richard Cantillon (1680–1734), who focused on the economic role of the entrepreneur, rather than on the individuals themselves. Cantillon is the father of economic theory for providing the first theoretical analysis of commerce in his *Essai sur la Nature du Commerce en Général*, posthumously and anonymously published in 1755. Additionally, Cantillon coined the word "entrepreneurship," and he is now credited for developing important theory underpinning the concept. Although the introduction of the term "entrepreneur" was originally attributed to Jean-Baptiste Say (1767–1832), it is now known that Cantillon was the "first significant writer to make frequent and obtrusive use of the term in a semblance of its modern form" (Hébert and Link 2006: 589; see also Formaini 2001; Hamilton and Harper 1994) and particularly as a concept for formal theoretical purposes (Hébert and Link 2006). Cantillon stated that entrepreneurship entails bearing the risk of buying at certain prices and selling at uncertain prices. The entrepreneur is charged with buying goods at a low price and transferring them to the market where the goods will be sold at a higher price (Cantillon 1931: 151).

Jean Baptiste Say (1800) broadened the definition to include the idea of bringing together the factors of production: "The entrepreneur shifts economic resources out of an area of lower and into an area of higher productivity and greater yield." Joseph Schumpeter (1883–1950) took a more specific view, considering entrepreneurship to be the process by which the economy as a whole goes forward, as something that disrupts the market equilibrium or circular flow. The essence of Schumpeter's analysis is "innovation," and he added to his characterization of the concept "the carrying out of new combinations we call 'enterprise'; the individuals whose function is to carry them out we call 'entrepreneurs'" (1934: 74). Furthermore, according to Schumpeter, it is possible to consider entrepreneurs as:

not only those "independent" businessmen in an exchange economy who are usually so designated, but all who actually fulfil the function by which we define the concept, even if they are, as is becoming the rule, "dependent" employees of a company, like managers, members of boards of directors, and so forth, or even if their actual power to perform the entrepreneurial function has any other foundations, such as the control of a majority of shares. As it is the carrying out of new combinations that constitutes the entrepreneur, it is not necessary that he should be permanently connected with an individual firm; many "financiers," "promoters," and so forth are not, and still they may be entrepreneurs in our sense. On the other hand, our concept is narrower than the traditional one in that it does not include all heads of firms or managers of industrialists who merely may operate an established business, but only those who actually perform that function. (Schumpeter 1934: 74)

Schumpeter described entrepreneurs as innovators who drive the "creative–destructive" process of capitalism, with their function being "to reform or revolutionize the pattern of production" (J. Gregory Dees 2001, available online at: https://entrepreneurship.duke.edu/news-item/the-meaning-of-social-entrepreneurship/). They can do this "by exploiting an invention or, more generally, an untried technological possibility for producing a new commodity or producing an old one in a new way, by opening up a new source of supply of materials or a new outlet for products, by reorganizing an industry and so on." Schumpeter's entrepreneurs are the change agents in the economy. By serving new markets or creating new ways of doing things, they move the economy forward. It is true that many of the entrepreneurs that Say and Schumpeter have in mind serve their function by starting new, profit-seeking business ventures, but starting a business is not the essence of entrepreneurship. Though other economists may have used the term with various nuances, the Say–Schumpeter tradition that identifies entrepreneurs as the catalysts and innovators behind economic progress has served as the foundation for the contemporary use of this concept (J. Gregory Dees 2001, available online at: https://entrepreneurship.duke.edu/news-item/the-meaning-of-social-entrepreneurship/).

Today, the word "entrepreneur" often refers simply to someone who has started his or her own business. Peter Drucker (1909–2005), how-

ever, rejected this commonly held conceptualization and considered Say's characterization to be closer to the point (available online at: https://www.drucker.institute/monday-issue/creating-an-entrepreneurial-society/). Peter Drucker observed:

> In the United States, for instance, the entrepreneur is often defined as one who starts his own, new and small business. Indeed, the courses in "Entrepreneurship" that have become popular of late in American business schools are the linear descendants of the course in starting one's own small business that was offered 30 years ago, and in many cases, not very different. But not every new small business is entrepreneurial or represents entrepreneurship. (Drucker 1985: 21)

According to Drucker, the definition of the entrepreneur is more general and open to the concept of change, as entrepreneurs innovate and innovation is the specific instrument of entrepreneurship. His elucidation remains applicable and significant in relation to other studies and contexts internationally.

The Italian literature also offers some definitions that characterize the concept of the entrepreneur as being associated with that of entrepreneurship. For example, Fabio Besta (1845–1922) defined entrepreneurship as:

> the sum of the phenomena, or stores, or relationships to be administered relating to an accumulation of capital that forms a whole to itself, or to an individual person, or to a family or any union, or even just a distinct class of those phenomena, shops or relationships. (Besta 1909: 3)

Following Besta's reasoning, there is no company without external goods and without wealth, yet wealth constitutes the substance or the assets of a company, not the company itself. There is no company where there is no manifestation of human activity, and each company belongs to a person or a union of people.

The definition offered by Gino Zappa (1879–1960) is more exhaustive and considers entrepreneurship as an ongoing, established, and upright economic coordination for the satisfaction of human needs:

> The company can not live isolated. The company fulfills the task to which it intends the more it conforms to the environment and uses it for its own ends. The becoming of a business economy can not consciously perceive that when it is reconnected with the process of the general economy. (Zappa 1920: 359)

A "company" in Zappa's vision is a combination of elements, and the value created is not just the sum of the value of each element but the output of the integration process among the specific elements.

A similar explication, although expanded, was taken up by Aldo Amaduzzi (1904–1991), who considered the company as a mechanistic or organicist system. Indeed, it is rather like a system, with a set of component parts joined together by constraints and stresses. The components of the system are economic forces—that is, personal energies, material economic means, and intangible economic factors—and the system itself should be considered in its motion (Amaduzzi 1948: 12). Thus:

> [t]he company appears to our mind as an intentionally coordinated whole, we would almost say as a system of economic forces, operating in continuous adaptation to the environment, of which it is a complementary part, and having for the end the development of a production process, or consumption, or production and consumption together, in favor of a given economic entity, consistent with the purposes of the environmental regime. And since production is only a means of consumption, it can be said that the ultimate goal of the company is that of satisfying human needs. The company appears as a cell of the economic–social fabric, a minor organism component of the overall economic system. (Amaduzzi 1948: 11)

Lastly, in terms of notable Italian contributions to the theory development, Egidio Giannessi (1908–1982) defined the company as an elementary unit of the general economic order with its own and reflected life, consisting of a system of operations originating from the combination of particular factors and the composition of internal and external forces, in which the phenomena of production, distribution, and consumption are prepared for the achievement of a certain economic equilibrium that is valid over time and capable of offering adequate remuneration to the factors used and a compensation, proportional to the results achieved, to the economic entity on whose behalf the activity takes place (Giannessi 1970: 11).

The outlines and descriptions described earlier make it possible to define "entrepreneurship" as a system of elements that are mutually linked and oriented toward the realization of a process of transformation in the economic sense. Moreover, the "company" is a system of elements and not a whole, in line with what was written by Zappa on the subject of the production combination. It is a dynamic system subject to constant adaptation to the environmental system in which it is inserted, and it is an open system, as a company cannot exist in isolation. For these reasons, a company can be compared to a biological system or a living being (a cell) whose life cycle cannot and must not coincide with the life cycle of its founder. The company, as Giannessi posited, is a phenomenon, the aim of which is to endure over time.

Furthermore, the systemic vision of the company as a combination of production elements oriented at lasting over time introduces the phenomenon of the business cycle. The manifestation of the business cycle is important in recognizing and differentiating players operating on the market in compliance with the principles of the corporate phenomenon and players who operate equally on the market without the need to respect those same principles.

Entrepreneurship

The difference between doing business and being an entrepreneur resides in the presence of an organizational structure that gives the business longevity. Entrepreneurship requires continuity as well, but, in this context, the necessary continuity is brought about by an organizational structure and by the presence of the entrepreneur, with the role of coordinating and directing the processes with which the individual elements are combined: as Zappa wrote, the enterprise is a productive combination.

The creation of an enterprise must therefore originate from a business idea and from the grounding of the same through the legal establishment of the business subject and the activation of the production process through the coordination of the productive combination. In particular, the enterprise must:

- have a life of its own—the life of the enterprise must be different and independent from the life of its founder
- have its own organizational structure
- create value, both economic and social

A business idea is not sufficient to realize a business or to activate the creation process of an enterprise, as illustrated in Fig. 1.1.

A business idea is strictly related to internal and external variables that play an important role in the process of transforming that idea into business. "Internal variables" are related to the promoter's ability to give substance to his idea and to reactivate the process of realization. Added to this is the ability to attract people of trust who are able to support the idea and the availability of capital to the extent necessary to finance the realization of the idea itself until it is able to generate economic value. "External variables" are linked to market conditions and to the ability to
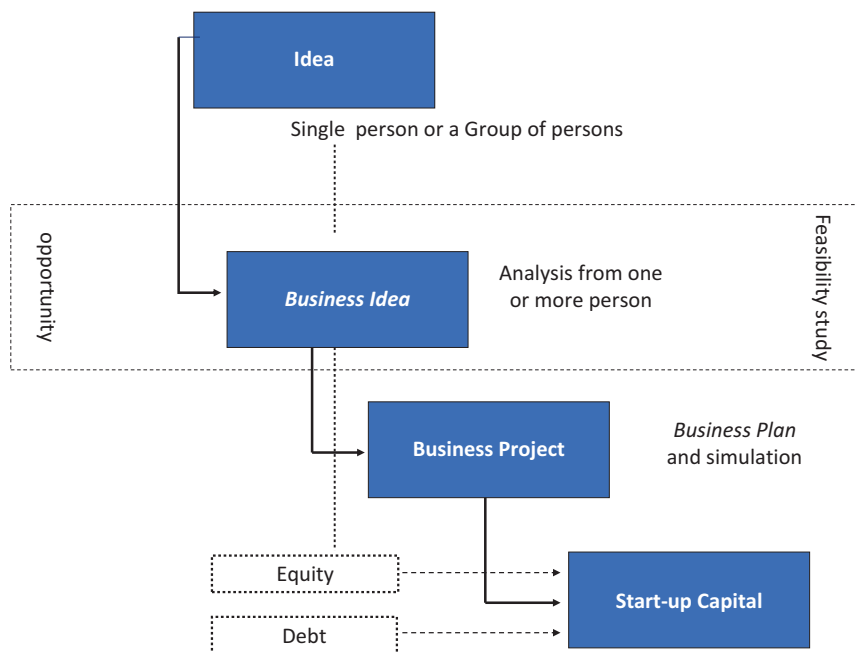
Fig. 1.1   From business idea to the start-up of the project

find and attract the financial resources necessary to integrate venture capital. Internal variables express the feasibility of the business idea, while external variables express the opportunity to realize the business idea itself.

The creation of businesses also depends on macro factors and on the capacity of the territory to generate processes of osmosis (contamination) and sharing among different actors: universities, research centers, corporations, and so forth. In the past, many companies were born in the factory. The worker, having learned the trade, took a risk and set up his own small business. Today, many of these small businesses—the manufacturing majority—are extant multinational companies. Today, companies are no longer originating in factories. They are increasingly linked to innovation and the ability to join the dots between different actors in the territory, creating new opportunities for young people. Today, more than in the past, the link between entrepreneurship and innovation, as theorized by Schumpeter, is at the center of the birth and development of companies and competitiveness in national and international markets.

Innovation and Entrepreneurship

With the transition from the sharing economy to the contamination economy, the phenomenon of "innovation" within the new entrepreneurship has taken increasing importance in Italy (and elsewhere) in recent years, partly driven by trends in other European countries. This importance is widely reflected in the doctrinal debate in which, during the 1980s, scholars such as Kline and Rosenberg (1986) introduced a linear concept of innovation according to which the process follows a series of well-defined phases that follow one another in a rigid and sequential manner. This analysis has been criticized because the rigid cause–effect relationship at its center does not allow for the "uncertainty" factor that characterizes, in practice, the experience of many companies.

Previously, other scholars, among whom Schumpeter (1968) and Kirzner (1973) deserve to be mentioned, had pursued an "individualistic" approach to innovation, linked to the personal characteristics of the innovator identified in the entrepreneur and understood as the one whose

personal creative abilities are able to bring about change and innovation. Later, the individualistic approach was enhanced by the contributions of other scholars such as Burns and Stalker (1961), Lawrence and Lorsche (1967), Woodward (1965), and Perrow (1970) to become what is known as the "structuralist" approach, which presents a contingent vision of innovation influenced by the reference context. The structuralist perspective can therefore be defined as a "systemic" approach, as it perceives innovation as a process that is affected by the context in which the organization is inserted, but also by the influence that on the context all the actors can exercise—they are part of it (Dooley et al. 2000). Hence, innovation as a systemic process aims to put the focus on policies aimed at creating and freeing resources that can incentivize investments in individuals and businesses as assets on which to build corporate competitiveness. Following this approach, innovation does not end in the confines of a single company understood as a productive combination, but is part of the system in which the company itself is inserted: that is, innovation is no longer the distinguishing factor of a single company, but becomes a competitive element for the whole sector.

Within the systemic approach, it is possible to identify two research strands that define innovation from an organizational point of view, on the one hand, and from a cultural point of view, on the other. Authors including Knight (1967) and Evan and Black (1967) have defined innovation as an organizational process or a change that impacts the organization, or as a social process that leads to a change relevant to the structure. Other authors, such as Barnett (1953), have placed cultural and perceptive aspects at the center of the analysis.

A further element that has distinguished the doctrinal debate on the themes of innovation concerns the distinction between innovation and invention, as proposed by Fagerberg (2006). It is not always easy to distinguish innovation from invention, but, undoubtedly, invention alone is not sufficient to create innovation. In fact, innovation takes place when invention takes shape, and, in this direction, invention comprises a complex relationship with company systems. Further, it is within the company system—understood as a productive combination—that invention becomes or can become innovation.

At an international level, there have been numerous studies that, since 2010, have demonstrated, through surveys and empirical analyses, the importance of innovation on productivity and employment levels. Similar findings have also been drawn from the economic and business-economics literature, which, in the past, has repeatedly given innovative companies the merit of assuming strategic importance in modern economic systems, both for the development of production and for the development of employment. As Drucker (1985: 67) observed:

> In innovation … there is talent, there is ingenuity, and there is knowledge. But when all is said and done, what innovation requires is hard, focused, purposeful work. If diligence, persistence, and commitment are lacking, talent, ingenuity, and knowledge are of no avail.

New Entrepreneurship in Italy

In Italy, innovation has been placed at the center of policies pertaining to new start-ups, as indicated in a report to the Parliament by the minister for economic development. The program of the Ministry of Economic Development was confirmed in an Organization for Economic Co-operation and Development (OECD) study conducted on 15 countries, at the end of 2013, on the position of the relationship between innovation and industry. The study highlighted the growth of employment within companies with a life cycle of no more than five years ("young companies") and companies with a life cycle of more than six years ("old companies"). The young companies had employed only 20% of total employment, but had generated almost half of the total new jobs. In the years of the economic crisis—from 2008 to 2011—the traditional firms (old companies) recorded the greatest loss of employment levels, while the new companies (young companies) maintained positive net employment growth in the same period.

On the same topic, a study conducted in 2010 by the Kauffman Foundation identified the dynamics of job creation within new companies and existing companies in the years from 1977 to 2005. The study found constant positive trend in employment levels within new companies, and a trend that was almost always negative within existing or tradi-

tional companies. In 2015, the Kauffman Foundation introduced the "Kauffman index," based on three variables:

1. rate of new entrepreneurs
2. opportunity share of new entrepreneurs
3. start-up density

Future implementations of the indicator will also take into consideration the following additional variables:

1. venture growth
2. density of scale-ups
3. survival rates
4. percentage of business owners in the population

The 2014 European Competitiveness Report confirmed the positive correlation between companies that realize innovations and the creation of employment in all phases of the economic cycle.

In Italy, "innovative start-ups" are capital companies, which can also be incorporated in a cooperative form, whose shares or shares representing the share capital are not listed on a regulated market or on a multilateral trading system, and which meet the following requirements:

1. They are new or have been established for less than five years.
2. They have their head office in Italy, or in another member country of the European Union, or in countries that are party to the agreement on the European economic area, provided they have a production site or a branch in Italy.
3. They have an annual turnover of less than € 5 million.
4. They do not distribute profits.
5. They have as an exclusive or predominant social purpose the development, production, and marketing of innovative products or services with high technological value.
6. They are not constituted by a merger, company spin-off, or following the sale of a company or a business unit.

The innovative content of such a company is identified with the possession of at least one of the following three criteria:

1. At least 15% of the difference between turnover and annual costs is attributable to research and development activities.
2. Of the overall workforce, at least one-third is made up of PhD students or researchers, or at least two-thirds is made up of members or collaborators holding a master's degree;
3. The company is the owner, custodian, or licensee of a registered patent or the owner of a registered original computer program.

In Italy, there are 5983 start-ups and 208 innovative SMEs (as at the end of 2016). The start-ups are distributed by region, with the highest concentration in Lombardy (21.71%), Emilia-Romagna (11.83%), and Lazio (10.06%). Registration data taken from the business register show, for start-ups, an increase in the years 2014 (1563), 2015 (1780), and 2016 (for the first six months, 832). As regards the value of production, almost 50% of start-ups are included in the range for up to € 100,000, with three cases above 5 million. Even with respect to the number of employees, almost 50% of start-ups have a value included in the range of 1–4, and, in five cases, the number of employees is in the range of 50–249. Finally, concerning capital, 87% of start-ups have a capital value of between € 1000 and € 50,000; in 75 cases, the capital is € 1, while in six cases, it exceeds € 5 million.

Enki Stove: An Italian Start-up

It is clear that the phenomenon of innovation accompanied by the emergence of new start-up companies has profoundly changed the way of doing business. As already noted, in the past, companies originated from the manual work of workers who set up their own businesses, and the received wisdom was that, in order to access financial resources, it was necessary to present financial statements in profit. Today, the paradigms of entrepreneurship have been significantly modified, as can be discerned from a case study like that represented by Enki Stove.

Enki Stove was born from the idea of two Sardinian students enrolled at the University of Pisa who invented and patented a system of energy production through the technique of pyrolysis to reduce the heating emissions. At the end of a lecture at the university, they asked me for advice about their business idea. I listened to them carefully, but, not being an engineer, I wasn't able to understand if their idea is technically valid or not, so I offered to organize a meeting with entrepreneur friends of mine to verify the technical validity of the business idea.

We organized the meeting with the entrepreneurs and other engineers, who listened to the two young people. The meeting was very positive, and I understood that their idea was technically viable. From there, they started a preparation course with business angels, and, after a few months, the two of them constituted a new company and commenced upon the first stage of an equity crowdfunding process. This first stage culminated with the collection of € 240,000, which were used to purchase equipment with which to start production as well as being used to protect the patent.

After a few months, a second crowdfunding exercise was launched, through Kickstarter: over 30 days, more than 400 units of product were sold worldwide for a total of over € 94,000. Today, Enki Stove (www.enkistove.com) has closed its second financial statement, and, while it is operating at a loss, it continues to produce and sell all over the world. A second patent has been registered, and the turnover continues to slowly grow. This case study demonstrates that it is possible to do business even in the global economy.

References

Amaduzzi, A. (1948). *Ragioneria Generale*. Firenze: Casa Editrice Dott. Luigi Macrì, p. 12.

Armadio Verde. (2018). Retrieved July 18, 2018, from www.armadioverde.it.

Barnett, H. G. (1953). *Innovation: The basis of cultural change*. New York: McGraw-Hill Book Company.

Besta, F. (1909). *La Ragioneria* (Vol. I). Milano: Dott. Francesco Vallardi editore.

BlaBlaCar. (2018). Retrieved July 18, 2018, from www.blablacar.it.

Burns, T., & Stalker, G. M. (1961). *The management of innovation*. London: Tavistock Publications.

Cantillon, R. (1755). *Essai sur la Nature du Commerce en Général*. Reissued for the Royal Economic Society by Frank Cass Company LTD, London, 1959.

Cantillon, R. (1931). *Essai Sur la Nature du Commerce en General* (H. Higgs, Ed. and Trans.). London: Macmillan.

CouchSurfing. (2018). Retrieved July 18, 2018, from www.couchsurfing.com.

DeRev. (2018). Retrieved July 18, 2018, from www.derev.com.

Dooley, L., et al. (2000). Supporting system innovation. *International Journal of Innovation Management, 4*(3), 277–297.

Drucker, P. F. (1985). *Innovation and entrepreneurship. Practice and principles* (p. 21). New York: Harper.

Eppela. (2018). Retrieved July 18, 2018, from www.eppela.com.

European Commission. (2014). *Helping firms grow*. European Competitiveness Report 2014, Luxemburg.

Evan, W. M., & Black, G. (1967). Innovation in business organizations: Some factors associated with success or failure of staff proposals. *Journal of Business, 40*(4), 519–530.

Fagerberg, J. (2006). Innovation: A guide to literature. In J. Fagerberg, D. C. Mowery, & R. R. Nelson (Eds.), *The oxford handbook of innovation*. Oxford: Oxford University Press.

Formaini, R. L. (2001). The engine of capitalist process: Entrepreneurs in economic theory. *Economic and Financial Review, Q*(IV), 2–11.

Giannessi, E. (1970). *Appunti di economia aziendale*. Pisa: G. Pellegrini.

Hamilton, R. T., & Harper, D. A. (1994). The entrepreneur in theory and practice. *Journal of Economic Studies, 21*(6), 3–18.

Hébert, R., & Link, A. (2006). The entrepreneur as innovator. *Journal of Technology Transfer, 31*, 589–597.

Kauffman Foundation. (2015). The Kauffman index. Startup activity.

Kickstarter. (2018). Retrieved July 18, 2018, from www.kickstarter.com.

Kirzner, I. M. (1973). *Competition and entrepreneurship*. Chicago: University of Chicago Press.

Kline, S., & Rosenberg, G. (1986). An overview of innovation. In R. Landau & N. Rosenberg (Eds.), *The positive sum strategy: Harnessing technology for economic growth*. Washington, DC: National Academy Press.

Knight, E. K. (1967). A descriptive model of the intra-firm innovation process. *The Journal of Business, 40*, 478.

Lawrence, P. R., & Lorsche, J. W. (1967). Differentiation and integration in complex organizations. *Administrative Science Quarterly, 12*, 1–47.

Mamacrowd. (2018). Retrieved July 18, 2018, from www.mamacrowd.com.

Ministero dello Sviluppo Economico. (2015). *Relazione al Parlamento sullo stato di attuazione della normativa a sostegno delle startup e delle PMI innovative*, Roma.

OCSE. (2013). *OECD science, technology and industry scoreboard 2013*. OECD Publishing.

Perrow, C. (1970). *Organizational analysis*. London: Tavistock.

Say, J. B. (1800). *Olbie*. Paris: Institut Coppet.

Schumpeter, J. A. (1934). *The theory of economic development*. Cambridge, MA: Harvard University Press.

Schumpeter, J. A. (1968). *History of economic analysis*. New York: Oxford University Press.

StarsUp. (2018). Retrieved July 18, 2018, from www.starsup.it.

Wikipedia. (2018). Retrieved July 18, 2018, from www.wikipedia.it.

Woodward, J. (1965). *Industrial organization, theory and practice*. London: Oxford University Press.

Zappa, G. (1920). *La determinazione del reddito nelle imprese commerciali. I valori di conto in relazione alla formazione dei bilanci*. Roma: Anonima Libreria Italiana.

2

Time in Entrepreneurship

The Economic Business Cycle

Entrepreneurship is a phenomenon that occurs over time, with the aim of creating transformation from an economic perspective. Time is a precious and determinant resource for entrepreneurship and strategy formulation (Forouharfar et al. 2014). Entrepreneurship is based on respect for the economic business cycle.

> *The economic business cycle for a company is like the perfect functioning of the automatic gear of a Swiss watch when the watchcase is opened.*

The economic business cycle as a unitary phenomenon represents a system that consists of all economic transactions, which the company puts in place for the achievement of its goals.

Figure 2.1 represents the economic business cycle articulated in five integrated phases. Phase 1 concerns the collection of the right level of capital required to start the production process from an economic perspective.
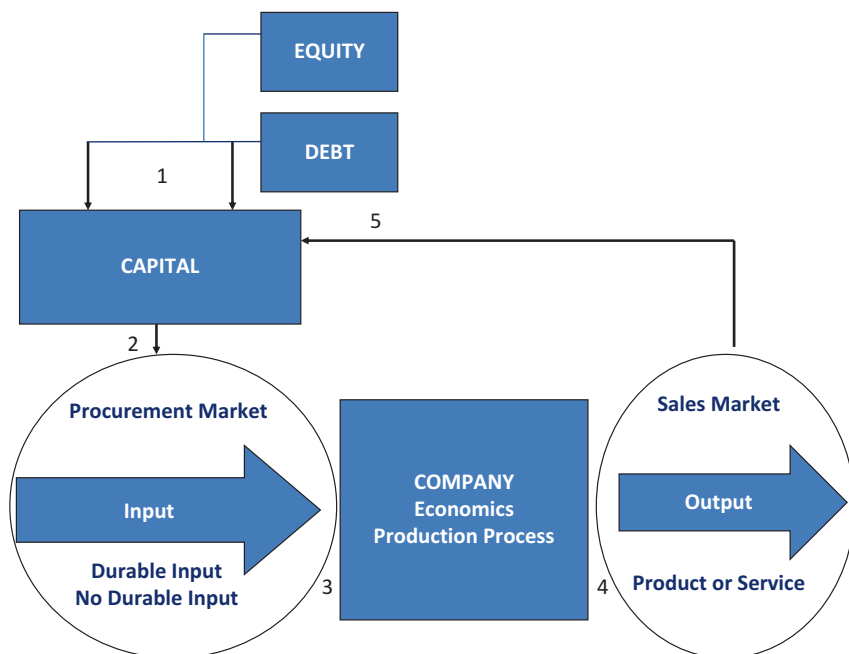
Fig. 2.1 The economic business cycle

Capital can have a double origin: own capital (equity) or risk capital contributed by the shareholders, or third party or debt capital acquired through financial institutions. It is very important before starting a new business, or when a new investment is planned, to understand in advance the total amount of capital the business requires. The total amount of capital depends on several factors: the nature of the business, the sector where the company operates, the duration of the production process (in particular the lead time), proximity to the outlet market, and finally the payment conditions.

To understand in advance the total amount of capital required, a simulation is necessary using the business plan managerial tool. The business plan should answer two main questions. (1) Is the business sustainable? (2) If yes, how much capital does it require to be activated?

Once the required amount of capital has been determined, shareholders must verify their underwriting capacity. The amount the shareholders

may underwrite represents the risk capital, which is also referred to as equity. The difference between the total amount of capital required and the equity represents the amount of capital that must be covered through debt capital.

$$Capital = Equity + Debt$$

Equity and third-party capital are differentiated by three main elements: (1) third-party capital is subject to an obligation to repay, whereas for own capital, being risk capital, there is no obligation to repay; (2) third-party capital is subject to expiry, whereas own capital does not have a repayment deadline because it has no repayment obligation; and (3) third-party capital is subject to the payment of an interest rate, while the remuneration of own capital is linked to the performance of the company's management and to the policies adopted by the shareholders.

The remuneration of equity requires the achievement of a profit by the company's management, and the shareholders will decide how to distribute the profit. Shareholders may also decide not to distribute the profit, but rather capitalize it in reserve by activating a virtuous self-financing process.

Capital is required by the company to buy all the productive factors (or inputs) involved in the production process. Production factors can have either a slow or a rapid cycle of use.

Production factors (phase 2) with a slow cycle of use will be used by the company several times and will participate in the production process for more than one cycle and for more than one administrative period. For this reason, they are also referred to as production factors with repeated fertility.

Production factors with a rapid cycle of use (or fast-cycle production factors) may only be used by the company once as part of a production cycle because they lose their effectiveness after use. For this reason, they are also referred to as production factors with simple fertility.

The difference between production factors with a slow or rapid cycle of use assumes importance in the accounting of the purchase cost. In the first case, the purchase cost is recorded in the balance sheet, and through the depreciation process the annual cost is recorded in the income

statement. In the second case, the purchase cost is recorded in the income statement among the other costs accumulated over the year.

The production factors acquired by the company are combined in the production process (phase 3). The production process has two aspects worthy of attention: (1) the meaning of the process, and (2) the economic prospects of the process. The meaning of production is different in different types of company. In a manufacturing company, the production process represents the transformation of inputs to outputs. Manufacturing companies may be industrial or craft companies. In the past, industrial companies were based on a capital-intensive model and required investment in their production structure. In contrast, craft companies were based on a labor-intensive model, with the center of production represented by a workforce factor.

Today, this distinction has lost its relevance because, even in artisan enterprises, the investment in technology has become important as a distinctive competence for competitiveness, and artisan enterprises have become capital-intensive models. The difference between industries and craft enterprises is therefore based on the organizational model, and the quantity and quality of production. In these industries there is large-scale production, which is standardized and of inferior quality. In artisan businesses, smaller quantities of higher quality outputs are produced.

Among manufacturing companies, in which the production process involves the transformation of inputs to outputs, there are service companies and commercial (or trade) companies. Service companies produce outputs that are intangible. In the commercial (or trade) companies, the production process involves the transfer of goods in time and space.

In all cases, the production process must be conducted from an economic perspective. This means that at the end of the production process, an output is obtained. The output (phase 4) is destined to be sold. The sales process presupposes the existence of an outlet market able to receive the product that is tangible, intangible, or transferred in time and/or space.

When the output enters the market at an economic level, the relationship between supply and demand determines the setting of price.

The price, as shown in Fig. 2.1, represents on the one hand the economic value that is determined by the relationship between supply and

demand, and on the other hand the value necessary to close the economic cycle by allowing the initial capturing of capital to be recomposed as outputs and the consequent continuity of the economic business cycle (phase 5). From an economic perspective, price is nothing more than an indicator that expresses the relationship between supply and demand in the market. From the business-economics perspective, the price is a lever to recompose the initial capital at the end of the management cycle, guaranteeing a productive continuity.

For the price to allow the recomposition of the initial capital, it is necessary that the economic business cycle respects the economic equation of business. The economic equation of business presupposes that the price is higher than or equal to the sum of all costs:

$$\text{Price} > \sum \text{Costs}$$

At the end of the economic business cycle, three different situations can occur:

1. Capital at the beginning of the cycle is equal to the capital at the end of the cycle. This means the price is equal to the sum of the costs. In this situation the business has not created profit, but the company is able to continue its business.
2. Capital at the beginning of the cycle is lower than the capital at the end of the cycle. This means the price is higher than the sum of the costs and the economic equation of business is positive. In this situation the business has created a positive profit. Profit can be invested in the company and/or it can be distributed to the shareholders.
3. Capital at the beginning of the cycle is higher than the capital at the end of the cycle. This means the price is lower than the sum of costs and the economic equation of business is negative. In this situation the business has created a negative profit. In this situation, at the end of the cycle the company has less capital than at the beginning. To recompose the capital necessary for the economic business cycle, the shareholders can capitalize on the company by paying new capital by way of equity or the banking system can be asked to intervene. It is

conceivable that the shareholders would not be happy with having to write off the loss by capitalizing the company due to it not generating the same profit. However, it is also possible that the banking system would not be willing to take responsibility for the loss and would therefore request the shareholders to first express their trust in the company's business and in its ability to generate wealth.

In all cases, it is clear that the economic business cycle should close with the reconstitution of the initial capital to give continuity to the management. The recomposition of the initial capital is linked to the company's ability to respect the economic conditions (or economic constraints), and therefore the price must cover the sum of the costs.

Compliance with the economic conditions of management depends on internal conditions within the company, and on external conditions such as market conditions.

The Meaning of Price

Following the business-economics approach, it can be observed that price may have three different meanings, as represented in Fig. 2.2.
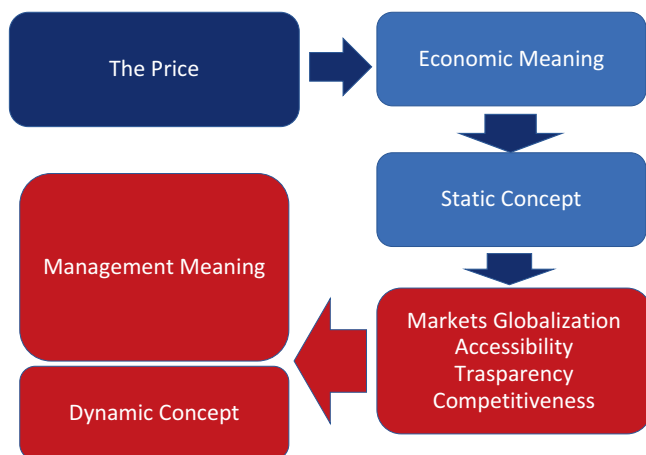
Fig. 2.2   The meaning of price

Traditionally, price has always been considered a static quantity, through which a certain value is attributed to an asset. Since the late 1970s, some economic sectors (e.g., air transport and hotel services) started to see price not as a static quantity, but as a dynamic value. Today, new technologies have facilitated real-time comparisons of prices in markets leading to changes in consumer behavior, and the dynamics of price has increased in even more traditional sectors.

Moreover, the same economic theory indicates that the price of an asset is closely linked to the intrinsic value of the asset itself as well as the time and space dimensions.

The price of a half-liter bottle of water can be used as an example. The price at which it leaves the factory is at most 0.12 cents. The price at which it can be purchased from a university vending machine is 0.20 cents. The same bottle of water can be purchased from a bar inside the university for 0.55 cents. The same bottle of water can be purchased at a bar outside the university for € 1. Finally, the same bottle of water on a low-cost flight can be purchased for € 3.50.

This example demonstrates how the price of a simple half-liter mineral water bottle is extremely variable and dynamic depending on where it is purchased. The same considerations can be made with regard to other goods and with reference to not only the space dimension but also to the time dimension. For example, a similar principle applies to the advance purchase of a flight or hotel room booking.

Price can therefore have a meaning in terms of an economic dimension, a business-economics dimension, or a social dimension.

In the economic dimension, price is an indicator that measures the relationship between supply and demand in a given market. The relationship between supply and demand generates an economic value (price) that expresses not just the value of the goods involved in the transaction but the value of the transaction itself.

In the business-economics dimension, price expresses the economic condition of the business, that is, the company's ability to cover all its costs with the price, guaranteeing the continuity of the economic business cycle as indicated in Fig. 2.2. Price is closely linked to the structure of company costs, which often represents a real constraint on the company's ability to create value.

The social dimension of price is of intermediate significance between the economic and business-economics dimensions. In the social dimension, according to the economic theory formulated by Porter, price is the maximum value that at a given moment and in a certain place the consumer (or potential consumer) is willing to pay to buy a certain asset.

In Porter's theory, the business is able to create value if the customer is satisfied. The economic level of satisfaction of the customer is measured by the maximum price that the customer is willing to pay at that specific moment and in that specific place to buy a specific asset. According to Porter, price is dynamic and is different for each customer (or potential customer) and is not related to the company's cost structure, but is more influenced by the customer's perception of value.

Many fashion companies create two product lines. One line has a high added value and a very high price. These are products aimed at a few select customers. A much cheaper line, which is normally called "Sport" and cannot be considered economic, has a high price for a low-quality product aimed at a very large market. The customer is typically willing to pay a high price for a low-quality product because they are attracted by the product brand and not the quality of the product.

The high added value product is aimed at a qualified customer who is able to recognize the quality of the product and has the economic ability to purchase it. The low-quality product that is sold at a high price is aimed at a customer who does not consider quality and is often unable to verify it or is otherwise disinterested. The customer aspires to the brand and to the recognition provided by the product. It is no coincidence that fashion products of this type are strongly branded and recognizable.

The situation for a company that produces wine is very different. The investment required to increase quality and consequently the price has implications for the production process and is often very high. There is also a very long time required to obtain the expected results from the investment, and there is a need to educate the consumer to understand the process and therefore to recognize the greater value of the product leading to a propensity to pay a higher price.

It is evident that for a company, the point is not just to sell, but to sell at the maximum price that a customer is willing to pay at a given moment and in a particular place. For a fashion company, this goal can be achieved

by investing in advertising, communication, and marketing. It is more difficult for a company that produces wine to achieve the same result because they would have to invest in technology and new production processes and would have to wait much longer.

In all cases the price today is becoming increasingly dynamic, and companies must on the one hand try to keep their costs low to have greater profitability, while on the other hand try to increase the willingness to pay of the customer. This would increase the price through the creation of economic value, which is consistent with the teachings of Porter.

Porter's theory on the creation of value through the maximum price that the customer is willing to pay introduced the most recent revenue management (RM) tools, which have the aim of maximizing company profitability through the willingness-to-pay lever.

Management Operations

Management operations are distinguished on the basis of their direct or indirect links with the business objective. Economic transactions that directly meet the business objective, also called ordinary operations, are:

- financing operations
- purchases or investments
- production in the economic sense
- divestments
- refunds or compensation

A company as an economic institution that aims to develop long-term, open, and dynamic systems, will link continuous business operations together through its economic business cycle to create a combined system. The management of economic operations cannot be considered individually, without being placed in relation to each other, that is, without analyzing the complex system of relationships. This allows for a mechanistic way of working in the course of the cycle of business management itself.

Even a single economic operation has its own identity and is equipped with its own dignity. Based on the very foundations of what a company should be, and with regard to the unitary nature of the operations management, the value of a manufacturing system is not expressed by its operation alone, but is represented by the manner in which the individual operations complement each other inside the combination of the business and its operating system. In this regard, the various relationships between the company and the business environment are also important, with a need for management operations that involve, or may involve, parties external to the combination of the business and its operating system.

The importance of a systemic view of the economic business cycle can be understood with reference to the complex dynamics that characterize the processes of production in an economic sense. Production in an economic sense requires a combination of elements and interactions between them and the performance of acts that are closely connected, not only chronologically and sequentially. This can be shown by considering the purchase/investment and use of inputs in the production process right up to the transaction point. It is clear that the aforementioned economic transactions are closely related: the sale of the output cannot proceed without first completing the production process, or without acquiring the inputs, or without taking the first steps to obtain the financial resources needed by the various financing channels.

The processes of reimbursement and remuneration are closely linked, not only for the realization of the cycle of management and production processes, but also to create the conditions of economic equilibrium, without which the company's ability to provide refunds and provide the remuneration mentioned earlier will be diminished or even precluded. The final value expressed by the output, before placing it on the market and also determining the exchange price, is a function of the operations that oversee the implementation of the output itself. This is achieved without being limited to the issue of quality in terms of a defective output.

The same systemic nature of the phenomenon requires a systemic corporate management. Corporate management should therefore only be considered in a unified manner. The decomposition of management

within a company into several variables does not correspond to such a unified management approach, but only responds to the need for analysis, control, and measurement. The complex relationships among operations and management that arise from the transaction system that is incorporated into the life cycle of a company must be considered as a unified entity that starts with the establishment of the business and ends at the end of the life cycle of the company, that is, after liquidation. The implementation of operations management provides answers in terms of economic, legal, and fiscal constraints.

Measurement of the Management System

Business management as a system of economic operations gives shape to a company's life cycle, accompanying the company's operations over time and determining its relationships with the environment in which it operates. Time is crucial to distinguish the company from generic production activities that are carried out in the economic sphere by many units that, for various reasons and in various forms, work for the satisfaction of human needs without complying with the principles of being a company.

A company is a form of wealth generation that needs time to emerge, and to assert and consolidate itself within the general economic system. Consolidation is the only time the company is able to express its full potential in terms of wealth creation. This allows us to state that the time dimension is an essential condition of the enterprise phenomenon. It is also necessary to distinguish it from anything within the economic system that generally does not represent the corporate phenomenon and has no systemic nature. Inside the company, time is required to set the pace for the management of economic operations, and the company needs a system to be established within the business environment. Within the management system, there is a significant theme regarding the measurement or analysis of business performance under such management.

The measurement and analysis of trends in management are relevant to determine the "health status" of the company and to improve its functioning in relation to the objectives that the company intends to achieve.

The measurement of management is conducted in several dimensions and with the use of management tools. The first dimension worthy of attention is the extent that time marks and accompanies the entire life cycle of the whole company as well as the conduct of operations management within the business system and its relation to the surrounding business environment. The time dimension is combined with the financial and economic dimensions, through which the unified management body can be viewed. From a financial and economic perspective, the technical dimension or production of such management can be combined.

The measurement of the management system and analysis of the business dynamics are conducted in response to a need within the company's system. A company has an interest in constantly monitoring the performance of its management according to the objectives that it intends to achieve. The measurement and analysis of the dynamics of management consist of a breakdown of the management operations within the dimensions cited earlier. Sometimes, measurement is conducted separately for each dimension, while at other times it is achieved by integrating the different dimensions.

The measurement and analysis of the dynamics of management are the basis for the design and development of an enterprise control system. The internal need for measurement, or the need to exercise control of the management of a company, exists alongside an external need for measurement represented by the need to protect all those who may come into contact with the company as an economic institute. This need is protected by legislature that imposes a burden on companies with a series of disclosure requirements in the accounting and non-accounting sectors. The protection of third parties conforms with the principle of ensuring a general interest, the importance of which is superior to the specific interest of the individual company.

The correct functioning of the entire economic system within which individual businesses operate is important. The protection of third parties against companies therefore introduces complex disclosure requirements, depending on the size and importance of the company. In this regard, it is clear that a listed company has greater disclosure obligations in comparison to a partnership. There are many relationships that bind the company's operating system to the business environment, and these are complex, dynamic, and variable over time. A modern company should

have a strong social impact, strengthening the link between the company and its operating environment.

There are corporate interests toward this phenomenon, and the individuals who carry them out are called stakeholders.

Within the corporate control system, there must therefore be a distinction between the internal control system and the system of external controls. Both systems help ensure business efficiency and sustainability within the same general economic system.

Recognizing the company as an open system means recognizing the company as having a bond with the business environment, and also means highlighting the dynamic nature of the system of "holding." In reality, a company must continually change and adapt for its own needs, which in relation to environmental changes may result in threats or opportunities.

The Life Cycle of a Company: Accounting Period

An element worthy of attention within the dimension of time and within the theme of the measurement of management relates to the life cycle of the company. In business management, a company can be likened to a living organism (a cell), which has its own life cycle. The life of the company does not necessarily coincide with the life of the founder or an entrepreneur. There are companies whose life cycle has involved many generations of entrepreneurs and companies whose life cycle was shorter than that of the founder or entrepreneur.

If it is true that the business life cycle must be considered as unified and systematic, it is also true that the measurements and needs related to the analysis of the business dynamics require certain activities to be performed in a periodic fashion. Hence the need to scan the business life cycle, identifying time intervals referred to as administrative periods.

The accounting period is the time interval that marks the passing of corporate life. The company's life cycle consists of the sum of multiple accounting periods. The number of accounting periods that make up the business life cycle is ongoing.

The accounting period normally has a duration of 12 months, but may be shorter (e.g., seasonal activities) or longer (e.g., certain agricultural crops). The accounting period in Italy normally coincides with the calendar year. If the accounting period coincides with the calendar year, it begins on the 1st of January and ends on the 31st of December of the same calendar year.

The duration of the accounting period is determined in accordance with the nature of the business and with the length of the production process. If a company is established at any time during a calendar year, for example, on the 15th of June, it could decide to have its first annual accounting period of less than 12 months, in this case from the 15th of June to the 31st of December. Alternatively, it could have a first annual accounting period that is longer, in this case from the 15th of June to the 31st of December of the following year. Within each period, the company carries out transaction management. The set or system of management operations that the company puts in place over a given accounting period is called an exercise. The exercise represents the content of operations determined by the time interval of the administrative period. The exercise and administrative period are closely connected, even if in practice they almost always use one year as the time interval of reference. At the end of each financial year, companies have the obligation to draw up a document in the form of a financial report referred to as a financial statement.

Inside the life cycle management of the company, measurements are made in different dimensions and are used to inform the unified business management. The first dimension worthy of attention concerns the time dimension. The time dimension is the most neglected within the measuring process, probably because it is less tangible and less noticeable, with a few limited exceptions. The time dimension is, however, of primary importance for business management because it indicates the specific time spent in a particular phase of a company's life cycle, and time indicates whether an organization can be represented by processes or in a functional way. When considering how to measure the work of human resources, remuneration policies, the operation of machinery, production cycles, investment policies, and periods of supply needs in terms of stor-

age and warehouse space, the time dimension expresses the vitality of the economic, financial, and productive systems of the company. Following Franceschi Ferraris and Cavalieri (2005), time

> is one of the most essential conditions necessary to characterize the phenomenon of business and is more significant than other types of economic activities (…) isolated, unsystematic (Franceschi Ferraris and Cavalieri 2005: 26).

The phenomenon is based on the effect of the time dimension on the company and provides opportunities and threats to the survival of the company. The time dimension is present throughout the life cycle of the company and marks the course of operations, directs the management, and determines efficiency and effectiveness. The time dimension affects the entire corporate system and can be considered to be a resource, with its exploitation depending on the success of the company itself.

Considering the time dimension, attention should be focused on the measurement of time inside and outside of the company system. It is in the measurement of time that the unity of a systemic nature and the corporate phenomenon can be achieved. The company does not exist for a single moment in time, but there is a system that can be considered a system of company time. It is through the time dimension that all companies can be summarized in a unified manner, and it is the time dimension that is expressed when company time is being considered.

The company can provide time or can manage time. A company that manages time or effectively controls the time dimension is like the conductor of an orchestra during a performance. The conductor combines and synthesizes all the musical instruments, but must also give attention to their individual details and sounds or accentuations, and reduce them in relation to the environment in which the act is performed. A company that manages the overall time dimension has a lesser degree of control of all the individual elements that make up the orchestra, that is, a combination of corporate activity and all the processes within the same business are implemented.

Time assumes a critical role and should be kept carefully under control when analyzing the capacity of the management cycle to sustain itself and to guarantee its continuity.

The Time Dimension in Management Operations

The main time dimension that requires measurement is represented by the "expansion" of the cycle of business management, that is, by the time lag between the establishment of the corporate capital and its recovery through sales in the export market output. It is evident that the time dimension affects temporal variables related to various relationships that the company has with the business environment and the internal dynamics of business operation, including its place in the in the local area, the organizational structure of the company with regards to the location of related establishments, and the organization of internal production processes relevant to business operation, the location of suppliers, the distance to supply markets and outlets, outsourcing policies, and transport logistics (Cinquini 1994).

The greater the time interval between the formation of corporate capital and its recovery at the end of the production process through divestment transactions, the higher the cost borne by the company and the greater the financial resources necessary to ensure the continuity of the productive combination. The time interval between the formation of the initial capital of the company and its recovery is termed the crossing time in terms of the business operation.

It is evident that there can be a time interval within which the company has incurred costs for the acquisition of all factors of production, but has not yet realized the exchange of the output on the market.

The company needs to minimize this time, while being consistent with the nature of its activity, and must first attempt to acquire the necessary inputs to the production process in relation to the estimated potential demand.

Despite the presence of a properly designed time system within the company, the characteristics and peculiarities of the market in which they can operate can lead to external variables that influence and affect the smooth running of the management cycle. This can be illustrated by considering the insolvency of a customer, non-recovery of a debt, or the sudden interruption of the production process. With reference to the internal

dynamics of the corporate operation, factors that could affect production include the presence or absence of stock, while even in the presence of stock it is necessary to consider the storage capacity, logistics (i.e., the mode of production and products within the business establishment), the organization of production processes, the existence of environmental and quality certifications, and the existence of organizational efficiency measurement systems and processes. In all cases the importance of the time factor is crucial to identify and measure in cycles within the broader management cycle:

- The cycle of the production process, beginning with the date of purchase of inputs and ending with the date of collection of revenues from divestment transactions.
- The technical economic cycle, beginning with the buying process and ending with the sale of the outputs, that is, divestment transactions.
- The technical cycle, beginning with the removal of the input from the warehouse and ending with the entrance of the output to the warehouse.
- The monetary cycle or cash cycle, beginning with the payment of the parties providing the inputs and ending at the moment they are recovered, that is, the proceeds from the divestment transactions of the outputs.

The articulation of these cycles is important, but even more so is the integration of the different cycles between them.

In this respect, it is evident that the maximum efficiency in terms of production that the company reaches is connected with the correspondence between the technical and economic business cycles; this correspondence informs the management perspective. It includes the correspondence between the time of purchase of the production factors and the entry into the production process, and the correspondence between the end of the manufacturing process and the sale of the output. The correspondence between the technical and economic business cycles minimizes or eliminates company stock from the system. The minimization or elimination of stock from the warehouse contributes to the efficiency of the production processes.

The technical and economic business cycles can also be combined with the monetary cycle. An optimal situation for the company is the inversion of the two moments in time that mark the monetary cycle. The time of receipt of the sale must precede the time of payment of the inputs. This is partly what happens in companies that produce on order, such as construction or shipbuilding companies.

Companies must understand their cycles, must constantly measure them, and must tend to their optimization. The optimization of the cycles of management is a prerequisite for efficient management and can create the conditions that ensure a company's profitability and its competitive advantage. As Miolo Vitali (2003) observed, the competitive pressure on markets has progressively emphasized the importance of leadership on the duration of critical time periods, whose compression can increase the speed of response and provide a source of differential advantage, as well as a phase of evolution of the economic equilibrium (Miolo Vitali 2003: 7). Time is also a differentiating factor in the relationship between the company and the entities belonging to the "*supply chain*"; this means that time also expresses the response of the company to the requirements of a potential customer.

The description of the management cycle allows us to easily understand what is meant by referring to a company as an "open system." This expression emphasizes the numerous reports and interrelationships that bind the operating environment in which a business is inserted, leading to the position where it is not possible to conceive of the corporate phenomenon being so far removed from the business environment itself.

References

Amaduzzi, A. (1948). *Ragioneria Generale*. Firenze: Casa Editrice Dott. Luigi Macrì, p. 12.

Besta, F. (1909). *La Ragioneria* (Vol. I). Milano: Dott. Francesco Vallardi editore.

Cinquini, L. (1994). *La dimensione "tempo" e il sistema dei valori aziendali*. Milano: Giuffrè.

Drucker, P. F. (2014). *Innovation and entrepreneurship*. London: Routledge.

Drucker, P. F. (2015). *Innovation and entrepreneurship. Practice and principles*. New York: Roultledge.

Forouharfar, A., Yaghoubi, N. M., & Motamedifa, M. (2014). Entrepreneurial timing theory: Time entrepreneurship and time strategy. *Asian Journal of Research in Business Economics and Management, 4*(11, Special Issue), pp. 1–27.

Franceschi Ferraris, R., & Cavalieri, E. (2005). *Economia Aziendale* (Vol. I). Torino: Giappichelli.

Giannessi, E. (1970). *Appunti di economia aziendale*. Pisa: G. Pellegrini.

Miolo Vitali, P. (Ed.). (2003). *Strumenti per l'analisi dei costi, Volume III, Percorsi di Cost Management*. Torino: Giappichelli.

Rifkin, J. (2000). *The age of access*. New York: Penguin Putman Inc.

Rifkin, J. (2015). *The zero marginal cost society: The internet of things, the collaborative commons, and the eclipse of capitalism*. New York: St. Martin Press.

Zappa, G. (1920). *La determinazione del reddito nelle imprese commerciali. I valori di conto in relazione alla formazione dei bilanci*. Roma: Anonima Libreria Italiana.

3

Entrepreneurship, Business Cycle, and Creation of Value

Accounting and Managerial Tools

The company management must be analyzed and observed with respect to three closely linked dimensions: financial, economic, and technical. However, observation often focuses mainly on the financial and economic dimensions, neglecting the technical dimension or its links with the other two.

The importance of the financial and economic dimensions is also confirmed by the main tools for analyzing business dynamics being based on accounting systems. The main accounting methods are general accounting, based on the double-entry method, and cost accounting.

In the most advanced accounting systems, these two methods are integrated into IT management systems capable of processing, in real time, closely related information.

Within IT management systems, accounting dimensions are often combined with non-accounting data, which are often of a statistical nature. This is reflected by the increasing importance of CRM (customer relationship management) systems and, more recently, latest big data.

In less-complex companies, accounting information systems have more limited integration, with some even lacking cost accounting.

General accounting is mandated by civil law. It relates to management facts, considers the company in its entirety, is consumptive, and detects management facts after their occurrence. The general accounting obligation is justified by the need for legal protection of third parties and stakeholders. Its output is the financial statements that detail the management's performance in the asset, financial, and economic dimensions at the end of the administrative period.

The management facts detail all the company's operations with third parties within the administrative period that generate variations of a financial nature, such as income or outcome.

Cost accounting can be preventive or final; it analyzes in greater detail what happens inside the company, but is not mandatory.

There are two main outputs of cost accounting. The first is the budget, which provides the basis for *ex ante* control of the management, that is, of their operational planning; the second is analysis of the deviations, through which *feed-forward* management control is conducted. The great importance of feed-forward management control lies in allowing corrective actions to achieve the company's objectives.

General accounting and cost accounting are complementary; if integrated, they allow management control processes to be articulated in three ways:

- *ex ante* control through the budget
- *analysis of the deviations*, with corrective actions where necessary
- *ex post control* through the financial statement

When general accounting and cost accounting are integrated, the management control system articulated in the circular planning and control processes can be realized. Planning is the initial moment of the control system, whereas financial statements are the final moment, without, however, allowing intervention through corrective actions. Feed-forward control brings greater effectiveness to the system and makes the budgeting process flexible.

The measurement of management operations and the analysis of their dynamics first meet the internal needs of the company. Management progress requires constant monitoring against agreed objectives, as means to exercise control over company management.

This is accompanied by the external need to protect all who come into contact with the company as an economic entity. This need is protected through legislation, which imposes on companies a series of reporting obligations, covering both accounting and extra-accounting information. Third parties are protected to guarantee a general interest whose importance exceeds each company's specific interests.

The Financial and Economic Dimensions

In running a business, management must aim to respect the conditions of financial and economic equilibrium. Financial equilibrium concerns the relationship existing at any given moment between financial income and expenditure. This ratio is not only measured in the quantitative dimension, by the prevalence of revenues compared to outputs, but also in the temporal dimension, by the synchrony between entrances and exits. In other words, financial equilibrium requires the prevalence of income and expenses and a correct temporal distribution between them.

Financial balance must always be verified. If equilibrium is lost at a given time, the company has two main options to meet its obligations without becoming insolvent: employ its own financial reserves—if any—or resort to borrowing or a capital injection by the shareholders (equity or risk capital). Recourse to indebtedness has clear repercussions for the economic dimension of management, as interest is payable on the capital acquired from third parties.

Financial equilibrium is closely linked to the concept of economic equilibrium. This requires the company "*to develop the production activity in such a way that the economic value of production is systematically higher than the value of the factors that are consumed in the production process*" (Cavalieri and Franceschi Ferraris 2005: 205).

Economic equilibrium is measured over a given time period (one month, quarter, semester, year, biennium, etc.), and concerns the

operating costs and revenues. For the considered period, operating costs represent the productive factors used in the production process, while operating income represents what the company receives by selling the services produced. Operating costs can refer to "simple fertility productive factors," purchased and used in the production process during the given period, or to productive factors with "repeated fertility."

Therefore, economic equilibrium is measured quantitatively through the relationship between costs and revenues during a specific time interval. Economic equilibrium may be absent in one or even multiple time periods without prejudicing the survival of the business. This is often found during a company's start-up period or when it makes significant investments. Of course, where balance is lacking, it is very important, if not decisive, to analyze the causes: depending on their nature, the identified causes may either allay or endorse concerns.

The conditions of financial and economic equilibrium are closely interrelated: the equilibrium

> "*of the company can therefore mean the state of composition and functioning of the system in which the company, in the economic aspect that is fundamental for its purpose, and to which the other conditions are connected, can remunerate all the factors of production, and attain at least a minimum amount of net economic income (profit), starting from this minimum point of equilibrium to the achievement of that income which, within a maximum, the entrepreneur will judge satisfactory, according to his advantage, measured in terms of arbitrage between uses*" (Amaduzzi 1978: 195).

A company's financial structure can also be represented through asset composition indices, such as the impact of equity or risk on total invested capital, the incidence of third-party capital on total invested capital, or the incidence of equity or risk on third party capital (or vice versa). It has repercussions on the company's economic structure and on profitability: for instance, in a company that has made extensive use of third-party capital with respect to risk capital (under-capitalization), financial charges will likely be greater than in a company that, having invested capital parity, has made greater use of its own capital.

Likewise, aspects related to the management and the economic dimension may have repercussions on the financial structure—for instance, in

the case of the price policies, the practice of discounts and extending payment times for customers. While discounts and payment extensions can be commercial "levers" to increase sales of tourist services, they also have implications for the company's financial structure and liquidity of the company.

The relationship between the financial and economic dimensions of management is easily summarized in the equation of financing needs: it expresses the necessary financial resources through the relationship between the product of the inputs for the corresponding prices and the respective rates of renewal (Giannessi 1982b) (Fig. 3.1).

The financing requirement is, therefore, calculated as the sum of the capital needed in each period (c1, c2, …, cn) to finance the purchase of productive factors, represented by the relationship between those factors' respective prices and the speed of their renewal.

Valid economic equilibrium over time can be expressed using the formula given in Fig. 3.2.

Lasting economic equilibrium occurs when the flow of sales revenues exceeds the flow of purchase costs for all productive factors combined: this positive difference in a given period (t0, t1, t2, …, tn) represents profit. For Amaduzzi, profit "*is a minimum amount of income in the sense of net economic income … after calculating among the various F. * P. [and] also the interest on the capital and the management fee to the entrepreneur*" (Amaduzzi 1978: 194).

It is clear that, in the long run, if the flow of sales revenues exceeds the flow of purchase costs, the conditions for financial equilibrium are met. In the short term, financial equilibrium is linked to the temporal distribution of revenues compared to outputs. The time interval within which short-term compliance with equilibrium conditions is determined is the administrative period.

With reference to a given year, operating performance is expressed (in the economic dimension) by the economic result, "*consisting of the profit or loss determined on the basis of the comparison between the values attributed*

$$\frac{f1*p1}{v1} + \frac{f2*p2}{v2} + \dots + \frac{fn*pn}{vn} = c1 + c2 + \dots \quad cn$$

Fig. 3.1 The equation of financing needs

$$\sum Fi* Pi + \alpha = \sum Qk*Pk$$

Where:
Fi is the quantity of production factor
Pi is the price of production factor
α is the profit
Qk is the quantity of the output
Pk is the price of the output

Fig. 3.2 Economic equilibrium over time

(with direct or indirect calculation) to productive factors used in the year and values attributed to operating income obtained in relation to the occurred utilizations of those factors. The qualitative aspect of the configuration of the operating income is made up of the type of productive factors used and the type of proceeds" (Amaduzzi 1948: 205).

The economic result—given by the difference between revenues and costs pertaining to a given year—qualifies the management in a positive or negative manner: "*However, the income configured is a value that is the object of economic calculation to give a monetary expression to the result that, in a positive or negative sense, economically qualifies management*" (Ferrero 1987: 82).

The economic result for a given year is determined by reference to the general accounts and the financial statements. In determining the economic result, the continuity of the management operations over time must be noted and, therefore, the conceptual impossibility, if not by means of accounting artifices, to interrupt management at the end of the year in order to verify the trends. If, at the end of the financial year, there is an interruption in the management, the company does not stop working, nor does it complete all operations in progress. To account for ongoing operations in preparing the financial statements and determining the economic result, certain accounting artifices called "settlement and rectification records" are employed: "*At the end of the financial year … the accounts must be closed for the determination of the value of the capital or the assets and the economic result for the year.… the closing entries are divided into two groups, which we can call settlement settlements and final writings*" (Amaduzzi 1978: 577).

The Output of General Accounting: Financial Statements

The accounting system of management facts allows a snapshot, at any time, of the company's status in the economic, financial, and equity dimensions through the preparation of financial statements, also known as the administrative report. Preparing the statements neither suspends nor interrupts the management, which is unitary and in continuous evolution. The company's situation is represented through accounting artifices with which the management is interrupted.

Within the fields of economics and business, the term "budget" has always assumed a double meaning. From a strictly accounting perspective, it means account balance, referring to the arithmetic sum of movements recorded in the two sections (giving and having) of the same account. Its broader meaning is an assessment procedure, through which the resulting accounting balance can be transformed by means of verification and assessment activities.

Drafting the administrative report is closely linked to systematic general accounting, that is, the recording of management facts. The administrative report is a consumptive and periodic document that represents the financial and economic situation of the company at a given moment. It is provided to the entrepreneur and management, and to potentially interested external subjects. It is intended to be an informative instrument through which the company's dynamics can be evaluate and interpreted.

The business situation is represented at the end of each financial year: "*The transfer of the accounting from the partial to the general plan has allowed the formation of the financial statements for the period, understood as indicators of results that, based on historical data and probabilistic data, it is believed can be attributed to each period*" (Giannessi 1960: 799).

The administrative report is, therefore, the document that interrupts management activity at the end of each financial year to allow its verification and evaluation.

The annual administrative report contains two interrelated statements: the balance sheet and the income statement.

The recording of management acts and the periodic preparation of financial statements meet the entrepreneur's need for control over management activity. General accounting thus ensures that the entrepreneur exercises control whether administering the company themselves or delegating this role to company management. Even in the distant past, the entrepreneur's management control function has always characterized the keeping of accounting records and the preparation of periodic and summarized schedules of management trends.

In addition to performing information and control functions internally, the statements serve to inform the outside world, particularly external stakeholders. Today, the external perspective of financial statements and company reporting is especially important, overcoming the accounting dimension and integrating with information and data of an extra-accounting nature: the themes of accountability and corporate social responsibility must be considered.

The growing importance of reporting to those outside the company is largely attributable to two factors: the increasing socioeconomic complexity of companies' operational environment and the greater demands for information from outside. Reporting meets the company's duty to provide information to the stakeholders.

Financial statements, as the main output of general accounting, are consumptive, being drawn up on the basis of what has been set beforehand. Once the continuity and non-interruption of company management have been made, if not from a purely accounting point of view, representing company dynamics requires the linking of existing and ongoing operations: this explains why both historical and probabilistic values are included. In this sense, we accept what Giannessi said: "*When we talk about the budget, we do not talk about a quote, or final balance, but only a 'ring,' the long chain of detection tools that begins with the establishment of the company and ends with its dissolution. (…) The financial statements are an expression of company dynamics and, as such, cannot correspond to past or future positions. It has no preventive or final character, but both of these characters together*" (Giannessi 1960: 800).

On reporting to those outside the company, it should be noted that the legal obligations and information duties of businesses have grown in

recent years, with the aim of enhancing protection of third parties and stakeholders through accounting and non-accounting information flows.

The balance sheet is, therefore, an instrument that periodically converts company dynamics into figures and, in turn, economic trends, combining and summarizing the past, present, and future of the company's management. Consequently, the budget is an important support tool for corporate governance.

The results highlighted by financial statements are related to both the management acts during the reference period (as recorded in the accounts) and the assessments made and assumptions used by those who draft the statements. Financial statements are not intended to determine the exact results attributable to the management; rather, they provide the entrepreneur and management with a tool enabling more in-depth analysis of the company's equilibrium conditions.

Financial statements cannot determine objective results. Both the statements and the results they contain are subjective, being linked to the assumptions underlying the evaluation processes used by their drafters. Thus, the balance sheet cannot give a true representation of the business reality in an absolute sense: "*The accuracy is only formal and has nothing to do with the representative and interpretative function of the corporate dynamics due to the budget…. The process of formation of the results of the period is a gross and approximate process*" (Giannessi 1960: 806).

In this respect, the budget has a dual nature: it is both objective and subjective. Objectivity applies to certain accounting records and some items recorded in the financial statements; subjectivity applies to all items linked to ongoing operations, for which evaluation processes must be employed. Therefore, the accuracy of the representation in financial statements depends on the drafter's observance of the correct corporate principles, as well as on the rationality and consistency of the hypotheses established as the basis for evaluation. Financial statements can only be objective with respect to compliance with certain principles and certain rules and procedures to be followed in their drafting, but cannot affect the true and fair view principle for the contents.

It follows that the company balance sheet does not derive from the mere application of accounting techniques and numerical rules. Instead, it requires the realization of evaluation processes and the verification of

correspondence between the numbers it contains and the economic variables that express the behavior of the company's operating system.

The Balance Sheet

The first document worthy of attention is the balance sheet, in which company capital is represented, divided between assets and liabilities. The balance sheet has opposing sections, and the statutory scheme requires balance sheet assets to be represented and classified as shown in Fig. 3.3.

The balance sheet unites the most recent financial years in line with the unitary and systematic nature of the management, allowing the forward transfer, over time, of balance sheet items that comprise the company's capital. The assets that existed at the end of the previous year, that is, at the time of the previous financial statements' preparation, are taken back

Active Assets	Equity liabilities

A) Credits towards shareholders	A) Net worth
	    I) Equity
	    II) Equity reserves

B) Assets	

I)   Tangible fixed assets
    II)   Intangible assets
    III)   Financial fixed assets
	B) Provisions for risks and charges

C) Current assets	C) TFR

I)   Stock
    II)   Financing assets
    III)   Finance current assets
    IV)   Liquidity
	D) Debts

D) Accruals and deferrals	E) Accruals and deferrals

Fig. 3.3   The balance sheet regulated by the Italian Civil Law

at the beginning of the following year, thanks to the liaison role exercised by the balance sheet itself.

To read and analyze the balance sheet for management purposes, it needs to first be reclassified from the mandatory civil statutory scheme to one more suited to the needs of analysis and interpretation. Though the reclassification processes need not be considered in depth here, it is important to underline how these facilitate reading the balance sheet, as illustrated in Fig. 3.4.

The balance sheet distinguishes between fixed assets (FAs) and current assets (CAs), based on the time the asset remains within the business. FAs include, for example, productive factors with repeated fertility, while examples of CAs include productive factors of simple fertility in the warehouse, unsold finished products, credits expiring in the following year, and existing liquid assets in cash and in bank or postal deposits.

However, in the reclassified balance sheet, operations that the company intends to carry out in the following year must also be considered in drawing this distinction. For example, if the company has a machine that it has decided to dispose of in the next financial year, it must be recorded as a CA, rather than an FA.

The reclassified balance sheet requires some adjustments from the classification regulated by the Civil Code. In fact, this classification does not
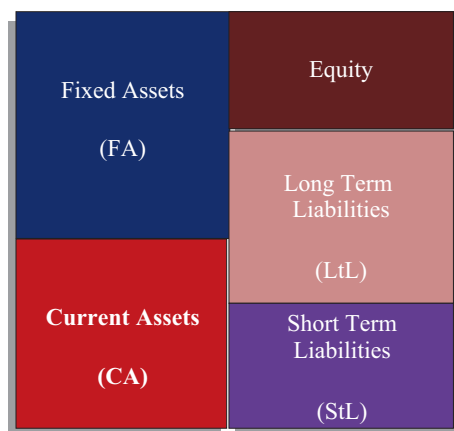

Fig. 3.4 The reclassified balance sheet

always correspond to the correct accounting principles. For instance, the Civil Code requires trade or operating receivables to be recorded as CAs, regardless of their expiry date. In the reclassified balance sheet, operating receivables are distinguished according to whether their real maturity is within (CA) or beyond (FA) the following year.

Similar considerations apply to liabilities in the balance sheet, particularly to the distinction between long-term liabilities (LtLs) and short-term liabilities (StLs). In this regard, bonds must be distinguished on the basis of their time of extinction: those with medium- or long-term maturity (i.e., beyond the following year) are classified as LtL, while those with a short-term maturity (i.e., within the next year) are classified as StL.

Whether, by their nature, particular liabilities are typically consolidated or current, due consideration must be given to planned management operations in reclassifying the balance sheet. By way of example, consider the severance indemnity fund (in Italy called TFR—Trattamento Fine Rapporto). This item has the nature of an LtL. However, if the company is aware that one or more employees will resign or retire in the following financial year, then the amount of applicable severance pay becoming due must be recorded as an StL. Alternatively, while a mortgage has the nature of an LtL, any installments payable in the following year must be classified as StLs.

The own capital is represented by the items that make up the shareholders' equity with the exception of item IX, which represents the profit (loss) for the year. Where the company makes an annual profit, it may be transferred to the shareholders through payment of a dividend; alternatively, it may be allocated to the reserve pursuant to a self-financing policy. Item IX, therefore, assumes a temporary nature, reporting the profit or loss for the year pending the company's decision on the destination of the same. In the event of a transfer, the profit exits the business; in the event of reserve allocation, the profit is capitalized and included in the reserves. Hence, in the financial statements, own assets do not include the profit for the year as the destination is unknown. If the destination is determined in the process of reclassification, the profit will be treated accordingly.
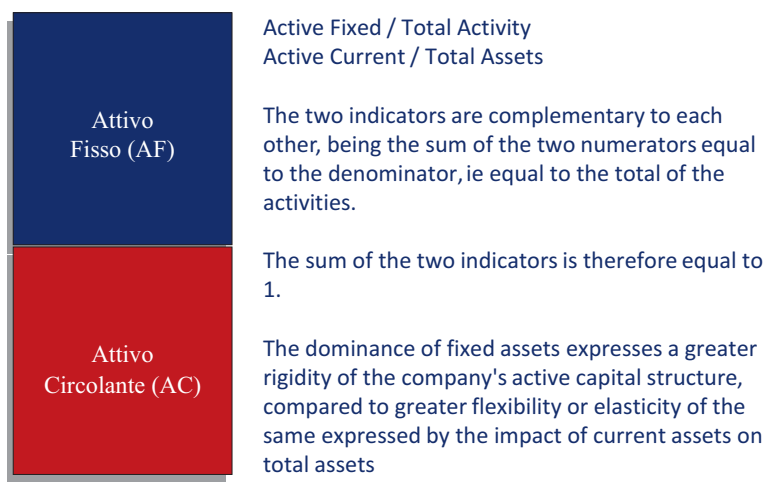
How to Read the Balance Sheet

The patrimonial situation of the company is represented by vertical reading of the balance sheet, while the financial situation is represented by its horizontal reading.
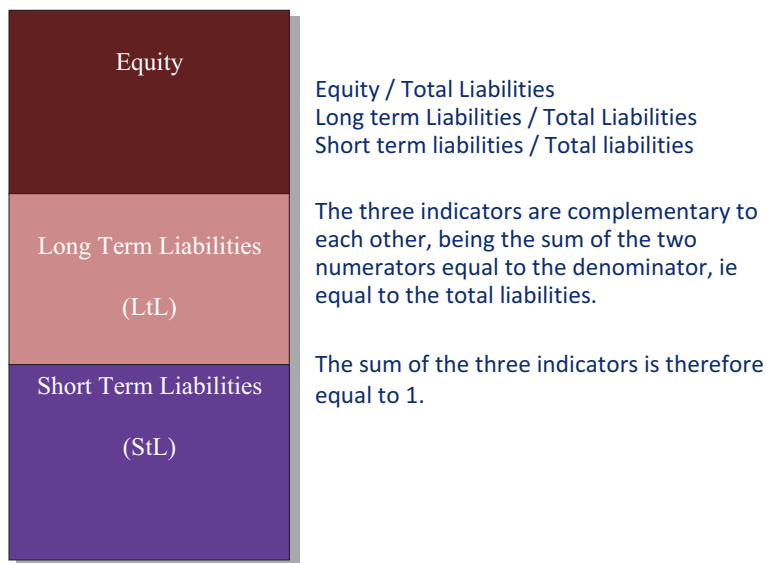
Vertical reading of the balance sheet occurs through the use of specific composition indicators, and the assets and liabilities are considered separately. Figures 3.5 and 3.6 provide some examples of the composition indicators.

Adding equity to LtLs expresses the permanent capital, that is, the means of financing that remain in the company beyond the following year. Adding LtLs to StLs expresses third-party capital, that is, financial resources from third parties with respect to the company's corporate structure, or borrowed financial resources.

Analysis of funding sources may, therefore, also consider the following indicators:

Active Fixed / Total Activity
Active Current / Total Assets

The two indicators are complementary to each other, being the sum of the two numerators equal to the denominator, ie equal to the total of the activities.

The sum of the two indicators is therefore equal to 1.

The dominance of fixed assets expresses a greater rigidity of the company's active capital structure, compared to greater flexibility or elasticity of the same expressed by the impact of current assets on total assets

Fig. 3.5 Vertical reading of active assets in the balance sheet

Fig. 3.6   Vertical reading of the liabilities and equity assets in the balance sheet

$$\left(\text{Equity} + \text{LtL.}\right) / \text{Tot. Liability}$$

$$\text{StL} / \text{Tot. Liability}$$

The first indicator expresses the presence and the impact of permanent capital on the total sources of financing, while the second indicator expresses the impact on the total sources of financing of StLs.

Particular attention is given to analyzing the company's level of indebtedness, expressed through the indebtedness (or "leverage") index:

$$\left(\text{LtL} + \text{StL}\right) / \text{Equity}$$

This indicator allows the direct relationship between own resources and third-party sources or debt to be measured. If equity is equal to the sum of liabilities, the indicator has a value equal to one; if equity is greater, the indicator assumes a value lower between one and zero (non-inclusive);

if liabilities are greater, the indicator assumes a value greater than one. This can be represented as follows:

if Equity = LtL + StL

$$\frac{(LtL + StL)}{Equity} = 1$$

if Equity > (LtL + StL)

$$0 < \frac{(LtL + StL)}{Equity} < 1$$

if Equity < (LtL + StL)

$$\frac{(LtL + StL)}{Equity} > 1$$

The financial situation is represented by horizontal reading of the balance sheet, using specific correlation indicators, which summarize and highlight the links and relationships between sources of finance and investments.

As already highlighted, a first relation is expressed by the following equality:

$$Total\ Assets = Total\ Liabilities$$

It must also be verified that the distribution of financing sources with respect to investments is appropriate. This distribution is expressed through analysis of correlations.

By way of example, two companies are considered whose reclassified balance sheet structure is represented as shown in Fig. 3.7.

Figure 3.7 highlights the capital structure of the Alpha and Beta companies. Which company's asset structure expresses a more solid financial situation?
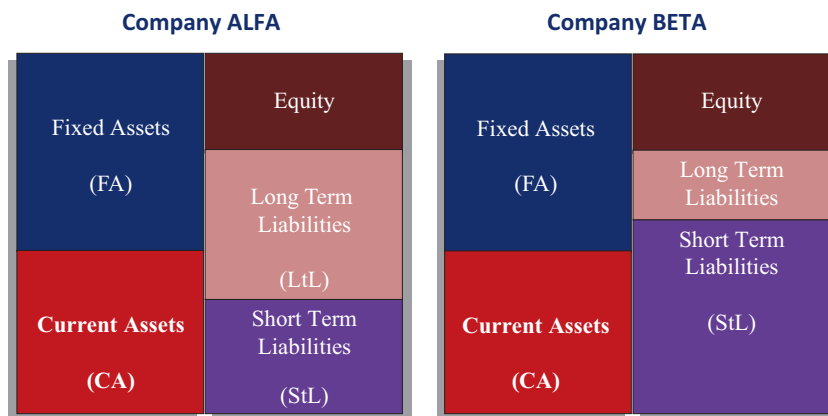
Fig. 3.7 Analysis of correlations and comparison between two companies

To answer this question, the correlations between funding sources and uses must be considered. In short, to be able to formulate an opinion on a company's financial situation, it is necessary to consider:

- the reported sources and uses
- the composition of sources
- the composition of uses

The Alpha company's reclassified balance sheet conveys excellent financial structure and an excellent correlation between the sources of financing and investments. FAs are less than the sum of own resources and LtLs, which means that FAs are covered by permanent capital. This is consistent since FAs are those whose usefulness is recovered by the company in the medium to long term, and certainly beyond the following year, while permanent capital comprises financial resources that will be repaid in the medium and long term, that is, also beyond the following year. Hence, the Alpha company shows a good correlation between medium- and long-term loans and medium- and long-term sources of financing.

The Alpha company's CAs are lower than its LtLs. This means that the CAs are hedged by short-term funding sources, that is, those expiring within the next financial year, and by permanent capital. Covering part

of the FAs with permanent capital is not problematic. This does not alter the correct correlation of sources of use, also because within the CA there is a warehouse that sometimes has a minor rotation with respect to the following year and its own capital is present in the permanent capital.

The Beta company's reclassified balance sheet conveys a bad financial structure and a bad correlation between the sources of financing and investments. FAs are greater than the sum of own assets and LtLs, which means that FAs are not covered by permanent capital. With permanent capital insufficient to guarantee the coverage of FAs, the remaining portion of the latter—Delta—is covered by StLs. In particular:

$$FA > \left(Equity + LtL\right)$$

from which:

$$Delta = FA - \left(Equity + LtL\right)$$

StLs in the Beta company cover CAs and part of the FAs. It is consistent that FAs are covered by permanent capital for the reasons explained earlier in relation to the Alpha company. Conversely, covering part of the FAs with StLs represents a serious alteration of the correlation between sources and uses, since the time limits for extinguishing liabilities are shorter at the time of recovery of investments or loans. Therefore, the company will not be able to repay its loans and third-party capital in the near term, not having recovered its investments or uses. The difference between the time limits for extinguishing StLs and the recovery time for FAs is a fundamental prerequisite for the company's financial imbalance.

In line with what has been outlined earlier, again with regard to the Beta company, Fig. 3.7 shows that CAs are lower than the StLs and, therefore, entirely covered by short-term funding sources, that is, those expiring within the next financial year. This does not constitute an alteration of the correlation sources of assets; rather, this alteration involves covering part of the FAs with part of the StLs.

Analysis of the structure of the balance sheets reveals a strong financial imbalance in the Beta company, deriving from an incorrect correlation between sources of financing and loans. The financial imbalance when it invests the patrimonial structure assumes great relief and significant gravity. In the Beta company's situation, it is reasonable to expect in the income statement a significant incidence of financial charges related to the high short-term indebtedness. The Beta company is likely to work with many poorly rated credit institutions and will be forced to chase through its financial cycle all the deadlines ending in the short term.

In this situation, the financial cycle takes over the economic cycle and consumes all the wealth produced by the latter. The Beta company sells to cash in and face deadlines: if an expected outcome does not materialize, the company risks insolvency.

The Beta company's situation can be improved through two closely related actions. The first consists of shareholder capitalization, whereby members contribute new own resources. Own assets can be made through increasing the share capital, the entry of new shareholders, or establishing or strengthening reserves. In reality, in difficult situations such as that represented by the Beta company, it is difficult for property to capitalize on the company by adding new life as its own means, and new potential members are unlikely to be willing to join the company. The second action consists of debt restructuring, through an increase in LtLs and a corresponding reduction in StLs. The restructuring of debt simply transforms short liabilities into LtLs. Debt restructuring requires the availability of financial institutions. In a situation such as that represented by the Beta company, it seems unlikely that a new bank would be willing to take on the risk of providing medium- or long-term loans. A more feasible alternative is for a credit institution to which the company is already indebted to convert its debt from an StL into an LtL. As a rule, the credit institution that is most exposed and has least security may be the most willing to help the company, since it would otherwise suffer greatly should the company become insolvent.

Referring again to Fig. 3.7, a company's financial situation can be analyzed by calculating the simple indicator called net working capital (Working Capital). Net working capital is the difference between CAs and short-term (or current) liabilities:

$$\text{Working Capital} = \text{CA} - \text{StL}$$

from which it is derived that:

$$\text{Working Capital} = 0 \text{ if } \text{CA} = \text{StL}$$
$$\text{Working Capital} > 0 \text{ if } \text{CA} > \text{StL}$$
$$\text{Working Capital} < 0 \text{ if } \text{CA} < \text{StL}$$

A company's net working capital needs to be greater than or equal to zero, meaning that StLs are equal to or less than CAs and that CAs are partly financed with permanent capital. This is the case in the Alpha company (Fig. 3.8).

If the net working capital is negative, as in the Beta company (Fig. 3.9), then StLs cover CAs and part of the FAs, thereby seriously damaging the correlation between sources and uses.

A final observation concerns the calculation of net working capital. Traditionally, this includes the stock, as part of the CAs. In this regard, it may be useful to also calculate net working capital without the stock. This exclusion allows for more precise analysis of the correlation between sources and uses through the second-level net working capital:

$$\text{Working Capital} = \text{CA} - \text{StL}$$
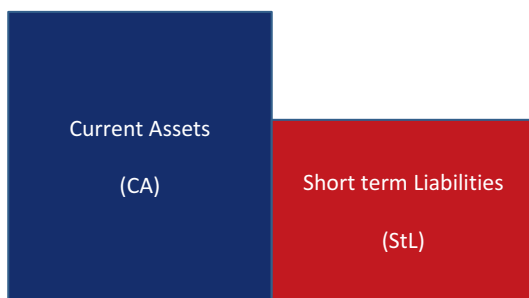
from which:

Fig. 3.8 Positive working capital
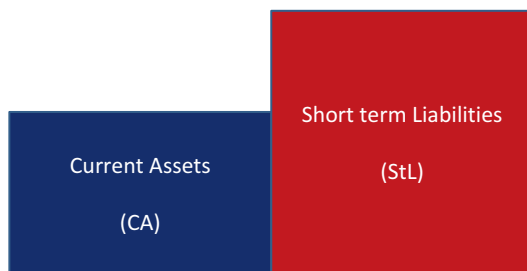
Fig. 3.9 Negative working capital

$$\text{Working Capital} = \big(\text{Inventories} + \text{Credits} + \text{Financial assets} + \text{Liquidities}\big) - \text{StL}$$

from which is derived:

$$\text{Working Capital II level} = \big(\text{CA} - \text{Inventory}\big) - \text{StL}$$

Excluding stock from the calculation of net working capital also responds to the need to neutralize the analysis from the effect produced by the presence of the stock, both because its accounting value may not correspond to its real value and because the company must always have stock available to deal with unforeseen requests or to avoid production bottlenecks.

If the company's second-level working capital is greater than or equal to zero, its financial situation can be regarded as extremely positive. If the working capital is greater than or equal to zero but the second-level working capital negative, the company's financial situation is still positive, but the analysis requires greater caution and attention.
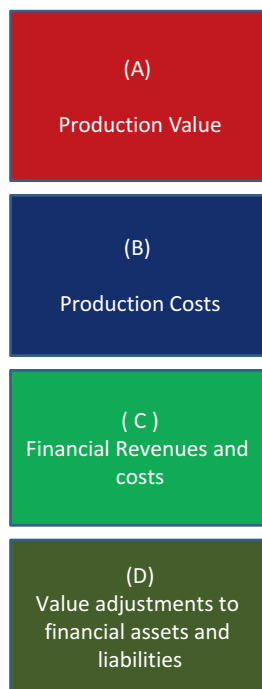
Profit and Loss Statement

Within the financial statement system, the second key document is the profit and loss statement, which represents and summarizes the economic dynamics of company management through the contraposition of positive and negative economic components. Revenues for the year are posi-

The Value of Production and the Cost of Production represent the characteristic management of the company or typical management.

The scalar shape therefore allows for identify the different in a specific way areas of business management:

- the characteristic management
- financial management

The scalar shape also allows to identify the partial economic results that take shape as a result of business management.

(A) Production Value	
(B) Production Costs	
(C) Financial Revenues and costs	
(D) Value adjustments to financial assets and liabilities	

Fig. 3.10 The profit and loss statement regulated by the Italian Civil Law

tive economic components, while costs pertaining to the year are negative economic components. Though the complexities of the profit and loss statement need not be considered in depth here, it is important to underline how the scheme adopted by the Italian Civil Code is scalar structure and follows the configuration of the production value by contrasting it with production costs, as represented in Fig. 3.10.

The scalar structure of the profit and loss statement allows analyzing the process of formation of the economic result due to the distinct management of the various areas. Several indicators are used to measure the creation of wealth at different management levels.

The first indicator expresses the difference between the production value and production cost. This partial result is referred to as earnings before interest and tax (EBIT); it conveys the economic result that the company achieves due to its typical management, that is, its own characteristic management.

The significance of EBIT lies in allowing the formulation of judgments on the company's ability through its own characteristic management (i.e., through its core business) to create wealth.

If EBIT is positive, then the typical company management is able to create wealth; if EBIT is negative, then the company lacks technical efficiency and so cannot carry out its productive activities in conditions of economic efficiency.

In the statutory scheme, the company's pre-tax economic result for the year is calculated as the difference between EBIT and the results of financial management. The latter is determined by juxtaposing revenues, financial costs, and value adjustments with financial assets. In short, the process of determining the economic result can be represented as follows:

$$(A - B)\, EBIT$$

$$+ / -$$

Result of financial management

$$=$$

Earnings before tax

$$-$$

Taxes

$$=$$

Profit for the year

The formation process is based on company profitability, with particular regard to the various areas of management.

The profit and loss statement required by the Italian Civil Code is a good starting point to understand a company's economic dynamics. Sometimes, however, it may be useful to reclassify the statement to deepen analysis of these dynamics and more precisely diagnose the formation processes of the economic value.

From the business-economics perspective, the configuration of the profit and loss statement and the production value is flanked by the con-

figurations of sales value and added value (AV). Without wishing to elaborate on reclassifying the profit and loss statement, exploding the analysis of what happens within the characteristic management (through different classification of costs) is especially important. On the one hand, with regard to value production, the statutory profit and loss statement enables isolating the characteristic management from the financial management; on the other hand, it does not allow the dynamics of the economic value creation to be deepened within the characteristic management.

In this direction, it may be useful to distinguish between variable costs and fixed costs within production costs. Variable costs are those that vary as the volume of assets and/or sales varies, whereas fixed costs do not vary with changes in business and/or sales volumes. Fixed costs are closely related to the business's maximum production capacity and to the concept of technical efficiency (or productivity). By contrast, variable costs are strictly linked to business performance and/or sales volumes.

The difference between sales revenues and variable costs provides an extremely useful indicator to support decision-making processes within the company and to better understand the dynamics of wealth formation. This indicator is called contribution margin (CM):

$$CM = Sales\ Revenues - Variable\ Costs$$

The CM expresses the extent to which sales revenues cover fixed costs. As the difference between sales revenues and variable costs, it measures the degree to which revenues contribute to covering fixed costs, after covering variable costs. If the CM is equal to or less than zero, the sales revenues cannot contribute to the coverage of fixed costs. Conversely, if the CM is higher than zero, then the sales revenues cover variable costs and contribute to covering fixed costs. This does not mean that the company will have a positive final economic result or a positive operating economic result: the latter depends on the measures of fixed costs and the CM. The higher the CM, the greater the contribution to covering fixed costs. If fixed costs are lower than the CM, the company will have a final positive economic result or a positive operating economic result. The usefulness of the CM is understood both upward and downward: upward or toward variable costs and sales revenues; downward or fixed costs:

$$\text{Sales revenues}$$
$$-$$
$$\text{Variable Costs}$$
$$=$$
$$\text{Contribution margin}$$
$$-$$
$$\text{Fixed costs}$$
$$=$$
$$\text{EBIT}$$

The relationship between the CM and variable costs and sales revenues is useful for increasing the percentage of contributions and, therefore, company profitability. In fact, since the CM is the difference between the sales revenues and variable costs, the two levers to increase the company's ability to cover fixed costs and create wealth are the variable revenues and costs:

$$\text{CM} = \text{Sales Revenues} - \text{Variable Costs}$$

from which:

$$\text{CM} = \Sigma pi \times qi - \text{Variable Costs}$$

Sales revenues are the sum of the quantities sold for sales prices. If the company wants to increase the CM, it can increase the quantities sold, increase sales prices, reduce variable costs, or jointly pursue all three options. It is clear that increasing the CM leads to an increase in company profitability.

To deepen the processes of wealth formation and company profitability, other useful indicators include AV and earnings before interest, taxes, depreciation, and amortization (EBITDA). AV is the difference between sales revenues and the costs of purchasing productive factors from outside

the company; EBITDA is the difference between sales revenues and the costs of productive factors with a fast use cycle:

$$AV = \text{Sales Revenue} - \text{Costs of inputs purchased from outside}$$

$$EBITDA = \text{Sales Revenue} - \text{Costs of productive factors}$$
$$\text{with a fast use cycle}$$

By integrating these indicators in the profit and loss statement, a reclassification scheme can be introduced that aims to deepen the processes of wealth formation and diagnose the company's status in terms of its economic and income dynamics. Changes in the inventories of finished products are not considered below for simplicity:

<div align="center">

Sales revenues

–

Variable Costs

=

Contribution margin

–

Fixed costs for factors purchased outside

=

Added Value

–

Fixed costs due to factors within the company

=

EBITDA

–

Depreciation and amortization of funds

=

EBIT

</div>

Within the fixed costs for factors within the company, personnel costs can be considered, though there is no unitary doctrine on the treatment of these costs. In particular, it is debated whether personnel costs can be considered variable or fixed costs. Finally, depreciation and amortization are deducted from EBITDA to determine EBIT.

References

Amaduzzi, A. (1948). *Ragioneria Generale*. Firenze: Casa Editrice Dott. Luigi Macrì.

Amaduzzi, A. (1978). *L'azienda nel suo sistema e nell'ordine delle sue rilevazioni*. Torino: UTET.

Amaduzzi, A. (2000). *Economia Aziendale*. Bari: Cacucci.

Amaduzzi, A. (2002). *Equilibrio e valore economico aziendale*. Milano: Giuffré.

Bertini, U. (1987). *Introduzione allo studio dei rischi nell'economia aziendale*. Milano: Giuffré.

Bertini, U. (1990). *Il sistema d'azienda*. Torino: Giappichelli.

Bertini, U. (1995). *Scritti di politica aziendale*. Torino: Giappichelli.

Cavalieri, E., & Franceschi Ferraris, R. (2005). *Economia Aziendale* (Vol. I). Torino: Giappichelli.

Ferrero, G. (1987). *Impresa e Management*. Milano: Giuffré.

Giannessi, E. (1960). *Le aziende di produzione originaria, volume I, Le aziende agricole*. Pisa: Colombo Cursi.

Giannessi, E. (1970). *Appunti di economia aziendale*. Pisa: G. Pellegrini.

Giannessi, E. (1981). *Possibilità e limiti della programmazione*. Pisa: Opera Universitaria.

Giannessi, E. (1982a). *Il "Kreislauf" tra costi e prezzi*. Milano: Giuffré.

Giannessi, E. (1982b). *L'equazione del fabbisogno di finanziamento e le possibili vie della sua soluzione*. Milano: Giuffrè.

4

The Short-Term Measurement of the Creation of Value: The Importance of Technical Efficiency

Creation of Economic Value: Profitability

The core business purpose of a company is to create economic value with which, at the end of the economic business cycle, the company reconstitutes its initial capital, thereby ensuring continuity of management.

The creation of economic value is closely linked to the condition of economic equilibrium, whereby:

$$\text{Total Revenue} \geq \text{Total Costs}$$
$$\text{Total Revenue} \geq \text{Variable Costs} + \text{Fixed Costs}$$

To simplify, suppose that the company (1) produces only one good, (2) sells all that it produces, (3) with a constant unit price, (4) and with a constant variable unit cost, and (5) has no limits on its productive capacity. Then:

$$\text{Total Revenue} \geq \text{Variable Costs} + \text{Fixed Costs}$$
$$P * Q \geq VC * Q + K$$

where:

P is the constant price
Q is the quantity produced and sold
VC is the variable cost per unit
K is the fixed costs.

The creation of economic value—the company's profitability—is therefore linked to the following levers: (1) the selling price, (2) the quantity produced, (3) the variable unit cost, and (4) the fixed costs.

Selling price depends on company policies and market conditions, so this driver is strictly linked to conditions external to the company. The quantity produced also depends on market conditions, understood as the market's ability to absorb the quantity offered, as well as on conditions within the company. Internal conditions affecting the quantity produced pertain to the company's production capacity or its productivity. The variable unit cost depends on the company's bargaining strength with suppliers and its ability to access competitive supply markets.

The fixed costs are closely linked to the company's economic efficiency, which itself depends on the company's technical efficiency. Technical efficiency concerns the company's ability to exploit its maximum production capacity.

Consider that:

$$P * Q \geq VC * Q + K$$
$$P * Q - VC * Q \geq K$$
$$Q * (P - VC) \geq K$$
$$Q \geq K / (P - VC)$$

Profitability can, therefore, be understood to depend on the following main drivers: fixed costs, and thus technical efficiency; and the CM, expressed by the difference between unit sale price and unit variable cost (the denominator). At constant fixed costs, company profitability can be increased by addressing the CM or the value spread between the unit sale

price and the unit variable cost. This range can be increased by raising the sale price, reducing the variable cost per unit, or combining both solutions.

The Technical Dimension of Business: Production Capacity and Productivity

The conditions for cost-effectiveness over time are closely related to the company's ability to maximize its potential production capacity, expressed in terms of the volume of activity available to the company and closely linked to the resources at its disposal. Production capacity depends on quantitative relationships between the inputs and outputs of production processes, and between the different factors and the different products. It can be defined as *the ratio between the physical quantity of the product obtained (obtainable) and the physical quantity of each single factor consumed (consumable) to make the product.*

The business has a limited endowment of resources (productive factors), which when used produce a certain volume of activity, according to the following function.

Make α the limited supply of productive resources available to the company at a given moment t, defining α as the Σ of the productive factors f1, f2, …, fn.

Then, productive capacity Y at moment t is a function of α:

$$Y = f(\alpha)$$

where f represents the organizational and management methods through which the resources are combined.

The productive potential of the company system cannot be measured by the mere sum of available resources, being also a function of the ways in which those resources—whether the organizational technical structure, plant, equipment, or the fast productive factors cycle of use—are combined from an organizational and management perspective. With the same resources, two companies can realize different production

potential. In this regard, consider the importance of technology, the ways in which company processes are identified and regulated, and how human resources are used.

Beyond production capacity as the productive potential of the company system, maximum production capacity must be understood as the maximum amount of activity that the company in a given period/instant can produce/sell using the limited supply of available resources.

This interpretation requires two clarifications:

- Temporally, the maximum production capacity can refer to a time interval or to an instant of company life. For some types of companies, the maximum production capacity over a time interval is most relevant; for other types, every moment of the company's life must be considered.
- Maximum production capacity can refer to the phenomenon of production or the phenomenon of sales. Indeed, the two phenomena can also coincide. For some types of companies, the maximum production capacity for the production phenomenon is most relevant; for other types, reference must be made to the phenomenon of sales.

Maximum production capacity is an important reference for measurement processes in relation at the technical efficiency within the business. The company must pursue as its purpose the exploitation of maximum production capacity: the "technical end" on which to base the company's "economic end." It is evidently important for the company to know its maximum productive capacity and the productive factors which are part of the productive combination. Knowing the maximum production capacity is a prerequisite for measuring the degree of exploitation, in relation to company policies and decisions.

Technical Efficiency and Economic Efficiency

One way to measure the exploitation degree of a company's maximum production capacity is through determining the so-called technical efficiency. This concerns the relationship between the given levels of output

and input. The output is represented by the level of activity realized or achievable; the input is represented by the level of resources used or usable. Technical efficiency is based on measuring "physical quantities" of output and input.

Having taken this relationship (output and input), technical efficiency has a double meaning, depending on the perspective of analysis and reading:

- The maximum output level achievable with a limited budget and input date.
- The minimum input level that can be used to obtain a given output level.

The two meanings are interrelated: each company can deal with the theme by indifferently following one or the other observation perspective. The appropriate measuring instruments depend on which perspective is chosen.

Measuring technical efficiency is closely related to measuring the company's economic conditions: replacing the output and input quantities with the economic values of the output obtained/obtainable and input used/usable converts technical efficiency to economic efficiency. Moreover, technical efficiency is a necessary condition for achieving economic efficiency.

Economic efficiency is represented by the ratio between the obtained/obtainable output value and the used/usable input value. The value is expressed in economic terms, that is in terms of wealth produced and wealth absorbed. Similar to what is claimed for technical efficiency, economic efficiency has two closely related meanings:

- The maximum output value that can be reached in relation to the data value of the inputs used.
- The minimum input value that can be used to obtain a given output value.

The company cannot achieve economic efficiency without first achieving technical efficiency, which itself requires fully exploiting its production

capacity. Thus, fully exploiting its production capacity is a necessary, but not sufficient, condition for the company to achieve economic efficiency, which is itself a prerequisite for guaranteeing the achievement of cost-effectiveness over time.

Economic efficiency is also related to economic variables, both internal and external to the company: for example, market price fluctuations.

Achieving economic efficiency is a necessary, but not sufficient, condition for achieving the economic conditions of the company equilibrium in a given time period.

Economy is a short-term measure calculated by the correlation between revenues and costs. In the financial statements system, the correlation between revenues and costs is guaranteed within the profit and loss statement through the accrual method.

Economic efficiency must be projected over the medium to long term in pursuit of long-lasting equilibrium conditions.

Achieving technical efficiency is not enough to guarantee economic efficiency: for instance, a company can maximize the exploitation of its production capacity but not achieve economic efficiency due to policies on purchase inputs or sales outputs.

Technical efficiency is a medium- and long-term objective that the whole business must tend asymptotically at any moment. While, from a purely theoretical perspective, companies lacking in technical efficiency should be economically inefficient, there have been many cases in which technically inefficient companies are able to maximize their economic value, keeping positions of economic efficiency and achieving very positive company performances. Conversely, technically efficient companies—those very close to exploiting their maximum production capacity—can perform poorly and fail to respond adequately to economic conditions.

What is certain is that poor technical efficiency has an economic cost for the company, represented by the higher incidence of costs of the unused production structure on the unit product/service. Although difficult to highlight in the income statement, this cost has an impact on the company balance sheet even in situations particularly favorable to optimizing the company's wealth creation.

The cost of technical inefficiency is twofold:

- The cost of the unused productive capacity or idle overhead costs, which can be easily determined.
- Opportunity cost, which is not easily determinable.

In manufacturing companies, production capacity depends on the structure and available facilities. These are usually "capital-intensive companies." By contrast, in service or commercial companies, production capacity depends on the available human resources. These are usually "labor-intensive companies."

The resources available to the business define the maximum production potential, that is, the maximum volume of activity. What appears essential is the construction of a correlation between a system of technical measurement of the production capacity and an economic measurement system of company performance—in short, a link between technical and economic dimensions.

The Relationship Between Volumes, Costs, Prices, and Revenues

The link between the technical measurement system of production potential and the economic measurement system of company performance recalls the relationship between volumes, costs, prices, and revenues. That relationship was explored in the Italian business-economics doctrine by Maestro Egidio Giannessi, in the study that led to his publication of *Kreislauf* (Giannessi 1982).

The starting point of the problem is related to cost behavior and price behavior: "*while costs cannot be determined without knowing the size of the production volume, strictly dependent on price trends, they find their meaning in the economic conditions that oversee the detection of costs. The summary of the 'Kreislauf' is expressed in terms of 'costs-prices-revenues' and is based on the volume of production volumes*" (Giannessi 1982: 4).

In other words, observing company phenomenology led Giannessi to criticize J. M. Clark's approach—very widespread in the 1950s and 1960s—of totally attributing the problem of company economy to the

exploitation degree of production capacity without considering the wider economic conditions.

Clark linked company profitability to the exploitation of production capacity, conducting an incomplete analysis of the process of cost formation and of the correlation of cost prices. Clark's analysis (J. M. Clark 1950) was based on classifying costs as either variable or constant. This classification was analyzed and promptly criticized by Giannessi, also with respect to the contribution contained in the studies of Eugen Schmalenbach (1956). Clark bases his observations on eliminating unused production capacity to reduce the incidence of constant costs on unit costs. By contrast, Schmalenbach analyzes all the cost components and, by creating a series of classes, attempts to represent the cost dynamics against production in a state of normalcy, a state of over-employment, and a state of under-employment.

Giannessi observes that the problem of company profitability is not only related to the exploitation of production capacity. Rather, it is necessary to measure the economic impact of that exploitation and, therefore, of the convenience or non-profitability to maximize exploitation itself, focusing particularly on the prices at which the products/services are offered on the market. In other words, Giannessi observes the need to investigate whether the output from greater exploitation of production capacity is traded on the market at a remunerative price, that is, at a price that improves the company's economic equilibrium conditions.

The economic impact cannot be measured by only distinguishing between variable and fixed costs; the concepts of marginal cost and marginal utility must also be considered. For increasing the utilization of production capacity to be convenient, the price of the additional output unit obtained thereby must exceed the increase in cost borne by the company in its production; otherwise, the increase has no convenience. To determine the convenience (or otherwise) through marginal utility, Giannessi observes the necessity of considering the loop created:

- Production costs depend on the production volume
- Production volume depends on price trends
- Price trends depend on production costs

If an approach similar to Clark's is adopted, classifying costs as variable or constant, his conclusions are easily reached: increasing volumes reduces the incidence of constant costs, thereby benefiting company profitability. In this way, exploiting production capacity becomes the main lever to improve company profitability.

Giannessi analyzes the weaknesses of Clark's thinking with regard to uncertainties in the behavior of both costs and revenues. For both economic components (costs and revenues), the uncertainties might include:

- Uncertainties of "entity," with reference to determining the measure of the economic component. Giannessi, in his publication, uses the term "evanescence areas" (Giannessi 1982: 42).
- "Distribution" uncertainties, with reference to allocating economic components to the "groups" or accounting aggregates with them.
- "Imputation" uncertainties, with reference to the impossibility of applying uniform criteria in the reference of "groups" or accounting aggregates to unit and production class costs.

These uncertainties create an area of evanescence within which it cannot be established to what extent an increase in production would benefit or damage the company's economy: "*this area also prevents establishing when, by reducing the offer price, we simply give up the profit margin we hoped for, when we start to no longer cover the constant cost components and when, finally, the non-coverage of variable cost components begins*" (Giannessi 1982: 45).

It is in this context that Kreislauf is inserted: if a company intends to strive for its technical purpose, represented by the maximum exploitation of its production capacity, how can it evaluate the convenience or non-profitability deriving from a possible increase in activity volumes?

To perform this assessment, it is necessary to accurately determine company costs and compare them with the corresponding price formations. Accurate costs determination requires knowledge of constant costs and their impact on unit and production costs. To know the incidence of constant costs, it is necessary to know the volume of activity. However, this is linked to prices. Due to the above-mentioned uncertainties, the Kreislauf is formed: "*without knowing the volume of production, it is*

impossible to determine the ratio of incidence of constant cost components to unit and production class costs. Without knowing this relationship, it is impossible to speak of exact production costs or, at least, sufficiently exact to be used in the formulation of expediency judgments" (Giannessi 1982: 47).

Costs tend to adapt to prices, even if their size is closely related to activity volumes, which themselves depend also on the company's sales policies, linked to the costs recognition. Prices tend to adjust to costs, but costs depend on activity volumes that, in turn, are linked to price levels. These dynamics create a loop whose solution appears complex. To find the solution, however, companies need to leave the evanescence area which, due to the Kreislauf, is created in the relationship between costs, prices, and revenues.

The solution identified by Giannessi is subjective and based on the logic that the company must consider all its decision-making processes. This solution is based on an evaluation process that extends beyond the mere application of mathematical formulas, taking into consideration all the elements directly or indirectly related to judging convenience. These elements may be internal to the company, but may also be external: "*The theory of use [at any cost] of the production capacity of the plants must be reviewed and replaced with the theory that requires the evaluation of all internal circumstances and external, economic and non-economic, particular and general, which influence the formulation of judgments of convenience*" (Giannessi 1982: 64).

Giannessi's observations on the relationship between volumes, costs, prices, and revenues are very relevant today, given the complexity of competitive dynamics, and are especially significant within the tourism sector. As in services companies in general, attention to the behavior of costs and the maximum exploitation of productive capacity is particularly important in the tourism sector due to the intangibility of the service and the consequent absence of a warehouse.

It is no coincidence that recent decades have been characterized by a real revolution in air transport with the appearance of the low-cost phenomenon. Giannessi's approach seems to disavow some business-economics foundations of the low-cost phenomenon; as will be seen shortly, this is due to the need to reduce the incidence of fixed costs, its reason for existing from a management and business-economics perspec-

tive. Giannessi's observations and studies on this theme are, therefore, particularly important in guiding the implementation of innovative management and managerial tools by tourism companies.

The Origins of Kreislauf: Marginalist Theory

Kreislauf can be considered as the origin of the most recent RM systems. Its origins are found in marginalist theory, whose birth is commonly dated by economic historians around the early years of 1870, during which period the works of those considered founders were published.

In 1871, Menger published the *Principles of Political Economy in Austria*, while Jevons published *The Theory of Political Economy of Jevons in England*. Just three years later, Walras published *Elements of Pure Political Economy in France* in 1874.

After the death of Ricardo in 1823, criticism of the classical theory, long-consolidated in the economic panorama by that time, grew considerably, feeding the birth of multiple changes in economic science, which also reflected contemporaneous changes in the economic and social fabric.

The theories of the first critics of Ricardism developed mainly in England, France, and Germany. Though sharing some commonalities, they moved in different directions regarding which theoretical aspects they considered important.

The new theories sought to provide solid explanations to justify the necessity of the capitalist social class. They, thus, defined the instrument through which capital is formed as abstinence. The fundamental principle around which the new theory develops is the assumption that the free market functions autonomously, without need for interventions to meet supply and demand (the invisible hand theory). On this basis, the state should not have a regulatory function, but should instead be confined to ensuring defense and justice.

Capital can, therefore, be considered a productive factor on a par with labor and land; as such, a sacrifice—abstinence from consumption—must be paid. This explanation of the origin of profits is substantially maintained in marginalism, particularly with regard to the concept of

capital productivity, with which marginalism shows how the services of such an instrument are not free but instead involve a sacrifice that not all individuals are at all times willing to make. This explains why these services can also be poorly defined.

An asset's value originates in its scarcity, particularly where it is useful in the production process. As Walras explained, all material and immaterial things are susceptible to price provided they are scarce, or "*on the one hand useful and on the other available in limited quantities.*" Thus, while the first critics of Ricardism certainly did not comment in detail, they succeeded in delineating the theoretical ideas from which marginalism could then evolve. Indeed, it was following the indications of these revolutionary precursors that Jevons, Menger, and Walras developed the so-called marginalist revolution. One speaks of a marginalist revolution not so much for the theoretical forms, already outlined earlier, but more for the advent of differential calculation in the economic landscape, used for the first time to determine the so-called optimal positions that, as discussed later, are fundamental to the studies and the bases of the marginalist model. The core of this new vision became the consumption that assumes a primary position with respect to exchange, production, and distribution, above all from the perspective of satisfying individual needs. This is one angle from which marginalist theory analyzes economic activity to understand its laws and regulations. The problem of the individual is, in fact, the distribution of available resources in order to maximize satisfaction of their needs and, therefore, their potential usefulness.

This individualistic approach, by which the value of an asset depends on its ability to satisfy human needs, leads to focus on the theme of utility, and particularly marginal utility, understood as an additional quantity obtained from unit increases in individual assets.

An innovative element of the marginalist doctrine was the possibility of measuring the value of use of an asset and its marginal increases through implementing differential economic calculations. In marginalist theory, the concept of value is fundamental, and value is given by the importance attributed to particular goods or services by each individual, dictated by their potential capacity to satisfy human needs. Value thus ceased to be solely based on objective quality with the introduction of subjectivity. This value must, in turn, be distinguished in the total utility

of a good and the utility derived from consuming a fraction thereof. Analyzing the latter became the foundation for the postulate of marginal utility, according to which the utility derived from consuming an additional unit of an asset decreases in proportion to the increase in the total amount consumed.

It is immediately obvious that prices are, for marginalists, the most direct indicator of the scarcity of goods. One innovative development was the introduction of use value and the possibility to measure it. However, it has been noted from measurements that this value decreases proportionally to the increase in the asset's availability. It is, therefore, essential to analyze the final degree of utility to determine prices, as these will coincide with the utility value of the last unit consumed—or the subsequent possible addition—of the asset: the marginal one.

In the marginalist doctrine, the degree of utility and (consequently) the price vary according to the available quantity of the good, decreasing as the quantity increases. From analyzing the usefulness of goods, we can, thus, obtain the so-called demand curves of individuals, which express their subjective degree of usefulness, derivable from the available quantity of the good in question (scarcity). These curves can be added together to derive a new curve representing the total demand for that same good on the market. The intersection of the demand curve thus obtained with the supply curve—which expresses the availability of the asset, and the costs and degree of production difficulty that characterize its position on the graph—determines the asset's equilibrium price.

The neoclassical production function is the focal point of the marginalist model, and is characterized by a mathematical link between "inputs" (productive factors) and "output" (the final product).

The different ways in which a company combines the available inputs to produce a given output is called "technology." To represent the technology, the production function is used where it is the very expression of combining the available inputs to obtain the maximum quantity of a given output. Given the function of neoclassical production, where the product (Y) is a function given by the ratio between capital (K)—understood as machinery—and labor (L)—understood as a labor force—used in the production process:

$$Y = F(K, L)$$

now focuses on the main objective for maximizing utility: determine the optimal quantity to use of a given input. To determine this quantity, we therefore need to calculate the increase in production obtained by using one unit in more than one given input, with the same quantity of the others. This quantity is termed marginal productivity.

Marginal productivity is a fundamental concept in marginalist economics, particularly the part of this theory that analyzes the branch of production.

More specifically, considering a generic production function:

$$y = f(x1, \ldots, xi, \ldots, xn)$$

the marginal productivity of the i-th input is defined as the increase in output recorded following a unitary increase in the input level i, keeping the levels of the other inputs constant. Mathematically:

$$MPi = \frac{\partial y}{\partial xi}$$

Depending on how the marginal product of the i-th input varies, there are three different cases: increasing, constant, or decreasing marginal returns.

The marginalist model considers diminishing marginal productivity, as can be inferred from the neoclassical production function (characterized by the presence of only two inputs).

The marginal productivity i is decreasing if, as the additional amount used of this input increases, $MPi = \partial y/\partial xi$ is decreasing (<0); therefore, the final output variation that it entails is always smaller.

Returning to the two-variable function $Y = F(K, L)$, it is possible to observe that for each value $K > 0$ and $L > 0$, the function will assume positive values, and marginal products of K and L also are positive but decreasing.

John Maurice Clark and the Division Between Fixed and Variable Costs

The economist John Maurice Clark was born in Northampton in the United States in 1884, and died in 1963. Son of John Bates Clark—one of the most prominent economists of the second generation marginalists—J. M. Clark collaborated with his father in writing *The Control of Trusts* (J. B. Clark 1901) and was one of the theorists behind Keynesian economics. Of its important contributions to the economic doctrine—which include determining the acceleration principle for analyzing the effects of the fluctuations of the question on the duration of investments (a forerunner of Keynesian theories)—we will concentrate here on analyzing the incidence of fixed costs in the business reality.

Clark's main work is, in fact, *Studies in the Economics of Overhead Costs* (1943), which discusses principle of acceleration, analyzes and addresses the internal costs of production, and proposes a systematic division between fixed and variable costs. The focus of the action is related to analyzing the inverse relationship he envisages between fixed costs and production volume: it is sustained as companies facing high fixed costs can significantly reduce the average production cost by expanding production volume—thereby increasing the output—and thus breaking down the impact of fixed defined costs across several units of possible output.

This division between fixed and variable costs cannot be totally attributed to Clark, although he was responsible for elaborating and diffusing this theory. In fact, it had already begun with the advent of single-phase industry, which produces totally standardized products, thus raising the problem of imputing fixed production costs. Witnessing first-hand the process of mechanization of business realities, Clark focused primarily on studying the reduction of unused production capacity, that is, the elimination of idle costs (which he termed idle overheads). His analysis mainly sought to illustrate the importance of adopting this cost policy in large industries characterized by significant capital investments, but he did not neglect small businesses, in which volumes need to increase to optimize and fully utilize machinery and infrastructure. For large industries, the

aim must therefore be to try to divide the constant costs over the entire production batch made from time to time, trying to produce a sufficiently large lot to ensure that these are distributed optimally.

Clark defines fixed costs as a large family not characterized by common elements, aside from being part of the category of business costs not directly attributable to a specific business unit and not easily delineated. One peculiarity of fixed costs is that their variation is in no way proportionally linked to an increase or a decrease in the output. Trying to track down these costs or assign them rationally is inhibited by strong complexity.

Initially, the optimal solution to this problem was to impute fixed costs to the individual units based on a coefficient expressing each unit's processing time under conditions of normal use of production capacity. A link was thereby created between fixed costs to be charged and hours of manpower used. As technological development progressed, the complexity of the conformation of the companies also increased, particularly due to the phenomenon of companies' vertical integration: original processing began to support activities that originally stood upstream or downstream of the production chain. However, the imputation of costs, now linked to both labor times and volumes, continues to resist until the problem of product specialization is created.

The main problem that emerges for companies is that of dividing constant costs over the entire production, without being able to fully attribute the actual cost involved in producing varied goods. This analysis, at the end of the search for a way to correctly manage and attribute overheads, leads Clark to identify a fundamental factor that is paradoxically simple compared to the difficulty of the context: unused production capacity. Analyzing unused production capacity led Clark to believe that failing to make optimal use of plant and, more generally, the productive factors ultimately increases the incidence of constant costs on the individual units produced, reducing profits in a more or less relevant way. The solution of exploiting maximum production capacity at all costs can, therefore, also lead to the adoption of company policy choices that are economically irrational, such as selling at a loss or at any cost. Such choices pursue the sole objective of increasing the number of output units adequate or sufficient to divide constant cost components, lowering

the rate of economy that would otherwise be lost, and thus reducing total costs to below total revenues. Clark maintains that a mathematical analysis of the constant costs must be carried out, accompanied by an estimate of demand, in order to estimate the quantity of output necessary to ensure full employment of production capacity and, therefore, eliminate causes of inefficiency within the company.

It is regarding this theoretical framework that we include the critique of Giannessi of J. M. Clark's cost theory. The fulcrum of his criticism is the non-sharing of the net and systematic distribution of the costs in constant and variable, as well as the base to try to draw, at all costs, complex mathematical elaborations to indicate the achievement of economy within the company system. Giannessi does not consider Clark's theory of unused production capacity to be unfounded; rather, he points out that the ratio of inverse proportionality between the constant cost components and production volume cannot be assumed to be based on universal mathematical developments. According to Giannessi, on the problem of fully exploiting unused production capacity exposed by Clark, a real distinction cannot be made between the actual unexploited productive force and the problem of enlarging the company's size (overlooked by Clark), or alternatively the existence of moments of emptiness in the company that are not necessarily considered to represent unused production capacity. Examples of the latter include technical times or the times between complementary or accessory operations.

References

Clark, J. B. (1901). *The control of trust*. New York: Macmillan Co.

Clark, J. M. (1943). *Studies in the economics of overhead costs. Tenth impression*. Chicago: The Chicago University Press.

Clark, J. M. (1950). *Studies in the economics of overhead costs. Tenth impression*. Chicago: The Chicago University Press.

Giannessi, E. (1982). *Il "Kreislauf" tra costi e prezzi*. Milano: Giuffré.

Jevons, W. S. (1871). *The theory of political economy*. New York: Sentry Press.

Menger, C. (1976). *Principles of political economy*. Institute for Humane Studies.

Schmalenbach, E. (1956). *Kostenrechnung und Preispolitik*, Auflage berabeitet von Richard Bauer. Kohn und Opladen: Westdeutscher Verlag.

Walras, L. (1874). *Elements of pure political economy*. Lausanne: Imprimerie L. Corbaz & C. Editeurs.

5

The Impact of Technical Inefficiency on Business Management

The Illusion of Low Cost

Within the tourism industry, recent decades have been characterized by the birth and development of the low-cost phenomenon in air transport due to deregulation in the sector. The low-cost phenomenon has contributed significantly to recent changes in tourism, particularly in the behavior of tourist consumers, with a cultural and then behavioral revolution. These revolutions have made air transport more accessible, driving a rise in passenger traffic and mobility and "reducing the distances" between different countries. Transportation times are shorter by air, and travel frequency has increased due to pricing policies resulting from deregulation and increased competition within the market.

Without questioning the importance of the low-cost phenomenon, we wish to reflect on it in terms of management and business-economics.

We first reflect on the organizational model of low-cost companies. Low-cost airlines have optimized the processes related to air transport logistics, minimizing operating costs and changing organizational and business models, both for back-office and front-office activities.

Back-office optimization includes choosing the most suitable airports at which to land, minimizing the amount of passenger luggage stored in the hold to reduce relative costs, the landing airport services, coordinating aircraft returning to base at the end of each day to avoid stopping at airports, and holding lower fuel reserves inside the aircraft to reduce weight and, therefore, consumption. Front-office optimizations include the weight of luggage, not allocating seats, and the non-free administration of food and drinks. Both optimizations are in compliance with safety standards.

It seems clear that the low-cost organizational model has radically changed travelers' habits, to the point that many travelers, due to the low price of flights, choose city destinations that they would not otherwise have visited. The increasing frequency of travel is sometimes accompanied by a reduction in the average stay.

Another consideration is airlines' use of the price lever to move demand from one airport to another or from one flight to another.

Consider an airline that provides two flights from Pisa to London each day, one of which departs at 07:00 and the other at 15:00. It seems clear that the 07:00 flight can meet the specific demand of people traveling for work that day. However, if such passengers are not sufficient to fill the aircraft, the airline will implement lower pricing for the 07:00 flight than for the 15:00 flight, which is likely to be more convenient for most travelers. Through this price lever, the company manages to shift some, but not all, demand from the 15:00 flight to the 07:00 flight. In particular, it targets price-sensitive passengers with the necessary flexibility to arrive at the airport at 05:00 (two hours before boarding). For flights to the same destination on the same day, some travelers may not be willing to change their flight schedule to benefit from a reduced ticket price.

Through the same dynamic, the price lever can be used to shift passengers' preferred destination from one airport to another. For instance, when flying from London to Tuscany, one would consider whether to land in Pisa or Bologna. In both cases, the distance by train to Florence is about an hour. Therefore, the airline may decide to increase the traffic of visitors to Florence via Bologna or Pisa in negotiating with airport companies and the main institutional stakeholders.

We next reflect on the economic aspects of the low-cost phenomenon. Those who travel low-cost cannot consider of traveling for free or that the airline aims to engage in corporate philanthropy. On a low-cost flight, the average ticket cost—calculated by summing the price paid by all passengers and dividing by the total number of passengers—is actually in line with the average ticket cost on a non-low-cost flight.

Making:

$$ni = passenger \ i$$

$$Pi = the \ price \ paid \ by \ passenger \ ni$$

then:

$$Average \ ticket \ revenue\left(ATR\right) = \Sigma Pi/\Sigma ni$$

where:

ΣPi is the total revenue from ticket sales to passengers
Σni is the number of passengers on board the aircraft.

For a low-cost flight, the airline sustains two types of costs: variable costs and fixed costs. Variable costs vary with the number of passengers, such as fuel consumption or aircraft cleaning costs. Conversely, fixed costs do not change as the number of passengers varies; they include the cost of on-board personnel, aircraft amortization, and maintenance costs.

Fixed costs are, therefore, stable whether the plane travels empty or full. The airline seeks to fill the aircraft in order to maximize its production capacity and achieve maximum technical efficiency. From this, we can understand why, from an economic perspective, the low-cost phenomenon is an illusion.

Suppose you have an aircraft with 100 seats in a single class that flies daily from Florence to Paris. The airline knows that the aircraft's occupancy rate, that is the load factor, averages 65%, meaning that the flight carries an average of 65 paying passengers.

The 35 empty seats represent a cost for the company in the form of technical inefficiency: an aircraft that can accommodate 100 passengers only carries an average of 65. The occupancy rate represents the exploitation rate of the aircraft's maximum production capacity, and therefore the technical efficiency rate. This percentage is represented by the ratio between tickets sold (Ts) and available tickets (Ta):

$$\text{Load factor} = \text{Ta/Ts}$$

The non-occupancy rate measures the aircraft's technical inefficiency, calculated from the difference between the maximum technical efficiency (reached at 1) and the load factor:

$$\text{Technical Inefficiency} = 1 - \text{Load Factor}$$
$$\text{Technical Inefficiency} = 1 - \left(\text{Ts/Ta} \right)$$

From an economic perspective, this inefficiency translates into a cost borne by the airline that is both twofold and "subtle."

The cost of technical inefficiency is twofold because it is expressed in two closely related components:

$$\text{Cost of Technical Inefficiency} \left(\text{CTIn} \right) = \alpha + \beta$$

Component α represents the lost revenues, while component β represents the higher incidence of fixed costs. The sum of the two components $(\alpha + \beta)$ represents the double cost of technical inefficiency.

Missed revenues represent the cost from failing to sell all 100 tickets. The cost to the airline of the 35 unsold tickets is calculated as the product of the number of unsold seats and the price of those seats:

$$\alpha = \Sigma \text{bi} \times \text{pi}$$

where bi represents an unsold ticket, and the price of each ticket is the same.

The higher incidence of fixed costs is linked to those costs' distribution over the number of seats sold. The amount of fixed costs (Ω) is stable compared to the number of passengers purchasing air tickets. Ω is spread over the number of seats in the aircraft. The minimum incidence of fixed costs is, therefore, represented by:

$$\text{Incidence Fixed Costsmin} = \Omega / 100$$

The minimum incidence of fixed costs expresses the aircraft's economic efficiency as a consequence of its technical efficiency. The maximum incidence of fixed costs is reached when the airline has not sold any tickets. In the latter case, the airline will probably cancel the flight and move the passenger to another.

If the airline sells 65 tickets, the incidence of fixed costs increases, as determined by the following ratio:

$$\text{Incidence Fixed Costs 65} = \Omega / 65$$

where:

$$\text{Incidence Fixed Costs 65} > \text{Incidence Fixed Costsmin}$$

The higher incidence of fixed costs consumes the margin on tickets sold, reducing overall company profitability.

This explanation demonstrates why airlines prefer potentially selling all tickets even at low prices, rather than having empty seats. The cost of an empty seat on the aircraft is higher than that from selling the same seat at a low price.

If the airline sells five tickets that statistically remain unsold at a low-cost price (LCPrice) commensurate with variable costs and a small contribution to fixed costs, it obtains a double advantage from the increase in revenues—albeit almost totally absorbed by the increase in variable costs—and the reduced incidence of fixed costs. In fact, the incidence of fixed costs is reduced by the distribution of the same amount on a 65 + 5 basis, that is, 70 tickets sold compared to the distribution on 65 tickets.

From here, it is easy to understand that low prices and low-cost policies represent:

- a management lever to increase technical efficiency and, thereby, corporate profitability
- a marketing lever, attracting many potential customers to seek the lowest-priced ticket despite only five (in the example) being available for the flight. The other passengers will pay a standard fare for their ticket

The double cost of technical inefficiency is "subtle" because the two components α and β do not appear in the airline's profit and loss statement or within a specific economic report of a single flight. The cost

> *To understand the double effect of technical inefficiency on company profitability, consider an admission test to a degree course that poses 50 multiple-choice questions. On each question, there are possible answers. The student receives one point (+1) for each correct answer, zero points (0) for each question they do not answer, and minus one point (–1) for each incorrect answer. Clearly, this scoring mechanism motivates the student to only give answers they know to be correct. An incorrect answer produces a double penalty for the student, since as well as not scoring a point on that question, the point they gain by correctly answering a different question is cancelled. In short, the wrong answer costs him two points. Technical inefficiency has the same effect on company profitability.*

items do not include either lost revenue or the greater incidence of fixed costs. However, these components are present and have an important influence on economic efficiency and on the company profitability. Hence, managers must pay close attention to the technical dynamics that characterizes the business and the exploitation degree of maximum production capacity.

Technical efficiency is a condition for economic efficiency. Company profitability is closely linked to the exploitation of maximum production capacity. Otherwise, the company should practice very high pricing policies with respect to production costs: this happens in some specific sectors, but cannot be the rule.

In short, though the low-cost phenomenon has decisively influenced changes in tourism in recent decades, it is essentially a technique for achieving higher technical efficiency to benefit company profitability. Companies induce customers to believe they can travel at a low price, yet all but a few will ultimately pay a standard price.

Another positive effect of low-cost policies has emerged in studies of travelers' behaviors related to spending capacity. Tourists set a certain budget for their trip, and any savings on transport costs tend to be spent on other services in the receiving territory. When considering the impact of tourism on the destination, this effect is very important for local economic development. It suggests that public administrators should seek to build relations with low-cost carriers to encourage them to add to their destinations.

The Importance of the Warehouse in the Business-Economics Dimension

Within the company system, numerous studies of the organization and management of production processes and logistics have concentrated on the warehouse.

This element is not present in all types of companies: it is found in manufacturing and commercial companies, but not in service companies and, more generally, those companies whose outputs are intangible. The warehouse can be defined as the place and the space in which the company keeps in stock both the inputs (production factors) necessary for the production process (in the economic sense) and the outputs produced or purchased (in the case of goods) that are waiting to be traded on the market.

The warehouse can cover:

- the output, representing the product deriving from the production process
- goods purchased and intended for sale on the market
- the inputs, representing the fast-use productive factors, necessary for the production process (in the economic sense)

- semi-finished or component parts of the final product, waiting to be processed and/or assembled

The warehouse can be internal to the company or external and managed by public or private third parties. In external warehouses, material management operations, such as loading and moving units to production plants or to customers, can also be carried out. Choosing between an internal or external warehouse depends on the type of input and output and on the company's outsourcing policies.

The presence and the number of warehouses within the company system depend on several factors, the most prominent of which are:

- the nature of the business activity
- the type of output produced/sold and the type of input purchased
- procurement policies
- sales policies

The nature of the business activity produced varies according to the type of company. For a manufacturing company, a warehouse is necessary to guarantee continuity in the transformation process and in product sales process; similarly, for a commercial company, a warehouse is necessary to guarantee the procurement, marketing, and (in certain cases) preservation of goods. By contrast, for a service company—for instance a consulting firm or airline business—the intangible nature of the output means it cannot be stored. However, though service companies may not require a warehouse for their output, their productive factors may need to be warehoused.

Typologies of outputs and inputs concern some characteristics that the products and productive factors must have to necessitate storing. The first is tangibility, understood as the materiality of the output or input, though it is possible in some cases to create a warehouse even for non-tangible (non-material) resources. In this last regard, consider a "time bank": a system used to store intangible resources such as working hours. In addition to tangibility, the outputs and inputs must be conservable and must be stored together with the equipment and systems with which the warehouse must itself be equipped. This conservation aims to ensure the

maintenance of the inputs and/or outputs and of their technical characteristics.

Procurement policies mainly concern the choice of suppliers, the location of suppliers, purchase quantities, purchase methods, and payment methods. If a company's supplier is geographically distant and the transport times are long, or if the price of inputs is extremely variable on the market, or as a means to obtaining greater discounts, a company can buy an amount of inputs exceeding its actual need from the programming of the production cycle, and store the excess for the purpose of future use.

Sales policies mainly concern customer identification, customer localization, production quantities, sales quantities, sales methods, and payment methods.

In the face of certain market or internal conditions, a company may decide to produce a higher quantity of output to the actual demand expressed by the market, storing the residual part for future sale.

Both for procurement policies and sales policies, the company must consider the cost of money and its degree of debt: both elements define the company's financial structure.

From a management perspective, the warehouse is considered controversial. In some respects, the presence of a warehouse is judged to be necessary, useful, and positive, since it supports the company's management and production processes; in other respects, the presence of even a necessary warehouse is judged negatively and limited to the minimum necessary use. This last direction is driven by considerations of the cost of the warehouse, as well as the themes of "just-in-time," and, more recently, lean enterprise explored in various studies.

The costs of managing the warehouse relate to the place and space occupied by the structure, and to the equipment the structure requires; the types of input and output; the stock management processes and personnel; logistics activities, oriented by policy to either minimum-cost or highest-level logistics service; maintaining stocks; feeding the warehouse; and goods damages.

To limit these costs, companies can pursue the economic lot policy, which aims to define the minimum level of inventory necessary to ensure continuity of the production process (in an economic sense) while minimizing the corresponding cost. Another alternative is the just-in-time

policy, whereby the company's supplies are regulated according to the moment at which the inputs are actually used: the inputs enter the company to be processed and the output is marketed for sale immediately after production. One further alternative is the lean enterprise policy, which aims to streamline the company structure by reducing, and in some cases eliminating, the warehouse, through outsourcing processes and relations with suppliers and/or distributors. The lean enterprise policy is subject, inter alia, to the company's contractual power over its suppliers and distributors.

From a management perspective, the importance of the warehouse extends beyond the storage function: it allows the transfer, over time and space, of inputs waiting to be used in the production process (in the economic sense) and outputs (products) waiting to be traded on the market.

Although this function generates a cost, represented by the abovementioned economic elements whose incidence appears in the company balance sheet, it fulfills a fundamental role for the entire management of the company system.

The transfer function in time and/or space is understood if the warehouse is analyzed as an element of the company system, taking into consideration its link to the company's production capacity.

Indeed, the importance and the managerial utility of the warehouse—alongside all the considerations applicable to related costs—are perceived when analyzing companies that typically do not have stock, such as service companies or companies operating in certain sectors, including tourism. From a management perspective, the warehouse—if connected to production capacity—represents a "shock absorber" of technical inefficiencies in the production processes, procurement policies, and sales policies, that is, inefficiencies deriving from failure to fully utilize the company's production capacity.

Non-utilization of the production capacity generates an inefficiency for the company that, while not always serious—where established in line with the company's planning processes—invariably generates costs, which are not always clearly represented in the profit and loss statement.

Inefficiency also occurs when the company, taking full advantage of its production capacity, produces an output quantity that exceeds market

demand. As already highlighted, such inefficiency generates a cost that is not always fully apparent in the balance sheet.

In both circumstances, the presence of a warehouse allows the company to move inefficiency over time:

- the company can buy more inputs (production factors) than are required by the production plan to take advantage of procurement policies, discounts available from suppliers, or fluctuations in price and/or exchange rates; the quantity not absorbed by the production process is moved forward over time through storage in the warehouse
- the company may decide to produce more output than required by sales plans to benefit from internal and/or market conditions, transferring the quantity not absorbed by the market through storage in the warehouse

The transfer function served by the warehouse does not eliminate inefficiencies, but allows their effects to be mitigated in economic terms. In some cases, in fact, the costs of managing the warehouse can be totally or partially absorbed by the advantages that have guided the company in its policies on supply, production process planning, and sales. The link between the warehouse and the company's production capacity requires the company to develop a measurement system able to combine technical and physical measurements with economic-financial measurements.

Overbooking: A Virtual Warehouse

The difficulty for tourism companies to transfer technical inefficiencies over time without a physical warehouse led these firms to develop techniques for creating a virtual warehouse. These techniques are better known as overbooking. From a business-economics perspective, overbooking is the tourism company's virtual warehouse. As in a real warehouse, the company must establish the optimal level of stock: for the virtual warehouse, this translates into quantifying the output units not corresponding to actual production capacity made available on the market.

The term overbooking highlights the will of the tourism company to go beyond its effective limits of production capacity in its booking/ordering/purchase request policies: "*Overbooking occurs whenever a seller with constrained capacity sells more unit than he has available.… The reason that seller engaged in such a seemingly nefarious practice is to product themselves against unanticipated no-shows and cancellation*" (R. L. Phillips 2005: 207).

As Phillips authoritatively asserts, overbooking policies characterize companies with limited production capacity, that sell or make available units of output beyond those available, pursuing the goal of protecting the company from possible cancellations of reservations/orders and so-called no-shows, that is, behaviors in which the customer does not cancel the reservation but nonetheless fails to show up to use the service or purchase the output unit.

Overbooking policies represent a lever for the company to maximize its profitability, in response to certain potential behaviors by customers, and to guarantee its technical efficiency.

It is a virtual warehouse because—analogously to what happens in a real warehouse—the company uses overbooking to transfer over time its production inefficiencies, which may be characterized by stasis in the production process as demand contracts or there is a peak in demand caused by an expansion of the demand function itself.

Unlike companies with a physical warehouse for stocking materials and finished products, companies that cannot have a warehouse are much more oriented to exploiting their full production capacity at all times. By contrast, for companies with warehouses, control over them and of production flows can be carried out within a given time interval.

In companies without inventories, the immediate economic manifestation of the cost, deriving from inefficiency in the allocation of production capacity, justifies the strong orientation toward maximizing production capacity exploitation at all times. By contrast, companies with warehouses can put in stock the output units produced and not sold.

For service companies such as airlines, theaters, hospitals, or hotels, this fact is noted because the quantity of output produced equals the amount of output sold.

In this direction, and to overcome the lack of stock, overbooking policies represent a preventive response by the company to ensure greater exploitation of its production capacity.

By selling a higher number of output units than those actually available through the production process, the company minimizes the risk of under-utilization of its production capacity due to demand contraction or certain behaviors, such as customer cancellations.

With overbooking, the company realizes a virtual warehouse of output units placed on the market.

As for a real warehouse, the company must determine the optimal level of outputs not available to be placed on the market, recognizing that the virtual warehouse poses risks related to forecasting the optimal level of virtual stock.

The company's policy of overbooking has, from a management perspective, economic and legal consequences. Economically, overbooking intends to limit—almost as a form of insurance within the company—the risk deriving from customer behavior, which can damage the company itself in terms of lost revenue and/or opportunity costs. The limitation of the risk takes place with the transfer of the same, in whole or in part, to the customer, who may be required to pay a penalty or part of the price even if they do not use the output.

The penalty may also vary depending on the time factor. Where the company establishes a penalty to customer Þ, it can be:

$$0 \leq Þ \leq P$$

where P is the price of the output.

A penalty equal to zero or a very low amount does not absolve the function of discouraging client behaviors potentially harmful to the company. On the other hand, a penalty equal to the price of the output discourage the exercise of the option. With reference to this last point, consider companies that make the customer pay the price entirely in advance, such as low-cost airlines. In these situations, by guaranteeing the advance payment of the price and by not allowing the customer to change the output, the company transfers the risk to the customer. In these situations, where the company does not run any risk in economic terms, it

may not be useful to resort to overbooking, thus removing the need for a virtual warehouse. Obviously, if the economic risk is zero, this does not exclude the non-achievement of the company's full production capacity, which has no economic consequences for the company's efficiency and profitability.

In legal terms, the consequences of overbooking include the risk of breaching contracts with customers: this occurs whenever those who have booked/ordered/requested the output units made available on the market complete the purchase. Breach of contract results in financial penalties for the company, pursuant to regulations that protect consumers: for instance, the company must compensate affected customers for any (actionable) inconvenience caused.

Finally, it is worth highlighting a difference in role between a real warehouse and its virtual equivalent with respect to the company's production inefficiencies. A real warehouse is employed at the end of the production process and performs the function of transferring over time any costs connected to technical inefficiencies. As stated earlier, a real warehouse enables the company to avoid immediately suffering the cost of technical inefficiencies in its production process. By contrast, a virtual warehouse is employed before the production process, fulfilling the function of protecting the company from potentially risky behavior by the customer and/or demand. A virtual warehouse anticipates the production process in an attempt to allow the company to adequately manage its risks.

Case Study

Hotel Vittoria in Milan has approximately 50 rooms with the cost structure as shown in Table 5.1.

Considering an occupancy rate in 2017 of 65%, with 365 days open and an average daily room revenue of € 130:

1. prepare the reclassified profit and loss statement, highlighting the contribution margin, AV, EBITDA, and EBIT
2. supposing an increase in the occupancy rate during 2018 from 65% to 75%, please describe the expected impact of the increase in occupancy rate on the company's profitability

HOTEL VITTORIA - MILAN			Rooms N.	50
COST STRUCTURE			Occupancy Rate per Year	65,00%
			Average Daily Revenue	130,00 €
			Revenue Room	1.542.125,00 €
			Other Revenue	246.740,00 €
			Total revenue	1.788.865,00 €
Electricity rooms	35.000,00 €	1,96%		
Electric energiy common spaces	18.000,00 €	1,01%		
Water	22.000,00 €	1,23%		
Gas	25.000,00 €	1,40%		
Housekeeping Rooms	44.484,38 €	2,49%		
Cleaning common areas	22.000,00 €	1,23%		
Fixed staff	200.000,00 €	11,18%		
Seasonal staff	100.000,00 €	5,59%		
Director	60.000,00 €	3,35%		
Food and Beverage	30.000,00 €	1,68%		
Rent Building	277.582,50 €	15,52%		
Furniture rental	80.000,00 €	4,47%		
Depreciation	120.000,00 €	6,71%		
Other Variable Costs	215.000,00 €	12,02%		
Other Fixed Costs	185.000,00 €	10,34%		
Total Costs	1.434.066,88 €	80,17%		

Table 5.1 Hotel Vittoria, Milan: cost structure

3. please provide arguments concerning point 2
4. assuming that the 110% occupancy rate could increase in 2018, please describe the expected impact on company profitability
5. considering all the data shown in the cost structure table, please quantify (in economic terms) the cost of inefficiency deriving from the hotel's non-full occupancy rate

References

Boardman, A. E., Greenberg, D. H., Vining, A. R., & Weimer, D. L. (2001). *Cost-benefit analysis*. New Jersey: Prentice Hall Inc.

Clark, J. B. (1901). *The control of trust*. New York: Macmillan Co.

Clark, J. M. (1943). *Studies in the economics of overhead costs. Tenth impression*. Chicago: The Chicago University Press.

Cohen, S., & Roussel, J. (2005). *Strategic supply chain management*. New York: McGraw-Hill.

Giannessi, E. (1982). *Il "Kreislauf" tra costi e prezzi*. Milano: Giuffré.

Jevons, W. S. (1871). *The theory of political economy*. New York: Sentry Press.

Menger, C. (1976). *Principles of political economy*. Institute for Humane Studies.

Phillips, R. L. (2005). *Pricing and revenue optimization*. Stanford: Stanford University Press.

Schmalenbach, E. (1956). *Kostenrechnung und Preispolitik*, Auflage berabeitet von Richard Bauer, Kohn und Opladen: Westdeutscher Verlag.

Talluri, K. T., & Van Ryzin, G. J. (2004). *Revenue management*. New York: Springer Science and Business Media Inc.

Walras, L. (1874). *Elements of pure political economy*. Lausanne: Imprimerie L. Corbaz & C. Editeurs.

6

Revenue Management from a Business-Economics Perspective

From Technical Efficiency to an RM System

Profitability is closely linked to technical efficiency. Technical efficiency measures the ability of the company to make the most of its production capacity. As the capacity utilization rate increases—within the maximum production capacity—the company's profitability increases due to a reduction in the incidence of fixed costs.

The importance of the technical efficiency dimension over the years has led to the development of new managerial tools within RM (or yield-management) systems. The importance of RM systems is also linked to the need to integrate accounting information with information that is not explicit in the balance sheet, such as technical inefficiency.

Since the end of the 1970s, RM has represented an innovative phenomenon that has characterized the management of companies operating in the services sector, with particular emphasis—especially in the initial phase—on the airline and the hotel sectors. The main reason RM has developed in service companies and airlines is the lack of stock, and therefore the impossibility of these companies transferring the costs of their technical inefficiency over time.

In the United States, RM techniques were developed by US airlines following deregulation of the sector in the 1970s (via the Airline Deregulation Act), and are currently considered an important tool within strategic management to optimize the exploitation of production capacity and to maximize the revenues related to it (Huyton and Peters 1997; Donaghi and McMahon 1995). The deregulation eliminated government restrictions imposed by the US Civil Aeronautics Board (CAB), with a consequent decrease in control activity by the CAB on prices; this opened the market to greater competition. Prices had been based on pre-established levels of profit, preventing competition between the various players and, above all, reducing market prices below certain thresholds. With deregulation, airlines gained more freedom in establishing both their pricing policies and the differentiation of their services; in addition, the increased competition and consequent price decrease led airlines to seek tools and techniques aimed at maximizing profits.

RM has been described, mainly by the Anglo-Saxon literature, as a methodology or a managerial technique able to support companies in selling "*the right product, to the right customer, at the right time, in the right place and for the right price,*" as represented in Fig. 6.1 (McEvoy 1997: 60).
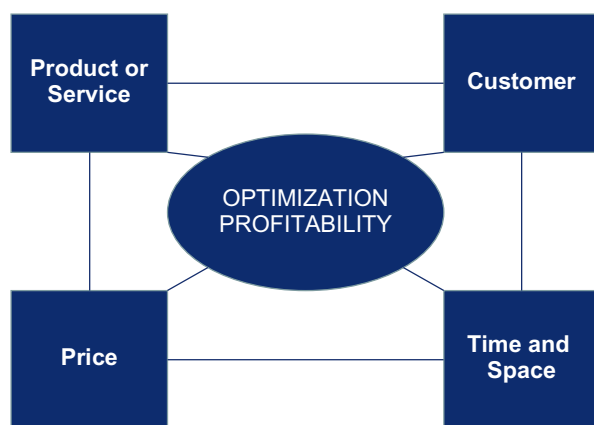
Fig. 6.1 Revenue management systems

RM as a technique and managerial methodology, therefore, correlates the service produced/delivered, the customer, the time of sale (though not necessarily provision of the service), the place, and the price to be paid.

The maximization of yield within companies that operate in services has always been understood as a programming problem centered on the dynamics and the relationship between the marginal revenue derived from the sale of an additional unit of output and the corresponding marginal cost. In other words, the theme of maximization has been analyzed as a problem of price differentiation and of optimization in the decision process.

The spread of RM has changed traditional approaches, focusing on exploiting the maximum production capacity available through the levers of price, time, and differentiation. Progressive RM techniques have extended not only to the airline sector but also to the hotel sector, and, more generally, to all companies providing services. However, the spread of RM has undergone slowdowns over time, especially in the initial phase of its appearance. This has been partly due to its links with the airline sector, which led to the erroneous belief that RM is limited to this sector, and hindered its study, development, and implementation in other production sectors.

Following initial limitations in the diffusion of RM models, these models are now progressing, and are expanding to other production sectors where they have great potential. From airline companies, these models have moved to the hospitality sector and, more recently, to the broader leisure sector and similar sectors, such as health and hospital facilities. The study of RM models related to manufacturing and energy sectors is rarer.

The Definition of RM

RM can be defined in a first approximation as a plurality of strategies based on specific models, which allow companies operating mainly in the services sector, and having limited production capacity, to realize maximum profit through the use of closely interrelated levers: "The RM

systems refer to the strategy and tactics used by a certain number of companies (…) to manage the allocation of their production capacity to different rate classes over time to maximize their profitability" (Phillips 1995: 120). As stated by McEvoy (1997: 60), "Important as revenue management is, it is the bottom line that managers and owners/investors are most interested in."

Owners, like investors, pay great attention to the ability to return the investment made within the company. The return on investment is obviously linked to the measurement of performance deriving from company management and the risk that characterizes the investment itself. The level of risk increases in all sectors characterized by significant fixed costs and high levels of indebtedness. In these sectors, RM provides support for company management to improve management performance. An increase in operating performance with the same risk can mean an improvement in the degree of return on investment in favor of property and investors. This improvement, with the same risk, can attract capital from the financial markets.

In this direction, RM can be defined as "A procedure used to maximize (…) the company profitability through the systematic and continuous manipulation of the indicators used in response to the sequences and reactions of the expected demand (…). The main objective of an RM system is to maximize the rate of production exploitation so as to achieve a profitability target that is as close as possible to the potential target of maximum company profitability" (Emeksiz et al. 2006: 536).

RM consists of a systemic approach aimed at maximizing revenue by differentiating the prices offered to potential customers to achieve productivity levels planned on the basis of the presumed demand. The literature has highlighted that the essence of RM is the sale of an additional unit of output to the "right customer," at the "right moment," and receiving as consideration the "right price." What appears to be complex is the identification of a tool that enables establishment of the "right" or most "equitable" correlation between the following variables: (1) additional unit of output, (2) customer, (3) time, (4) space, and (5) price.

The additional unit of output (or marginal increase) is given by the possibility of using the residual production capacity, and therefore by the

existence of a deviation between production capacity used and maximum production capacity. The customer is the potential buyer of the additional output unit, whose interception by the company depends on the time factor and the price factor. Time is linked to the way in which the output is sold, while price is linked to the company's pricing policies and to the possibility of differentiating the price with the same output offered. The whole model is based on the demand forecasting system and, therefore, on the management-planning and management-control system:

> "The RM is strictly related to the company decision-making process and the RM methodologies and systems are oriented to make efficient said process. This management involves the company in relations with its market in order to maximize company profitability. The RM can be considered as a useful complement to the management of the production chain, which addresses the decisions related to the offer of products/services and business processes with the (typical) objective of reducing production and delivery costs" (Talluri and Van Ryzin 2004: 2).

With regard to these, RM systems are based on two closely related levers:

- Price (dynamic pricing)
- Capacity (capacity allocation)

Price represents the selling price and the corresponding cost for the potential customer. The principle on which use of the price lever is based is that the potential customer must pay the maximum price he/she is willing to pay as a cost to purchase the good/service according to his/her willingness to pay. The company must therefore be able to identify and measure its customers' willingness to pay. The price lever principle recalls studies conducted by Porter (Porter 1985) on the creation of value, and requires the company to understand its potential customers via market segmentation. The knowledge of potential customers is expressed via a determination of the critical variables thereof and, thus, of characteristics on the basis of which customers make judgments of satisfaction/dissatisfaction for the good/service to be purchased. The determination of critical variables is the basis for any policy of differentiation and focus. We

think about the policies carried out by low-cost airlines that are mistakenly imagined founded on price alone, and that are otherwise based on the lever of differentiation and focus on the critical variables of potential customers.

The leisure customer is more sensitive to the price variable, and consequently more willing to bear sacrifices in terms of quality of service if he/she is offered a price reduction; the business customer, on the other hand, is less sensitive to price, but more attentive to other critical variables, such as punctuality and the convenience of flight and related services, including the location of the airport. For companies, use of the price lever requires the preparation of a set of prices that is appropriate for the needs of the various potential customers and the definition of a system of own rules and constraints through which to give certainty to the demand. The price lever must also take into account the economic and financial performance of the company and, therefore, the sustainability of its pricing policies.

Capacity represents the company's ability to manage its offer through the exploitation of its production capacity. The greater the company's ability to schedule/temporally distribute demand through appropriate planning tools, the greater its ability to guarantee purchases and sales, and to manage its capacity—that is, to guide the exploitation of its production capacity by following the driver of the offer. Capacity expresses the greater or lesser rigidity on the part of the company in the management of its production capacity—that is, the response time from the company to changes in demand, which the company can react to provided it has low production rigidity and can intervene with RM levers, or cannot react to if it has a high degree of production rigidity and no control over RM levers.

The link between the price lever and the capacity lever is the customer or the potential customer. In this direction, RM systems enhance value creation, according to a theory put forth by Porter, as a result of which the company creates value if it increases the maximum price that the customer is willing to pay at a given moment and in a certain place to purchase a specific product/service (Porter 1985). The company's ability to increase the maximum price that the customer is willing to pay depends on the customer's satisfaction and the company's compliance with the

propensity to purchase the same customer: in other words, on the customer's willingness to pay.

The subject of willingness to pay is consistent with the economic theory in which the value of an asset depends on the intrinsic characteristics of the asset itself, but also on the time and place in which the client or the potential client is located. There is no absolute value for an asset in economic terms.

> As an example, take a 0.5-liter bottle of mineral water. At a university's vending machine, a bottle of water costs 20 cents. At the university's bar, the same bottle costs 55 cents. At a bar outside the university, the bottle costs € 1. On a low-cost flight, the same bottle of water costs € 3.50. Thus, the same good appears at different places and times for very different prices.

The Principles of RM

Within an RM system, the correlation between potential customer, company production, and price is realized if the company takes into account certain variables. The essence of these variables can be expressed in seven fundamental principles, whose observation guides the implementation process of RM:

1. Determination and analysis of willingness to pay
2. Focus on price instead of cost
3. Value pricing
4. Market segmentation
5. Correlation between products/services and willingness to pay
6. Rationalization in the decision-making process
7. Monitoring of the company's profitability

The determination and analysis of willingness to pay requires a definition of the potential customer to whom the company intends to address its products/services. Very often, companies know their customers

through extensive market research and the use of CRM tools and loyalty, but do not know non-customers.

An example of a tool that is strongly oriented to gathering information from customers is loyalty cards used by large retailers. The loyalty card, in fact, responds to several purposes: the first is customer loyalty, even though the customer (since the card is almost always free) can have multiple loyalty cards and be loyal to multiple companies; the second is knowledge of the customer's personal data, on the basis of which companies can conduct studies, for example, on the location at which sales points are earned; the third purpose is the possibility of "manipulation" of customer consumption through policies of discounting and distribution of points on certain products in place of others; the fourth—which is less visible—is transmitting to the company analytical information on the customer's shopping cart, which allows the company to understand the frequency of purchases, the sum of expenditure, and especially the individual products and brands bought by the customer.

Loyalty cards provide distribution companies with a wealth of information that is of great competitive and strategic value. The company is able to understand the consumption patterns and brands chosen by its customers, which gives the company great contractual power in its relations with suppliers. Indeed, it is precisely in this relationship that the competitive advantage of distribution companies is realized, while it is in the relationship with suppliers that the company produces value in economic terms. This value should at least partly be distributed to the customers who make their information available; indeed, the value distributed by the company to the customers through "gifts" to which they are entitled with the score achieved is small compared to the value achieved or achievable by the company through relations with its suppliers.

The collection of information relating to customers and their consumption responds to the need to anticipate demand compared to competitors, and to try to "manipulate" the consumption propensity of customers. Information systems are, however, unbalanced toward the corporate customer, neglecting the non-corporate customer. To strengthen and maintain competitiveness, the company must try to understand the profile of non-clients and define the potential client toward whom it directs its development policies.

This appears to be even more important in sectors that have seen competition increase in recent years; this competition pushes companies to strive for competitive positioning based on the cost of the product/service or on the quality of the product/service itself. The definition of the potential customer pushes the company to question itself on the critical variables regarding customers, and on the distinctive elements that the product/service must possess in order to meet and satisfy customer demand. The willingness to pay by the potential customer is, in fact, closely related to the quality of the product/service and to the distinctive identities of the same with respect to the products/services of the company's competitors. The focus on price is strictly linked to knowledge of the potential client and measurement of their willingness to pay. Price is the indicator that measures the meeting between the demand function and the offer function.

The demand function and the supply function—if not from a purely theoretical point of view—do not correspond in the market: this requires companies to react to cyclical market trends, especially on the demand side, with the aim of reducing costs through investment policies (which is typically done during periods of growth and expansion of the market), and in order to restructure their production cycles and resources employed (typically in periods of cycles of contraction and reduction of market growth).

Companies tend to pay less attention to the price lever. This happens in companies in which price is considered a mere instrument linked to the sales process or the marketing process, and/or in companies that adhere to the market price—that is, the pricing policies of competitors.

Being able to use price as a lever at the center of the company's reactions to cyclical market trends means that the company knows its potential customers and can correlate this knowledge with flexibility and a tendency to differentiate its product/service. In other words, the company can use the price lever to manage its profitability in reaction to cyclical market trends if it establishes a direct correlation between the differentiation of its product/service and the needs expressed, or not expressed, by the potential customer.

If the company establishes this correlation, price, as an indicator of a balance between the demand function and the offer function, becomes an indication of the company's ability to satisfy the needs of its potential clientele based on differentiation of its product/service; that is, price becomes an indicator of value creation by the company. Use of the price lever is strictly related to this differentiation of the product/service. The focus on the price lever requires the company to also differentiate the control of its production capacity. The price lever, together with the exploitation of production capacity, allows the company to align the demand function with its own supply function.

The focus on price as a replacement for the cost focus should push the company toward pricing policies that are no longer based on production cost, but rather based on so-called value pricing. Value pricing represents, in economic terms, measurement of the value that the customer attributes to the product/service purchased in relation to their degree of satisfaction.

Companies tend to monitor their production costs with their own IT tools and with managerial tools such as analytical accounting, on the basis of which they determine the volumes of activity and the resulting sales prices. While the company's focus on cost-cutting processes is important, as is the implementation of adequate control tools based on the development of analytical accounting, it is equally important that the company pays attention to the value that the potential customer attributes to the product/service, using appropriate tools for monitoring and measuring the creation of value.

Knowledge of the production cost pushes the company to develop pricing policies based on mark-up, that is on the margin that the company applies to the full cost of production in order to determine the sales price while guaranteeing a profit margin. The knowledge and measurement of value that the potential customer assigns to the product/service pushes the company to develop pricing policies based on value pricing, which pertains to the propensity of the potential customer to pay a price that is even higher than the market rate and prices of competitors for that specific product/service.

Similar to what has been said for price focus, value-pricing policies require:

- that price is the main lever of company policies
- that the company knows the potential customer and the critical variables on the basis of which the latter expresses his own needs
- that the company has margins for product/service differentiation, and
- that the company has the opportunity to exploit its unused production capacity

As noted, value pricing can result in prices above the cost, plus a top-up in terms of cost percent deriving from mark-up.

Value pricing can be measured by the company, using the corporate customer as a reference. The use of the value price imposes the measurement of the value as an estimate, that is, referring to the non-customer. The measurement of estimated prices is extremely complex and may require sophisticated management tools. The difficulties in measuring the value price justify price policies focused on production costs.

An example of value pricing policies can be seen by companies operating in the fashion sector. Often, these companies develop two product lines for each type of product: the first is of high quality, and is positioned in the market at a high price and aimed at a narrow range of customers spread all over the world; the second is normally branded using a sportswear name, and is of medium–low quality, characterized by being easily recognizable even to the "naked eye" with its own brand and positioning in the market at a medium–high price. In the first line, the quality–price ratio certainly takes into account the characteristics of the product in terms of research and development, manufacturing techniques, materials used, and marketing. In the second line, the price–quality ratio is unbalanced in favor of price. It is in the second product line that the company succeeds in making the market converge, as it manages to recover the high costs of marketing and to achieve the highest profitability. While the first line is rarely immediately recognizable, the second line is strongly characterized by the company's brand. The price positioning of the second product line in the market is deliberate, and responds to the company's measurement of value creation compared to the potential customer. This also represents product differentiation in relation to the potential customer target and to price.

The principles described so far push the company not only toward greater knowledge of its customers and toward an attempt to get to know its own non-customer, but also toward a segmentation of their own demand. This segmentation of demand translates into the identification of different types of customers within the same market.

The Cannibalization Effect

The opening of the company toward segmentation must gradually replace the undifferentiated, "mass market" attitude with regard to the characteristics of the product/service, commercial policies, and pricing policies. The company must identify its market segments and build pricing policies and/or differentiation policies for each.

Market segmentation can follow demographic parameters or, preferably, psychoattitudinal parameters. The former are more easily accessed by the company, and are less expressive than understanding the customer's willingness to pay. In recent years, academic studies have developed psychoattitudinal parameters with integration processes, and demographic parameters. Combination of these two parameters appears to be the optimal solution for companies.

Customer segmentation is the foundation for measuring the maximum price that the company can charge in each individual segment through its production and marketing policies: the company's objective is to optimize its profit (value extraction) from each segment market through its RM system.

Customer segmentation must avoid the risk of "customer cannibalization." For example, in the automotive market, some car manufacturers that have been traditionally strong in mid-market segments have designed cars for lower segments. This is the case for BMW's production of the 1 Series, or Mercedes' production of the A-Class. Both car manufacturers have tried to intercept a market segment typically represented by younger companies, thereby competing with car manufacturers such as Volkswagen, which has always been present in this segment with the Golf. Indeed, even if the goal of reaching a new type of customer base has been achieved by BMW and Mercedes, it must also be pointed out that a

"cannibalization" effect has occurred within its customer base. That is, those who might have bought the BMW 3 Series might be attracted to the 1 Services by the related standards and lower price, thereby shifting consumption from one segment to another; similarly, for Mercedes, those who would have bought the C-Class might be attracted to the A-Class.

The "cannibalization" effect is a risk that car manufacturers have decided to run, anticipating that the value produced by entry into the new market segment and competing with other car manufacturers will be worthwhile. In any case, it is possible to measure in economic terms the value produced by entry into the new market segment in terms of the acquisition of new customers and the value produced by the cannibalization effect.

Customer segmentation must also take place in order to guarantee that the company has the most room for maneuver between one market segment and another; in other words, segmentation policies can be considered successful if the company manages to move its customers from one segment to the other while still maximizing production capacity and profit. While, on the one hand, the segmentation may appear more effective the greater the separation between each market segment, on the other hand, the possibility for the company to reduce boundaries between the different segments can be a useful tool to overcome the difficulties derived from the cyclical demand trend.

An additional risk for the company is represented by the desire to consider the market segments on the basis of the potential average customer toward whom product/service and pricing choices are addressed. There is no average customer, and it makes no sense to establish an average price for each segment.

Another risk associated with customer segmentation concerns the allocation to each segment of a different willingness to pay and the limited production capacity of the company and consequent limitation of the products/services available. The different propensity to consume within the various segments and the limitation of available resources raise the problem of the temporal distribution of consumption and/or choices in terms of production policies.

Assume, for example, that a company has two market segments, where one has a propensity to consume more than the other. The company must try to achieve maximum profitability from both segments, but also avoid a scenario in which the maximization of one market segment jeopardizes that in the other. The company must also prevent satisfaction of the second segment from being temporally distributed, which would hinder satisfaction of the first segment. This concerns the distribution of consumption over time, but may also concern the distribution of production policies over time.

Market segmentation must, therefore, push the company toward research, through its RM system, to achieve a constant correlation between market segments and willingness to pay, so that the company can succeed in maximizing its profitability in segments with a greater willingness to pay. Such maximization is possible if the company evaluates the willingness to pay of each segment and favors those market segments with a higher rating in term of willingness to pay than those with a lower rating.

RM systems must facilitate the rationalization of decision-making processes through the use of information tools to process information from the elements that make up the systems. Greater rationality of the decision-making process also requires constant monitoring of company profitability and the profitability of each market segment. Monitoring activity is instrumental to using the levers on which the RM system rests, that is, the price of exploiting production capacity to its fullest.

The Implementation of RM Systems

To be effective and comply with the principles of their functions, RM systems must be articulated on three distinct, but closely related, levels (Phillips 1995: 123):

1. RM strategy, aimed at defining customer segments and determining the products/services and specific prices for each segment identified. Consider this with regard to the distinction made in many hotel or transport companies between business customers and leisure customers.

The characteristic differences of the two types of customer have allowed companies to produce/provide services differentiated by characteristics and price.

2. RM tactics, aimed at calculating and updating, constantly or periodically (daily, weekly, monthly), the production/sales capacity—that is, the quantity of products/services that can be produced/sold for a specific segment of customers and at a certain price level over a given time period.

3. Booking control, aimed at establishing in real time, or moment by moment, whether a request or order should be accepted or rejected. In many cases, booking control translates into the mere activity of checking availability.

Customer segmentation pertains to the company's need to differentiate its offer, both by characteristics and by price. For example, in the airline industry, there may be different classes of business customers and different classes of leisure customers. Differentiation of the leisure product with respect to the business product is introduced by including certain restrictions in the purchase of airline tickets, as well as through varying technical construction of the service in terms of customer comfort. The restrictions enable the company to artificially create a difference in the product reserved for business customers. The leisure product has a lower price, but the aforementioned differentiations may include other aspects, such as the sale of tickets at different prices in different countries or regions, the provision of special rates for residents in the islands, further segmentation within the two macro classes (leisure and business), the diversification of booking channels, and the creation of clubs in relation to accumulated miles or the frequency of service use.

Tactical RM requires the definition of resources, products, and price classes. Resources are represented by the units by which the company's production capacity is measured such as flight departures, single-night hotel room availability, or single-day rental car availability. Resources have restrictions: for air travel, the restriction is represented by the number of seats available; for hotels, the restriction is represented by the number of rooms available; and for car rental, the restriction is represented by the number of cars available.

Products are represented by what the potential customer wants to buy. The product can coincide with a resource, but it can also be represented by the "sum" of several resources; consider this with regard to tourism products including flight, hotel, and rental car.

Price classes can be uniquely or univocally associated with individual products. Each price class is a combination of price level and a series of restrictions. Problems related to tactical RM concern the determination of the price class to be opened and the price classes that must be closed for each product in order to maximize the return resulting from the use of a fixed number of resources.

Booking control consists in the activity of constantly monitoring reservations or orders to determine whether they should be accepted or rejected. A common tool among airlines to facilitate the control activity is allotments—that is, the division of production capacity across "groups" (chunks) and the determination of a price class for each group.

Allotment is an easy tool to manage, although it does have some limitations—for example, it is based on a strict distinction of price classes

Consider the case of an aircraft with 100 available seats divided into "groups": 30 places correspond to the "B-Class" price; 45 to the full "M-Class" price; and 25 to the "Y-Class," business price. Two weeks before the departure of the flight the reservation situation is as follows: 25 places for B-Class; 45 seats for M-Class; and 15 seats for Y-Class. The residual production capacity is represented by 5 seats for B-Class and 10 seats for Y-Class.

associated with "groups" across which the production capacity is divided, which allows for the creation of mechanisms to the effect that one customer is required to pay a higher price to compensate for another customer who pays a lower price.

In this example, a customer willing to purchase a Y-Class ticket will not be able to buy the ticket at the price of the lower B-Class. This limitation contrasts with the purpose of RM systems for maximizing revenue or profitability.

To overcome the limitations of allotments, many companies resort to "nesting." Nesting activity aims to avoid the risks of allotment by allowing the sale of the units at the highest price for the same residual production capacity. Nesting aims to avoid cannibalization between price classes—that is, to enable units of lower production capacity to be sold at a lower price instead of units of residual production capacity at a higher price.

In the example, let us assume that the price classes are numbered from 1 to n, from the highest price class down. In this way, class limits can be identified by defining "bi" the reservation limit for class "i," so that:

$$b1 \geq b2 \geq b3 \geq \ldots \geq bn$$

Compliance with this report allows customers, at any time, to access in each class all the units of production capacity available, thereby overcoming the strict limits between one price class and another. Nesting activity can also be analyzed as the level of protection for each "group" of available resources: the level of protection in the "i" class is represented by the total number of available places in that class and in classes with a price higher than that class.

References

Recommended Readings

Belobaba, P. (1987a). *Air travel demand and airline seat inventory control.* Ph.D. dissertation, Flight Transportation Laboratory Report R87-7, Massachusetts Institute of Technology, Cambridge, MA.

Belobaba, P. (1987b). Airline yield management. An overview of seat inventory control. *Transportation Science, 21*(2), 63–73.

Bitram, G. R., & Mondschien, S. V. (1995). An application of yield management to the hotel industry considering multiple day stays. *Operations Research Journal, 43*(3), 427–443.

Cohen, S., & Roussel, J. (2005). *Strategic supply chain management.* New York: McGraw-Hill.

Dolan, R. J., & Simon, H. (1996). *Power pricing: How managing price transforms the bottom line*. New York: Free Press.

Donaghi, K., & McMahon, U. (1995). Managing yield: A marketing perspective. *Journal of Vacation Marketing, 2*(1), 55–62.

Donaghi, K., McMahon, U., & McDowel, D. (1995). Yield management: An overview. *International Journal of Hospitality Management, 14*(2), 139–150.

Emeksiz, M., Gursoy, D., & Icoz, O. (2006). A yield management model for five-star hotels: Computerized and non-computerized implementation. *Hospitality Management, 25*, 536–551.

Huyton, J. R., & Peters, S. D. (1997). Application of yield management to the hotel industry. In I. Yeoman & A. Ingold (Eds.), *Yield management: Strategies for the services industries*. London: Cassell.

Jauncey, J., Mitchell, I., & Slamet, P. (2007). The meaning an management of yield in hotels. *International Journal of Contemporary Hospitality Management, 7*(4), 23–26.

Jones, P., & Hamilton, D. (1992). Yield management: Putting people in the big picture. *The Cornell HRA Quarterly, 33*(1), 88–95.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decisions under risk. *Econometrica, 43*, 263–271.

Kahneman, D., Knetsch, J., & Thaler, R. (1986). Fairness and the assumption of economics. *Journal of Business, 59*(4), S285–300.

Kaplan, R. S., & Cooper, R. (1998). *Cost and effect: Using integrated cost system to drive profitability and performance*. Cambridge, MA: Harvard Business School Press.

Kaplan, R. S., & Norton, D. P. (1996). *The balance scorecard*. Boston, MA: Harvard Business School Press.

Littlewood, K. (2005). Forecasting and control of passenger bookings. *The Journal of Revenue and Pricing Management, 4*(2), 111–123.

Lovelock, C. H. (1984). Strategies for managing demand in capacity constrained service organizations. *Service Industries Journal, 4*(3), 12–30.

McEvoy, B. J. (1997). Integrating operational and financial perspectives using yield management techniques: An add-on matrix model. *International Journal of Contemporary Hospitality Management, 9*(2), 60–65.

Merrifield, R., Calhoun, J., & Stevens, D. (2008). The next revolution in productivity. *Harvard Business Review, 86*(6), 72–80.

Nagle, N. T., & Holden, R. K. (1994). *The strategy and tactics of pricing: A guide to profitable decision making*. Englewood Cliffs: Prentice Hall.

Nielson, G. L., Martin, K. L., & Powers, E. (2008). The secrets to successful strategy execution. *Harvard Business Review*, 61–70.

Pareto, V. (1974). *Manuale di economia politica con una introduzione alla scienza sociale*. Milano: Società Editrice Libraria.

Phillips, R. L. (2005). *Pricing and revenue optimization*. Stanford, CA: Stanford University Press.

Porter, M. E. (1985). *The competitive advantage*. New York: The Free Press.

Porter, M. E. (1996). What is strategy? *Harvard Business Review, 74*, 61–78.

Quinn, J. B. (1980). *Strategies for change: Logical incrementalism*. Homewood, IL: Irwin.

Talluri, K. T., & Van Ryzin, G. J. (2004). *Revenue management*. New York: Springer Science and Business Media Inc.

Talluri, K. T., & Van Ryzin, G. J. (2005). *The theory and practice of revenue management*. International Series in Operations Research & Management Science (Vol. 68). New York: Springer.

Winer, R. S. (1992). A reference price model of brand choice for frequently purchased products. *Journal of Consumer Research*, 250–256.

Yeoman, I. (1996). *A conceptual model of yield management*. Edinburg: Napier University.

Yeoman, I., & McMahon-Beattie, U. (Eds.). (2004). *Revenue management and pricing*. London: Thomson Learning.

Yeoman, I., & Watson, S. (1997). Yield management: A human activity system. *International Journal of Contemporary Hospitality Management, 9*(2), 80–83.

Yeoman, I., Ingold, A., & Kimes, S. E. (1999). Yield management: Editorial introduction. *The Journal of the Operational Research Society, 50*(11), 1083–1084.

7

Revenue Management Systems Based on Dynamic Pricing

Pricing Models

The first of two levers of RM systems is dynamic pricing, which represents the company's ability to sell each unit of a product/service at the maximum price that the potential customer is willing to pay at a specific time and place.

In theory, the dynamism of the price means that each unit of the same product/service cannot be sold at the same price.

In fact, even if two units of the same product/service are sold in the same place, the price can differ because the buyer is different and the time of purchase is different. In short, purchases made by different subjects cannot be contextual. The dynamism of the price makes the customer or potential customer and their willingness to pay central. The degree of dynamism varies between sectors and according to the type of product/service sold.

Prices should be dynamic in all sectors, though the dynamism is typically greater for services or intangible outputs.

To traditional approaches for determining and defining pricing policies must be added a more innovative methodology, strongly oriented to

optimizing company profitability: this methodology is known as pricing and revenue optimization (PRO).

Through PRO, companies' traditional approaches to pricing policies can be transcended, seeking a correlation between the company's decision-making system and its governance: price policies thus become the main lever to guide the company toward maximizing profitability. As Phillips authoritatively stated: "*The price and optimization of profitability through RM systems provide a significant contribution to decision-making processes within the company organization. This means that a company needs to have a clear vision of all the possible positions that prices can assume in the market and the way in which they are determined*" (2005: 26).

The purpose of PRO is to create the right correlation between price and product for each market segment and/or customer and through each distribution channel, thereby maximizing company profitability. This correlation must be maintained over time in response to continuous changes in market conditions.

Make:

X = product/service dimension;
Y = distribution channel size;
Z = market/customer segment size;
Pi = the price of the "i" unit,

then:

$$\mathrm{Pi} = f\left(\mathrm{X,\ Y,\ Z}\right)$$

The three-dimensional PRO is a useful tool for analyzing the different possible combinations between product/service, market/customer segment, and distribution channel, and to measure the degree of price differentiation implemented with company policies.

In theory, a different price level can be set for each possible combination of the three dimensions; in practice, however, not all dimensions can be used to differentiate prices, as some dimensions are not significant. If two of the three dimensions are significant for a company, the PRO problem is represented within a plan; if only one dimension is significant,

the PRO problem is represented within an axis: "*The PRO cube is a useful starting point for a company seeking to understand the magnitude of the pricing challenge that it faces. Enumerating the combinations of products, market segments and channels gives a rough estimate of the total number of prices a company needs to manage*" (Phillips 2005: 27).

PRO models are oriented at the market, continuous analysis of which is required, accompanied by constant adaptation of price levels using IT tools and mathematical methods. To constantly adapt prices, the company must have a streamlined decision-making process.

Prospect Theory

A customer's expectations in terms of willingness to pay can be influenced by prices and company policies. Although a potential customer's behavior can be analyzed and partly simulated using mathematical models, these are based on forecasts and hypotheses that are not always able to objectively represent market reactions. Individual behavior does not always conform to models of economic rationality, as evidenced by the studies in which Simon introduced the concept of bounded rationality.

Most PRO systems seek to measure the behaviors of the market in terms of economic rationality, relying on IT tools and particularly complex mathematical models. In this context, the prospect theory, a complex mathematical model, is worth mentioning. Introduced by Kahneman and Tversky in the late 1970s, the starting point of prospect theory is the mismatch in terms of economic rationality between company decisions and policies, on the one hand, and market reactions and customer behavior, on the other: "*Individuals do not evaluate opportunities based on a precise assessment of expected costs and benefits. Rather they use different shortcuts and rough rules to make a decision. This can lead to the achievement of results that are inconsistent with the idea of economic rationality*" (H. A. Simon 1997).

This lack of correspondence is attributable to the so-called asymmetry between gains and losses: according to prospect theory, the individual does not attribute the same weight and value to a loss and a gain. In terms of experience, a loss has greater weight than a gain, which directly impacts

an individual's perceptions and behavior of the company policies. This asymmetry decisively influences the value attributed to the price by a potential customer: if they perceive the price as a loss, then they will evaluate any increase much more negatively than a discount on the same price.

Prospect theory attaches importance to how potential customers behave in response to the form with which prices and pricing policies are communicated by the company. While not necessarily predicting a potential customer's reaction to company policies and decisions, prospect theory emphasizes the non-economic rationality that often characterizes market reactions to companies' price policies.

Companies are always careful to define price policies that are functional to them, but do not always seek to analyze and predict market reactions, thereby undermining their efforts to maximize profitability.

Given a discount rate of α, the company's benefit in terms of increased sales is $V\alpha$. Supposing a second discount rate of β, with:

$$\beta > \alpha$$

the company has no certainty that:

$$V\beta > V\alpha$$

Above all, there is no correlation between the discount percentage and the benefit in terms of increased sales.

In other words, if:

$$\beta = n * \alpha$$

with n being the correlation coefficient, the company cannot be sure that:

$$V\beta = n * V\alpha$$

In all likelihood, the company is sure of a mismatch, that is:

$$V\beta \neq n * V\alpha$$

Prospect theory introduces, with reference to the potential customer and their spending behavior, the concept of the "reference price," on which all the potential customers' perceptions are based. The reference price plays a key role in the potential customer's decision-making process, becoming the benchmark against which to compare the price charged by the company: exceeding the reference price pushes the potential customer away from purchasing the asset/service, whereas undercutting the reference price pushes them toward purchasing and positively perceiving it. Comparison against the reference price can occur in the spatial dimension in relation to policies adopted by different competing companies and/or in the temporal dimension in relation to the evolution of the same company's policies over time. Spatial and temporal comparisons help to determine potential customers' perceptions and thereby influence their spending behavior. The formation of the reference price for each individual can depend on several variables:

- The potential customer's purchasing power and ability to spend: the greater their spending capacity, the greater the reference price they assign to the product/service.
- The potential customer's level of knowledge of the product/service: the greater this level, the greater their ability to assign a reference price expressing the quality level of the product/service.
- The level of information available to the potential customer on the market, the presence of companies within the market, the distribution channels of the product/service, and past, current, and future prices.
- The degree of accessibility to information for the potential customer.

The reference price concept should not be confused with the potential customer's willingness to pay. The former can help to determine willingness to pay, whereas the latter is considered by some studies to be independent of price trends.

The reference price can coincide with the list price published by the company. However, in many cases, potential customers' access to information and greater awareness drive spending behavior, moving the reference price away from the list price and making the former difficult to determine. The dynamics and variables of the reference price's formation

should be analyzed and studied by companies as a useful competitive lever to guide potential customers toward choosing their product/service. The impact of the reference price on a potential customer's perceptions can significantly influence that individual's consumption, which may shift from one product/service to another or temporally postpone or anticipate the consumption on the same product/service.

Within PRO, prospect theory assumes importance in relation to the influence of the reference price on potential customers' behavior. How potential customers behave in reaction to company pricing policies has been analyzed in various studies and continues to be investigated in practice by many companies (Gourville and Soman 2002: 90).

The "Fairness" Concept

For the company, predicting the behavior of potential customers constitutes the starting point for planning price policies with the aim of maximizing profitability. To this end, the company must base any pricing policy on market reaction forecasts and the expected behavior of potential customers.

Potential customers do not always assume behave rationally or react in line with economic principles and models. In analyzing the non-rational behavior of potential customers, Phillips introduces the fairness concept, understood as the potential customer's perception of whether the purchase price of a given product/service is fair. This perception is closely linked to the above-mentioned variables and the ways in which the company communicates its price policies.

The fairness concept can be divided into two different perceptions of the potential customer regarding the price:

- Perception of the profit obtained by the producer/seller
- Perception of the price other customers are believed to pay

According to the economic literature, potential customers believe it right for the company to derive an economic advantage from selling products/services, but this advantage cannot be unlimited, even when the customer has high willingness to pay.

The potential customer's perception of the selling company's profit is characterized by the conviction of dual entitlement (Kahneman et al. 1986: 289): it is correct for the potential customer to pay the "right" and reasonable price (or fair price) to buy the product/service and for the company to derive a reasonable economic advantage in terms of profit. If the company's economic advantage exceeds a certain limit, the potential customer perceives this to be unfair, which can negatively impact their willingness to pay. This limit is hardly calculable and determinable, and is premised on the generic criterion of reasonableness.

Generally, the potential customer does not positively perceive other potential customers being able to purchase the same product/service at a lower price. The perception of the price paid by other customers is called interpersonal fairness, and it can be attributed to any price differentiation for the same product/service.

Regarding dual entitlement, the focus is mainly on the company's profitability, but it can also involve other economic variables contributing to changes in the potential customer's perception. The potential customer could negatively judge very high expenses as a result of which the company increases prices.

The factors that can positively influence the market/customer acceptance of PRO policies can be:

- Product-based: the differentiation must be linked to a corresponding variation in the product/service. In many cases, content differentiation is achieved by including additional services with the main product/service.
- Openness: the company needs to openly communicate its pricing policies to the market and potential customers.
- Discount and promotion: discount and promotion policies can support the company's pricing innovation.
- Ease of understanding: company policies are more accepted by the market and potential customers when immediately comprehensible.
- Familiarity: most customers are traditionalists and prefer classic ways of doing business and undertaking corporate policies, including the approach to innovation.

In conclusion, "The most successful pricing and revenue optimization trend to the most invisible (…) virtually any pricing innovation will be met with *skepticism (at best). Part of the art of pricing and revenue optimization is knowing when to change in response to consumer resistance and when to preserve*" (Phillips 2005: 320).

Dynamic Pricing Strategies

With reference to different production sectors, dynamic pricing strategies include:

- Markdown strategies (very common among commercial companies)
- Discount pricing strategies (very popular among airlines)
- Consumer-packaged goods promotions

Markdown strategies relate to products/services whose sales/supply cycle has a temporally defined start and end, and involve reducing prices as the end of the sales cycle or season approaches. These strategies help a product company to deplete its inventory and a service company to avoid unsold service units. Markdown strategies are mainly employed by commercial companies in relation to selling products/services subject to (1) decay, (2) high technological innovation, and (3) high seasonality.

These are very widespread policies, despite the difficulty for a company of predicting at the beginning of the sales cycle which products/services will be more widespread on the market. Using these strategies is necessitated by companies' desire to eliminate inventories or unsold units.

Lacking knowledge of which products/services will be more successful on the market, the company tends to determine very high-price levels at the beginning of the sales cycle or the season, guided in any event by expectations of profitability. Over time, the products/services that are less successful on the market have their prices progressively reduced. The reductions can also reach a high incidence compared to the starting price, as the end of the sales cycle or season becomes imminent (Talluri and Van Ryzin 2004: 179).

Price reductions serve to urge the market to purchase the product/ service, and the extent of the reduction depends on what the company deems necessary to drive willingness to pay.

Discount pricing strategies are very common among airlines, particularly the low-cost carriers. As a rule, low-cost airlines offer a single type of non-refundable air ticket with restrictions on changing the date and time of travel. In seeking to maximize their profitability, low-cost airlines increase prices as the flight's departure date approaches: in other words, seats on a given flight are priced lower at the opening of the sales cycle than at the end. In the period between the opening and closing of the flight sales cycle, prices are expected to increase following appropriated dynamics pricing policies.

This increasing trend in the price distinguishes discount pricing strategies from the previous ones, in which the price decreases as the end of the sales cycle approaches. Discount pricing strategies tend to reward early purchasers of the product/service and penalize those who purchase later. As in other cases, the customers first to buy the product/service have the greatest willingness to pay, while those who buy last have lower willingness to pay. The difference under discount pricing strategies is that the company rewards customers with the greatest willingness to pay by increasing prices over time.

Another advantage of discount pricing strategies is allowing the company to reach its breakeven point and to control price increases based on sales and/or bookings/orders/requests. Reaching the breakeven point is particularly useful for management purposes, allowing the company to make decisions on other important policies, such as recruitment and procurement strategies.

Consumer-packaged goods promotions are the most common form of dynamic pricing within sectors characterized by producing consumer goods. These strategies have a particularly complex structure, involving:

- the producer subject
- the seller subject
- the potential customer

The producer can design promotions favorable to the seller without necessarily creating a benefit for the potential customer. Alternatively, the seller can design promotions to benefit the potential customer. In some cases, the producer implements promotions to directly benefit the potential customer.

Various motivations drive promotions. The producer may decide to implement promotion strategies to facilitate disseminating its brand or distributing its products/services. In some cases, promotions can be used to enter certain distribution channels of the company's product/service, or to challenge competitors.

In all cases, promotion strategies pose risks related to:

- the image of the company and/or of its products/services: the potential customer does not recognize in economic terms the value expressed through the price in force in the absence of promotions
- the perceptions of the potential customer: remembering past promotions, they may not be willing to pay the full price to buy the product/service, thus decreasing their willingness to pay

Promotion strategies may involve a trade-off between the short-term advantage of increased sales or bookings/orders/requests and potential medium- to long-term negative repercussions, due to possible effects on the corporate image and potential customers' willingness to pay.

Dynamic Pricing Models

Analyzing dynamic pricing models seems to be particularly complex, despite all the models being based on determining and measuring the variation of the demand function, both individual and aggregated, in response to price variation. Therefore, a model is needed that can describe how demand behaves as price levels change: "*Any dynamic-pricing model requires a model of how demand—either individual or aggregate—responds to changes in price*" (Talluri and Van Ryzin 2004: 182).

In evaluating the reaction of the demand function, it is necessary to consider the dynamics of potential customers' behavior and the condi-

tions and dynamics of the market, focusing particularly on the competitive arena. To identify a model able to express the behavior of the demand function, it is thus necessary to define:

- the level of sophistication of the potential consumer's behavior
- the population of potential customers
- the level of competition in the market

By defining the level of sophistication of the potential customer's behavior, potential customers can be distinguished into two categories: myopic customers and strategic customers.

Myopic customers are those who buy the product/service as soon as the offered price level is lower than the economic value deriving from their willingness to pay, that is, lower than their willingness to pay.

By contrast, strategic customers are those whose behavior aims at optimizing their purchases and consumption according to both the company's pricing strategies and the behavior of its market competitors. Strategic customers may decide not to purchase a certain product/service at time t, where the product/service is offered at a price P (t), in the hope that the price at time tn will be lower. Accordingly, they may decide to postpone their willingness to pay over time while awaiting the following condition:

$$P(tn) < P(t)$$

Models based on strategic customers are more realistic than those based on myopic customers, although the latter, being easier, are more widespread. The greater diffusion of models based on myopic customers is also partly justified by the fact that, in many cases, consumers lack sufficient time and information to adopt behavior strategically aimed at optimizing their consumption and maximizing their usefulness. Due to this lack of time and information asymmetry, most potential customers are myopic, rather than strategic.

In fact, the definition of models based on myopic customers can expose companies to risks such as continuing to offer discounts and/or promotions at the end of the sales cycle or season of a product/service, believing

that demand at this time is more price-sensitive. This overlooks that the greater sensitivity of demand to price may be attributable to the consolidation of a practice in potential customers' behavior, which pushes them to wait for particular moments to realize their purchases. Such customers postpone their consumption pending price reductions, and the company, consequentally, deprives itself of the possibility of maximizing its profitability.

The potential customer population may be limited or infinite. In the first case, dynamic pricing models assume and are based on a certain number of potential customers with a different willingness to pay. When a potential customer buys the product/service, that individual is no longer considered within the population of potential customers, so forecasts for future purchases are determined on the basis of potential customers yet to make any purchases. From an economic perspective, these models realize the so-called durable-goods assumption. By contrast, if the potential customer population is infinite, dynamic pricing models apply the non-durable-goods assumption, keeping customers who make a purchase within the population of potential customers.

The choice of which model to employ is closely linked to the number of potential customers, the number of customers who purchase the product/service, and the type of product/service. Models based on an infinite population are preferable when the population of potential customers is very large and the company's market share is very low: in these cases, the statistical memory of corporate behavior and pricing strategies do not significantly influence potential customers' future behavior, and so may be considered negligible. These models are also preferable when the products/services are widely used. Otherwise, for products/services that are not widely used and/or where the company has a high market share, models based on a limited population of potential customers are preferable.

In fact, the latter tend to push the company toward price-skimming policies, whereby higher prices are charged to the first customers to buy the product/service and lower prices to later purchasers. Price skimming policies achieve customer segmentation based on the price paid to buy the product/service; in the medium- to long-term, this segmentation can negatively impact the company.

The last element to consider here is the level of competition in the market, that is, to what extent the RM system considers the behavior and

reactions of competitors. It is clear that, in addition to variations in the demand function, a company's dynamic pricing strategies also represent the reaction to the competitors.

Many RM systems based on dynamic pricing represent monopoly models, in which the company's demand is supposed to vary according to the company's price, but not the behavior of competing companies. Monopoly models are preferred because they are easier to implement, especially since the company is not required to consider its competitor's historical sales performance. To consider the behavior and possible reactions of competitors, a company needs to find and process information that is not always easily accessible.

Monopoly models are flanked by oligopoly models, in which the reaction of competitors through their pricing strategies is an integral part of the company's RM system. Such RM systems are particularly complex, as the company must also analyze and plan for its competitors' reactions. The difficulty lies in collecting and processing information relating to competitors.

The third model type is those based on perfect competition, in which the individual company has insufficient weight to influence the market price: "Each firm is essentially a price taker—able to sell as much as it wants ate the prevailing market price but unable to sell anything at higher prices" (Talluri and Van Ryzin 2004: 187). It seems clear that if the company lacks the power to change the market price, then price may not constitute a lever for maximizing company profitability: such companies may prefer to implement quantity-based RM systems internally.

Defining the demand function is essential for determining the behavior of the market and the potential customers as the company's pricing strategies change. Dynamic pricing models are particularly complex due to the many variables that must and can be considered in constructing RM systems. Following the scheme presented by Talluri and Van Ryzin (2004), the analysis of RM systems can be articulated by distinguishing:

- single-product dynamic pricing without replenishment
- single-product dynamic pricing with replenishment
- multiproduct, multiresource pricing

In all three cases in practice, the implementation of deterministic and stochastic models is required.

Management Implications of RM Systems Based on Dynamic Pricing

From a management perspective, when dynamic-pricing-based RM systems (whatever the model) are implemented, the aim is to enable business decisions that guarantee maximizing profitability by continuously satisfying the demand function.

Suppose a very simplified situation with a quantity C of available units of product/service and a complete sales cycle t, with t ranging from 1 to n, such that the company can distribute sales across the time interval t1 to tn.

For management, the challenge is to fix the maximum price of the product/service in each instant t to guarantee the purchase of the product/service units. Suppose a decreasing price trend, with P (t1) greater than P (t + 1).

If, at time t1, the price set by the company is P (t1) and the demand D (t1) is lower than C (where C is the quantity available of units), the company must decide whether to leave the price for time t2 unaltered or reduce it to urge consumption. This is a complex decision because the company cannot know the demand at time t2.

In particular, if:

$$P(t2) = P(t1)$$

it is not possible to be sure that at t2

$$D'(t2) = C - D(t1)$$

but it is also not possible to state that if

$$P(t2) < P(t1)$$
$$D(t2) > D'(t2)$$

And finally it is not possible to state that the total profitability of the company will increase:

$$P(t2)*D(t2) > P(t1)*D'(t2)$$

For the company, different situations can be determined as shown in the tree representation in Fig. 7.1.

Figure 7.1 highlights how, at time t1, demand may be greater than or equal to the availability C of product/service units. In this case, the company will sell all the units at time t1, achieving a profit equal to:

$$P(t1)*D(t1) = P(t1)*C$$

Conversely, at time t1, demand may be less than the availability C of product/service units. In this case, the company will achieve a profit of:

$$P(t1)*D(t1)$$
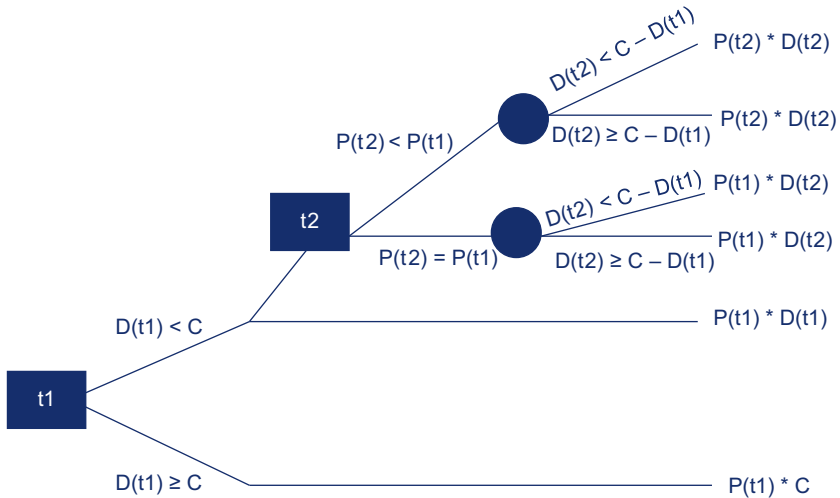
Fig. 7.1   A possible decision-making issue related to dynamic pricing

with a surplus of available product/service units equal to the difference between the initial allocation C and the demand at time t1, that is, C − D (t1).

The company must then decide its pricing strategy for time t2. It may decide to keep the price unchanged at time t2, and find that demand equals the residual availability of product/service units. In this case, at time t2, the company sells all the remaining product/service units, achieving a profit of:

$$P(t1)*C$$

Having not changed the price at time t2, the company may find a demand D (t2) to be lower than the residual availability of product/service units. In this case, at time t2, the company does not sell all the remaining product/service units being able to continue the sales activity in the period t3, and achieving a total profit for t1 and t2 of:

$$P(t1)*D(t1)+P(t1)*D(t2)$$

which can be more simply expressed as:

$$P(t1)*\left[D(t1)+D(t2)\right]$$

Alternatively, the company may decide to reduce the price at time t2, and find demand to be equal to the residual availability of product/service units. In this case, at time t2, the company sells the remaining product/service units, achieving a total profit for t1 and t2 of:

$$P(t1)*D(t1)+P(t2)*D(t2)$$

where:

$$D(t1)+D(t2)=C$$

On reducing the price at time t2, the company may alternatively find demand D (t2) to be lower than the residual availability of product/service units. In this case, at time t2, the company does not sell all the remaining product/service units being able to continue the sales activity in the period t3, and achieving a total profit for t1 and t2 of:

$$P(t1)*D(t1) + P(t2)*D(t2)$$

It is clear that, at the end of period t2, the decision that the company adopted with the support of its RM system was based on maximizing profitability. Therefore, where the company reduces the price for time t2:

$$P(t1)*D(t1) + P(t2)*D(t2) \geq P(t1)*D(t1) + P(t1)*D(t2)$$

This example is based on a simplification of hypotheses: RM systems based on dynamic pricing are much more complex in relation to the many variables that can be considered according to the type of product/service, the market in which the company operates, competitors' behavior, and the behavior of potential customers.

In the example, reference was made to the price reduction strategy with the understanding that, in practice, dynamic prices may rise differently. All companies with a RM system based on dynamic prices aim to ensure maximum profitability at all times.

References

Belobaba, P. (1987a). *Air travel demand and airline seat inventory control.* Ph.D. dissertation, Flight Transportation Laboratory Report R87-7, Massachussets Institute of Technology, Cambridge, MA.

Belobaba, P. (1987b). Airline yield management. An overview of seat inventory control. *Transportation Science, 21*(2), 63–73.

Bitram, G. R., & Mondschien, S. V. (1995). An application of yield management to the hotel industry considering multiple day stays. *Operations Research Journal, 43*(3), 427–443.

Cohen, S., & Roussel, J. (2005). *Strategic supply chain management*. New York: McGraw-Hill.

Dolan, R. J., & Simon, H. (1996). *Power pricing: How managing price transforms the bottom line*. New York: Free Press.

Emeksiz, M., Gursoy, D., & Icoz, O. (2006). A yield management model for five-star hotels: Computerized and non-computerized implementation. *Hospitality Management, 25*, 536–551.

Gourville, J., & Soman, D. (2002). Pricing and the psychology of consumption. *Harvard Business Review, 80*, 90–96.

Jauncey, J., Mitchell, I., & Slamet, P. (2007). The meaning an management of yield in hotels. *International Journal of Contemporary Hospitality Management, 7*(4), 23–26.

Jones, P., & Hamilton, D. (1992). Yield management: Putting people in the big picture. *The Cornell HRA Quarterly, 33*(1), 88–95.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decisions under risk. *Econometrica, 43*, 263–271.

Kahneman, D., Knetsch, J., & Thaler, R. (1986). Fairness and the assumption of economics. *Journal of Business, 59*(4), S285–S300.

Kaplan, R. S., & Cooper, R. (1998). *Cost and effect: Using integrated cost system to drive profitability and performance*. Cambridge, MA: Harvard Business School Press.

Kaplan, R. S., & Norton, D. P. (1996). *The balance scorecard*. Boston, MA: Harvard Business School Press.

Littlewood, K. (2005). Forecasting and control of passenger bookings. *The Journal of Revenue and Pricing Management, 4*(2), 111–123.

Lovelock, C. H. (1984). Strategies for managing demand in capacity constrained service organizations. *Service Industries Journal, 4*(3), 12–30.

Merrifield, R., Calhoun, J., & Stevens, D. (2008). The next revolution in productivity. *Harvard Business Review, 86*(6), 72–80.

Nagle, N. T., & Holden, R. K. (1994). *The strategy and tactics of pricing: A guide to profitable decision making*. Englewood Cliffs: Prentice Hall.

Nielson, G. L, Martin, K. L., & Powers, E. (2008). The secrets to successful strategy execution. *Harvard Business Review*, 61–70.

Pareto, V. (1974). *Manuale di economia politica con una introduzione alla scienza sociale*. Milano: Società Editrice Libraria.

Phillips, R. L. (2005). *Pricing and revenue optimization*. Stanford, CA: Stanford University Press.

Porter, M. E. (1996). What is strategy? *Harvard Business Review, 74*, 61–78.

Quinn, J. B. (1980). *Strategies for change: Logical incrementalism.* Homewood, IL: Irwin.

Simon, H. A. (1997). *A study of decision-making processes in administrative organizations* (4th ed.). UK: Simon & Schuster.

Talluri, K. T., & Van Ryzin, G. J. (2004). *Revenue management.* New York: Springer Science and Business Media Inc.

Talluri, K. T., & Van Ryzin, G. J. (2005). *The theory and practice of revenue management.* International Series in Operations Research & Management Science (Vol. 68). New York: Springer.

Winer, R. S. (1992). A reference price model of brand choice for frequently purchased products. *Journal of Consumer Research*, 250–256.

Yeoman, I. (1996). *A conceptual model of yield management.* Edimburg: Napier University.

Yeoman, I., & Mcmahon-Beattie, U. (Eds.). (2004). *Revenue management and pricing.* London: Thomson Learning.

Yeoman, I., & Watson, S. (1997). Yield management: A human activity system. *International Journal of Contemporary Hospitality Management, 9*(2), 80–83.

Yeoman, I., Ingold, A., & Kimes, S. E. (1999). Yield management: Editorial introduction. *The Journal of the Operational Research Society, 50*(11), 1083–1084. https://doi.org/10.1057/palgrave.jors.2600855

8

Revenue Management Systems Based on Capacity Allocation

Capacity Allocation

The second of two levers of RM systems is represented by the capacity allocation, which indicates the company's ability to optimally distribute demand among the different classes of a product/service it provides. Capacity allocation is, therefore, only relevant to companies that produce/sell more than one type or class of a good/service. Typical examples include traditional airlines, hotels, and theaters. Through optimal allocation of its maximum available production capacity, the company can maximize its profitability.

To better understand capacity allocation, consider the case of high-speed train travel in Italy. Suppose you want to buy a Frecciarossa 500 train ticket from Florence to Milan for a certain day. Visiting the Trenitalia website, the search engine offers various travel solutions, as shown in Fig. 8.1, which presents the six different ticket types that can be purchased for the 12:00 Florence–Milan train, each representing a different service class: (1) Standard, (2) Premium, (3) Business Salottino (Business comfort area), (4) Business Area Silenzio (Business silence area), (5) Business, and (6) Executive.

Offer	Standard	Premium	Business Salottino	Business Area Silence	Business	Executive
Base	56,00 €	67,00 €	107,00 €	77,00 €	77,00 €	144,00 €
Economy	39,00 €	52,90 €	87,90 €	62,90 €	57,90 €	117,90 €
Super Economy	29,90 €	37,90 €	77,90 €	39,90 €	34,90 €	95,90 €
Carta Freccia Special	28,00 €	33,50 €		38,50 €	38,50 €	
Senior (Over 60 years old)	28,00 €	33,50 €		38,50 €	38,50 €	
Young (Up to 30 years old)	28,00 €	33,50 €		38,50 €	38,50 €	

Fig. 8.1 Ticket options for Frecciarossa 500 high-speed train from Florence to Milan

The different service classes qualitatively differentiate the same service offering, so as to justify the difference in price associated with each class. Standard class offers only a seat, without any additional services. Premium class offers more comfort (leather armchair) and some additional services: the morning newspaper and a drink and snack during the trip. Business comfort area and Business silence area offer a more comfortable chair of greater dimensions, more legroom, a daily newspaper in the morning, and a drink and snack during the journey. Business class offers an even more comfortable armchair inside a compartment with only four seats, again complemented by a daily newspaper, drink, and snack. Finally, Executive class offers well-spaced armchairs and a waiter service available throughout the trip, providing the passenger with hot and freshly prepared drinks and snacks on demand.

The Frecciarossa 500 train is formed of one executive coach, four business coaches with two comfort areas with 4 seats each and a silence area with a limited number of seats, one premium coach, and five standard coaches. In total, it has 574 available seats divided among these classes.

Theoretically, profitability is maximized by first assigning the most expensive seats and then allocating the cheaper ones. In practice, this is not possible since the company cannot know how demand will manifest over time, and whether executive or standard seats will typically be booked earlier. Indeed, the manifestation of demand is free and random.

What is certain is that, to maximize profitability, the company must ensure every seat is filled, thus exploiting the maximum production

capacity of 574 available seats, and that each ticket is sold at the base price indicated in Fig. 8.1. From this, it is easy to understand that the company wants to sell as many tickets as possible at the maximum price. Where some seats go unsold, profitability is determined by the combination of seats sold in each class.

Reading Fig. 8.1 vertically shows that seats on the train can be available at different price rates. When the fare changes, the services available to the customer and the restrictions applied by the company change. The base rate gives the customer freedom to change the route, date, and time at any point prior to the booked journey, or alternatively receive a full refund. The economy fare does not allow the ticket to be reimbursed and only allows to change the travel time but only before the train departure and paying a fare difference. Finally, the super economy rate does not allow any changes after booking. These three rates are the means through which the company can use price to try to orientate or manipulate demand for each type of ticket.

Besides the basic, economy, and super economy rates, the company offers three further tariffs representing promotions or specific price policies for only certain customer categories: holders of the arrow card, those aged 60 and over, and those aged 30 and less. Disregarding these three specific tariffs, in seeking to achieve maximum production capacity at the maximum price, the company must intelligently manage the different rates it offers for the different ticket classes.

In total, the company offers three possible fares for each ticket class, forming 18 possible combinations. Clearly, the company cannot open all tariffs at the same time. While the base rate must always be available, the economy and super economy tariffs need to give flexibility to the system to enable the company to direct and manipulate demand. To better understand the functionality of the price lever, consider Fig. 8.2.

Figure 8.2 depicts an inefficient situation. For instance, an economy-rate Business class ticket is cheaper than a base-rate Premium class ticket and slightly more expensive than a base-rate Standard class ticket; a super economy-rate Business class ticket is the same price as the Premium class economy fare and lower than the Standard class basic fare.

From Florence (12.00) to Milan (13.40)						
Offer	Standard	Premium	Business Salottino	Business Area Silence	Business	Executive
Base	56,00 €	67,00 €		77,00 €	77,00 €	144,00 €
Economy	39,00 €	52,90 €		62,90 €	57,90 €	117,90 €
Super Economy	35,90 €			57,90 €	52,90 €	95,90 €

Fig. 8.2 Use of price to manage capacity allocation

Some customers will not want to purchase an economy or super economy ticket so as to avoid the associated restrictions. However, customers who are less attentive and/or sensitive to restrictions will shift from buying a base-rate ticket in Standard class or an economy ticket in Premium class, instead purchasing at the super-economy rate in Business class. The obviously resulting impact on company profitability can be measured by the difference in tariff, but also depends on the company's ability to achieve maximum production capacity.

To avoid cannibalization between the different ticket classes, the company must manage the availability of the different rates (economy and super economy) considering two variables: (1) the time between ticket purchase and the train's departure, and (2) available production capacity. From a rational perspective, as the departure date and time approaches and the number of available seats falls, prices should increase. In this case, while Trenitalia cannot follow the approach of airlines by increasing prices, it can close the economy and super economy rates. Figure 8.2 also shows that Executive class is best protected by the company, by ensuring none of its price rates are lower than the base-rates of the other travel classes.

What has been described to this point demonstrates how capacity allocation is closely linked to company profitability and how its management must be integrated with pricing policies.

In quantity-based RM systems, the main lever for optimizing company profitability is the exploitation of production capacity through optimally distributing residual units of output among the different types of customers (segments) and/or different price classes.

The search for optimal distribution (efficiency) of the available or remaining production capacity is called capacity allocation: "Capacity allocation is the problem of determining how many seats (or hotel rooms or rental cars) to allow low-fare customers to book when there is the possibility of future high-fare demand" (Phillips 2005: 149).

Case Study

A supermarket chain has asked the University of Milano-Bicocca to carry out a feasibility study on constructing a greenhouse on the roof of a point of sale, in which certain fruit and vegetables would be cultivated.

The total usable area is 1900 m^2, comprising an NFT area of 400 m^2, a MAREA area of 1000 m^2, and a POD area of 500 m^2.

Each macro area is then further subdivided into SLOTs. The division into macro areas and then into SLOTs assumes importance in the revenue model as regards allocating production capacity (i.e., capacity allocation). This is because the productions have different productivity in terms of yield, produce outputs with different market prices, and have heterogeneous production cycles. Each production (n) must therefore be analyzed along three closely related dimensions:

- Cp (n)—production cycle (annual basis)
- Ra (n)—yield per square meter (based on its dedicated SLOT)
- P (n)—output market price, supplemented by an eventual and variable surcharge due to the "zero meter" model

Assuming the surface area distribution shown in Table 8.1, it is easy to understand how a change in this distribution directly impacts the overall profitability of the greenhouse.

In terms of capacity allocation, it is evident that the surface area distribution—at least between the three macro areas—is rigid and not dynamic in the short term. The important point to recognize is that differently distributing the available area between the three macro areas would directly impact the project's profitability and, therefore, on its sustainability over time.

Table 8.1 Total surface area distribution of the greenhouse

	Macro AREA/Produzione								
	NFT			MAREA			POD		
n	Mq	Ra	Cp	Mq	Ra	Cp	Mq	Ra	Cp
1	100	2.5	1	250	1.25	1	300	2.9	3
2	50	2.2	1	250	2	1	100	2.9	3
3	50	1	1.5	250	1.8	1	100	1.2	3
4	50	0.9	1.5	250	2	1	0	0	0
5	150	1	0.5	0	0	0	0	0	0

Considering the limited available data regarding the different typologies of production, company profitability may change according to two conditions:

1. the distribution of the total area across the three macro areas
2. the distribution of the total area across the three macro areas and the SLOTs inside each of them

Capacity Allocation and Optimization

Optimizing the exploitation of production capacity assumes importance for companies that can produce different or differentiated outputs corresponding to different price classes. The available business production capacity is divided into organized units or resources, with units of available production capacity assigned to different classes or price levels.

To optimize production capacity, the company needs to establish how many units of available production capacity can be produced/sold at a certain price, conscious of a potential future demand for units of residual production capacity that can be sold at a higher price. In other words, a company must evaluate whether to sell a unit of available production capacity at a given price or await the possible future sale of a unit of residual production capacity at a higher price.

Which option is preferable depends on many variables, including (1) the information available to company management at the time of the

decision, particularly as regards the forecast future demand, (2) the time available to company management, both to make the decision and to determine the dynamic reactions in demand, and (3) the managerial tools (including technological) available to company management.

In general, the guiding principle is that units of available production capacity should be assigned to the customer only when the benefit they generate for the company exceeds the value of the units of capacity needed to satisfy the demand.

A core factor is, therefore, the opportunity cost (displacement cost), represented by the difference between the benefit deriving from allocating, at a given moment, a resource (unit of residual production capacity) to a determined price and the potential future benefits deriving from allocating the same resource unit to a higher price. The first allocation is certain and defined in the quantity and in the value that determines, while the second is potential, and the price (value) that can determine is not defined (Boardman et al. 2001).

The opportunity cost can be represented by an f function that correlates the expected optimal revenue based on the residual production capacity x.

Making Co the opportunity cost:

$$Co = f\left[V(x) - V(x-1)\right]$$

The logic underlying the opportunity cost is simpler than the methods based on capacity allocation, since residual production capacity is allocated only if the revenue (R) is not lower than the value of the capacity required to obtain it:

$$R \geq V(x) - V(x-1)$$

Consequently, the value of residual production capacity should be related to its expected opportunity cost, understood as the expected loss of future revenues resulting from devoting reserve capacity to instantaneous, rather than future, use.

In this direction, calculating the opportunity cost (displacement cost) and comparing between the revenue R and the opportunity cost Co are useful tools to support decision making on whether to accept or reject a purchase or booking request.

It is clear from this that the optimal situation for the company occurs when:

- It does not practice price differentiation for classes
- It allocates available production capacity resources at the highest price

In the first case, the problem of capacity allocation does not arise; in the second case, the opportunity cost is zero. In both cases, it is assumed that the company's residual production capacity is subdivided into n classes that require the same resource. The capacity allocation issues can be analyzed in different contexts with two or more classes.

Capacity Allocation Control Mechanisms

The control mechanisms are based on advanced technological tools, through which the processes of booking/ordering/receiving the purchase request are also managed. For instance, for manufacturing companies, it is assumed that production planning systems are based on demand fore-casting. These mechanisms support company management decision making on the opportunity of accepting or rejecting a customer's purchase request.

The main control mechanisms are:

- Reservation/ordering/production scheduling limits
- Levels of protection
- Bid prices

Reservation/ordering/scheduling limits involve allocating a certain capacity to each class of production capacity unit. Once the designated capacity has been reached for a particular class, no further requests and

orders are accepted for that class. Booking/ordering limits serve to protect the other classes of units with respect to future demand flows.

Limits for reservation/ordering/scheduling can be partitioned (fixed levels) or nested (variable levels). In the first case, residual production capacity is divided into blocks called separate buckets that correspond to different classes. The allocation of residual production capacity units to each block and the correlation with the different classes is rigid, precluding any transfer from one class to another. This can prevent the optimization of profitability, since the company cannot transfer units of residual production capacity to a class with a higher associated price. In the second case (nested limits), the division of residual production capacity into separate blocks is non-rigid, allowing available units to be allocated to classes with a higher associated price. This ensures the company is free to allocate production capacity units to the highest price class and then go down to the lower-priced classes. The available production capacity is distributed hierarchically among the different classes so as to ensure that the classes with higher price levels include all the productive capacity reserved for the classes with lower price levels.

In certain company categories, the booking/ordering/scheduling limits of the partitioned production are also known as allotments. Allotments are an ineffective and inefficient method of assigning production capacity due to their characteristically static nature: allowing the refusal of a reservation/order for or the non-production of a certain high-priced product/service in favor of accepting a reservation/order for or the processing of a lower-priced product/service. By contrast, nested logic allows for optimal allocation of available production capacity, as units associated with the lowest and unsold rates can be sold at higher rates.

Protection levels determine the amount of production capacity to be protected (reserved) for a particular class or series of classes. They can also be partitioned (fixed) or nested (variable). Partitioned security levels are practically equivalent, in their effects, to the reservation/ordering/scheduling limits of partitioned production. Nested security levels hierarchically combine a series of classes: for example, if the residual production capacity amounts to 30 units, these can be distributed according to a system of nested protection levels:

- 18 units for class 1
- 25 units for class 2
- 30 units for class 3

where, following the value:

$$\text{class}\,1 \geq \text{class}\,2 \geq \text{class}\,3$$

Assuming that X1, …, Xn are the units allocated to the hierarchically numbered classes, the protection level PL represents the amount of capacity to be reserved for classes i, i − 1, …, 1, that is, to the major or equal classes to:

$$PLi = \Sigma Xj$$

where:

j ranges from 1 to i − 1
for i > 1
Xj is the number of units attributed to class j.

If i = 1, then PLi = 0, since:

$$0 = PL1 \leq PL2 \leq \ldots \leq PLn \leq C$$

The reservation/ordering/scheduling limits of production and the nested (variable) protection levels can be based on two different approaches: "standard versus" and "theft nesting."

With the standard versus approach, given a certain production capacity (in terms of units) at the time of receiving a reservation/order/purchase request concerning a certain class, the level of protection for the future application of the that class is reduced.

Assume a level of protection for class 1 of y1 = 12. If one or more requests for class 1 equal to five units are received, it can be deduced that future demand for class 1 will be seven units; therefore, the system proceeds to reduce the level of future protection of class 1 to seven units for

future application. The standard versus approach involves continuously updating the level of protection in response to requests received. The limitation of this approach is that protection levels are updated following requests received, rather than the dynamics of demand.

By contrast, with theft nesting, there is no reduction in the level of protection of class 1: in the example, the initial protection level of 12 units is maintained. This is possible because units from other classes are "stolen" to protect classes with a higher price level. This approach more effectively guarantees maximizing company profitability by preserving initial levels of protection.

The two approaches have the same effect on business management and company profitability if demand is distributed among the different classes chronologically, starting from the lowest classes in favor of the highest classes in terms of price. However, they produce very different results when demand—that is, the flow of bookings/orders/purchase requests—does not proceed chronologically from the lowest price classes to the highest price classes (Talluri and Van Ryzin 2004: 31). It appears evident that the second scenario is far more common in practice; therefore, theft nesting is far preferable to the standard versus approach.

In some types of companies, management tries to "drive" purchase requests by offering favorable prices to customers who book or submit requests first, aiming to facilitate the optimal allocation of residual production capacity.

Bid prices are control mechanisms based on revenue, rather than price classes. With this mechanism, we define price threshold levels through which the company decides whether to accept or refuse a booking/order/purchase request: it will be accepted if it exceeds the threshold price level, and rejected otherwise. Threshold levels may change over time depending on the performance of different variables. This mechanism is particularly recommended when products/services with different prices are within the same class. This is a seemingly simple mechanism, but it poses the complex challenge of determining the criteria for changing bid prices dynamically over time.

Capacity Allocation with Two Classes

The optimal distribution of residual production capacity can be explored by considering a company that has segmented its customers into two classes. Assume the following classes and respective prices (P):

Class 1, with P1 > 0
Class 2, with P2 > 0

Assume further that:

$$P2 > P1$$

Thus, the price in each class (respectively P1 and P2) is greater than 0, and the price of class 2 is higher than that of class 1.

The model also assumes that customers who buy the product/service at the lower price (P1) will make their purchase/booking/order requests before customers who buy at the higher price (P2). It is a static model with a given production capacity. The question that the company management must ask is the quantity of customers for the class 1 needed to maximize the company's profitability. This question may be made regarding the reservation/order/purchase limit of class 1 or, in the same way, with regard to the level of protection to be determined for class 2.

It is clear that, with two classes, the level of protection y for the higher price-level class (2) is equal to the difference between the capacity C and the reservation/order/purchase request limit b of the lower price-level class (1):

$$y = C - b$$

The traditional approach to the problem of capacity allocation with two classes of product/service assumes there are no additional costs (incremental costs) and ancillary contributions (subsidy or additional contributions) (Phillips 2005).

A similar problem—albeit with a much more complex solution—confronts manufacturing companies in planning the production of two product classes with different corresponding price levels. In US literature,
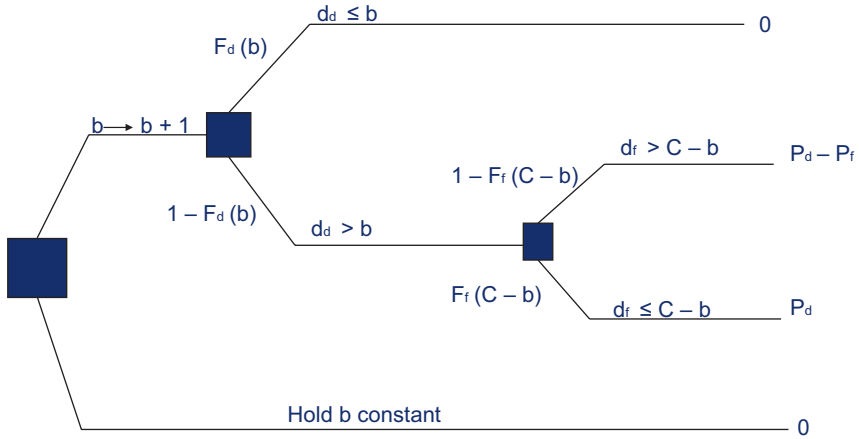
Fig. 8.3 Decision tree for allocating capacity between two classes

the problem of optimally distributing residual production capacity between two classes has been schematically represented with a tree diagram of the decision process, as depicted in Fig. 8.3 (Phillips 2005: 150).

Figure 8.3 schematically represents the trade-off in decision making with two product/service classes.

C represents the production capacity;

$F_f(x)$ represents the probability that demand for the higher-priced class is less than or equal to a given value x;

$F_d(x)$ represents the probability that demand for the lower-priced class is less than or equal to a given value x;

b represents the reservation/order/request limit for the product/service of the lower-priced class;

$C - b$ represents the protection level for the product/service of the higher-priced class.

The decision-making process focuses on increasing b by one unit or reducing $C - b$ by one unit. In the first formulation, the question is whether to increase the reservation/order/request limit of a unit from b to b + 1:

$$b \rightarrow b + 1$$

If demand for the lower-priced class (dd) is less than or equal to b, no effects on expected profitability are expected, since the limits placed on reservations/orders/requests are assumed to be nested. Thus, the effect of increasing the limit of a unit produces an effect equal to zero, as reported in Fig. 8.3.

Conversely, if the demand for the lower-priced class (dd) is greater than b, then the profitability result from increasing the output availability of that class by one unit is closely related to the behavior of demand for the highest-priced class:

- If demand for the higher-priced class (df) is greater than the difference between the residual production capacity C and the reservation/order/request limit b (i.e., greater than the protection level), the additional unit allocated to the lower-priced class replaces a higher-priced product/service unit, thereby negatively impacting company profitability. The impact on profitability is measured by the difference $Pd - Pf < 0$, that is, the difference between the prices corresponding to each class.
- If demand for the higher-priced class (df) is less than or equal to the difference between the residual production capacity C and the reservation/order/request limit b (i.e., less than or equal to the protection level), the additional unit assigned to the lower-priced class does not replace a higher-priced product/service unit, thus positively impacting company profitability. The impact on profitability is measured by the price relative to the additional unit of Pd output.

The risk to the company in a two-class case concerns the level of limits on bookings/orders/purchase requests. If this level is too low, the company may be unable to accept orders for the lower-priced class due to insufficient capacity and cannot be certain of receiving sufficient requests for the higher-priced product/service, meaning that its production capacity is not fully employed. This risk, which is particularly relevant to airlines, is called spoilage. By contrast, if the level of the limit is set too high, the company may not receive requests due to lack of capacity by customers who want to purchase the higher-priced product/service. This risk, which is also particularly relevant to airlines, is called dilution.

In the last branch of the decision-making tree diagram (Fig. 8.3), the request limit remains constant, with no effect on company profitability.

The model described recalls studies conducted at the beginning of the 1970s by Kenneth Littlewood, an analyst of the British Overseas Airways Company (predecessor of British Airways) until 1977. Littlewood's notable contribution was to develop RM in the aviation industry by applying mathematical models based on the specific study of individual flights, rather than revenue maximization research.

Littlewood's Rule

Littlewood attempted to determine, through mathematical models, the optimal b* level of the reservation/order/purchase request limit for the lower-priced product/service class. His rule is expressed by the following algorithm:

$$1 - Ff\left(C - b^*\right) = Pd/Pf$$

Considering the optimal level of protection for the higher-priced class y*, where:

$$y^* = C - b^*$$

the algorithm can be written as:

$$1 - Ff\left(y^*\right) = Pd/Pf$$

where $1 - Ff(y^*)$ is the probability that the demand for the higher-priced class product/service exceeds its corresponding level of protection. This probability decreases as the level of protection increases, with a consequent decrease in booking/ordering/request limits, and increases as the level of protection decreases.

Littlewood's rule bases the solution to maximizing expected profitability on the probability that the demand for the highest-priced product/service exceeds the level of protection for that class. This probability is equal to the ratio between the two classes' respective price levels.

Following Littlewood's rule, make the two classes and their respective prices:

Class 1—Price Pd
Class 2—Price Pf

where:

$$Pd \leq Pf$$

The interval in which the analysis is carried out is marked by the following two extremes:

Pd = 0 (lower extreme)
Pd = Pf (upper extreme)

At the lower end of the interval, if the price level of Class 1 is zero (Pd = 0), then following Littlewood's rule, it is possible to fix a high level of protection for the Class 2 product/service, since the probability that the corresponding demand is higher than the level of protection is null. From this, it follows that the optimal level for the reservation/order/request limit for the Class 1 product/service is zero. This follows logically from setting the price level of that class to zero: if the customer of Class 1 does not pay, the company has no interest in making seats or product/service units available; all residual production capacity C should be made available for customers willing to pay the higher price for Class 2.

As the price level of Class 1 Pd increases, the optimal level of protection for Class 2 decreases, since it increases the probability that the corresponding demand exceeds the level of protection. In other words, by increasing the price of Class 1, the likelihood that demand for Class 2 exceeds the protection limit set by the company increases. The company, therefore, should increase the booking/ordering/request limits for Class 1 and decrease the protection level for Class 2.

At the upper end of the interval—that is, when the two price levels are equal (Pd = Pf)—the optimal level of the reservation/order/request limit for Class 1 is equal to the entire production capacity C, and the level of protection for Class 2 is equal to zero. This appears intuitive: since the two classes have the same price level, allocating residual units of production capacity C between the two classes is the same for the company. This means that there is no benefit from applying a level of protection to the upper class.

As the price of the lower class increases, the level of protection of the upper class decreases, thus increasing the likelihood that demand for the upper-class product/service will exceed the corresponding level of protection. By thus increasing this probability, the company should increase the booking/ordering/request limits for the lower class, which leads to a reduction in the level of protection for the upper class.

Again using the Littlewood's rule, the optimal level of protection for Class 2 y^* is, therefore:

$$y^* = \min\left[Ff^{-1}(1 - Pd/Pf), C \right]$$

The following steps lead to determining the optimal level of protection y^* following Littlewood's rule. From the starting point:

$$1 - Ff(y^*) = Pd/Pf$$

Moving from one member to another:

$$Ff(y^*) = 1 - Pd/Pf$$

from which:

$$y^* = Ff^{-1}(1 - Pd/Pf)$$

where Ff (y) is the probability that demand for Class 2 is less than or equal to the level of protection y. This function is almost always increasing with respect to the level of protection y. To extract the

optimal protection level y*, the inverse function is used, which leads to the final version of the optimal level of protection for the higher-priced class.

At the point where:

$$y* = Ff^{-1}\left(1 - Pd/Pf\right)$$

the risk of over-protecting the residual production capacity in favor of potential customers for Class 1 and the risk of under-protecting the same are balanced.

What distinguishes Littlewood's model is that the optimal level of protection does not depend in any way on the demand forecasts for the lower-priced class. The distribution of demand for the lower-priced class Fd (Dd) does not appear in the aforementioned equation.

Furthermore, the optimal level of protection does not depend on the production capacity. Rather, it depends only on the expected demand distribution for the upper class and the two price levels:

> "*Littlewood's rule determines the optimal discount booking limit in the case when discount demand books before full-fare demand. The optimal booking limit depends only on the forecast of full-fare demand, the (…) capacity, and the fare ratio. It is not affected by the forecast of discount demand. However, the forecast of discount demand has a big impact on the sensitivity of expected revenue to the booking limit. When the forecast of discount demand is low, expected revenue is usually not very sensitive to the booking limit, within reasonable ranges. But when the forecast of discount demand is high, expected revenue becomes very sensitive to the booking limit. The lesson is that it is most critical to calculate precise booking limits when we forecast high levels of discount demand*" (Phillips 2005: 155).

Littlewood's rule allows the optimal limit for bookings/orders/purchase requests to be defined and the balance between the spoilage risk and dilution risk to be achieved. Spoilage occurs when the reservation limit for the lower-priced class is too low and the company refuses some bookings/orders/requests for that class in anticipation of potential future sales at a higher price. Where this future sale does not materialize, the

company fails to sell a unit; for companies operating in sectors with no warehouse or in which the offering is perishable, this results in lost revenue. Dilution occurs when the reservation/order/request limit for the lower-priced class is too high and the company accepts numerous bookings/orders/requests at the lower price, resulting in its inability to accept other bookings/orders/requests from customers willing to pay the higher price. Here, the company's revenue is lower than its full potential, as measured using the difference between the lower-class and upper-class price levels.

Littlewood's rule recalls what was, in 1888, called the "newsvendor problem" (Edgeworth 1888): establishing the amount of input to purchase based on forecasting demand. The problem's name recalls the case of a newspaper vendor who must, in the evening, quantify the number of copies to be purchased for the next day based on his forecast for demand: if he buys too many copies, compared to the actual demand, he will bear a cost equal to the number of unsold copies; conversely, if he buys fewer copies than the actual demand, he will sustain a cost represented by the loss of revenue from unsold copies. The cost sustained by purchasing more than the actual demand is termed the overage cost; the cost sustained by purchasing less than the actual demand is termed the underage cost. In the case of the newspaper seller, if the cost of buying one copy is 20 cents and the selling price of the same is 25 cents, the overage cost is 20 cents for each unsold copy, while the underage cost is 5 cents for each lost sale.

Make:

O = overage cost
U = underage cost
F (y) the distribution of demand

The optimal quantity for the company to buy is that at which:

$$F(y) = \frac{U}{U+O}$$

In the aforementioned example, if a newspaper copy costs 20 cents and the sale price is 25 cents, the amount of newspapers that the newsvendor must buy will correspond to the lower value of y, where:

$$F(y) \geq 5/(20+5)$$
$$F(y) \geq 0.2$$

Littlewood's rule seeks to solve the same problem of the newsvendor through the optimal protection level, which risks protecting an excessive or insufficient amount of a given output with respect to the potential demand function. In Littlewood's rule, the overage cost is represented by the lower-class price, O = Pd, while the underage cost deriving from selling one product/service unit at a lower price instead of one product/service unit at a higher price. The underage cost is represented by the difference in price levels, U = Pf − Pd. From this, we obtain:

$$F(y) = \frac{U}{U+O}$$
$$F(y) = \frac{Pf - Pd}{Pf}$$
$$F(y) = \frac{1 - Pd}{Pf}$$

The aforementioned steps demonstrate how Littlewood's rule merely elaborates the newsvendor problem. It is useful to remember that Littlewood's model is based on the hypothesis that demand for the lower-priced product/service class manifests itself chronologically before demand for the higher-priced product/service class.

In reality, this hypothesis may not always be verified, even if many companies—and not only those providing services—strive to encourage demand for lower-class product/service through promoting discount policies. Consider, for instance, the cruise organizers that promote discount packages well in advance of the departure date. This also responds

to other management needs: reaching the breakeven point allows the allocation of residual production capacity to be managed with greater confidence. However, this also has implications for other company policies, such as personnel recruitment.

The Effectiveness of RM Systems Based on Capacity Allocation

The segmentation of customers or the segmentation of the product/service in practice cannot represent the model having two classes and the model developed with Littlewood's rule. The two-class and Littlewood's models are based in part on the hypothesis that the demand functions related to the different classes are independent. This hypothesis expresses the perfect segmentation of the market, and it assumes the absence of cannibalization among the different classes.

In practice, this hypothesis frequently does not hold: that is, the demand function of a given class is in some way influenced by the demand function of one or more other classes. In other words, there is no perfect segmentation, as potential buyers/customers in the market seek the best conditions and best offers in relation to their needs at the time these manifest. The potential buyer/customer is not only a bearer of needs, but is also guided in his consumption path by the time factor, that is, the opportunities that the market presents at a given moment.

Quantity-based RM systems use the exploitation of production capacity as a lever for maximizing company profitability. To be technically in efficiency, companies must use suitable methodologies to read the dynamics of demand in order to predict how it will behave. Business-planning processes are based on demand forecasts, in terms of both production and finding the best profitability conditions.

Due to the complexity of company phenomenology, there are no techniques and tools that guarantee full exploitation of a company's production capacity at all times. The company must develop techniques and tools within its RM system that can gather, select, and process the necessary information and make it accessible for management purposes.

Different types and configurations of RM systems are applicable in each business context. Once implemented, an RM system must be tested to verify its adequacy with respect to the needs of business management, as well as constantly monitored and adapted to dynamic changes in business needs.

The effectiveness of an RM system is measurable over time, and cannot be usefully measured in the short term. It can be analyzed ex post in the company balance sheet.

Effectiveness also depends on improving the system to better adapt to the company's evolving information and management needs.

In practice, tools and methodologies for measuring the effectiveness of RM systems have been developed, on which the international literature has often reported.

Among the numerous measurement systems, the "revenue opportunity model" developed by American Airlines is noteworthy (Smith et al. 1992: 8).

This measurement model is based on chronologically recording the different bookings made by customers until either the available production capacity is completed or demand has been exhausted.

Once the bookings/orders/purchase requests have been completed, the revenue obtained is quantified by adding the value attributable to them. Obviously, the value of each booking/ordering/request for collection is strictly related to its applicable price level.

After calculating the revenue achieved (RR), we proceed to calculate the so-called perfect revenue management (PRM), following the theoretical hypothesis that reservations/orders/purchase requests are received chronologically in descending order, that is, covering first the production capacity available for the higher-priced classes and then for the lower-priced classes.

PRM sets a theoretical target that is unachievable in practice since it is based on perfectly forecasting demand. It is also clear that:

$$RR < PRM$$

From here, the company can calculate:

- The total revenue opportunity (TRO), given by the difference between the achievable revenue through PRM and the revenue achieved by the company (RR):

$$TRO = PRM - RR$$

- The revenue opportunity metric (ROM), given by the ratio between (1) the difference between the achieved revenue and the minimum revenue achievable by the company and (2) the difference between the maximum and the minimum revenue achievable by the company.

Assume that the company, given a certain available production capacity, can obtain a maximum profitability equal to € 100,000.00 from using its RM system and a minimum profitability of € 45,000.00 without using this system. If the company's profitability is € 65,000.00, then:

$$ROM = (65,000.00 - 45,000.00)/(100,000.00 - 45,000.00)$$

from which:

$$ROM = (20,000.00)/(55,000.00)$$
$$ROM = 0.3636$$

In percentage terms:

$$ROM = 36.36\%$$

While the TRO and ROM cannot exhaustively measure the effectiveness of RM policies in maximizing company profitability, they are useful tools to start monitoring the performance of an RM system over time.

References

Belobaba, P. (1987a). *Air travel demand and airline seat inventory control*. Ph.D. dissertation, Flight Transportation Laboratory Report R87-7, Massachusetts Institute of Technology, Cambridge, MA.

Belobaba, P. (1987b). Airline yield management. An overview of seat inventory control. *Transportation Science, 21*(2), 63–73.

Bitram, G. R., & Mondschien, S. V. (1995). An application of yield management to the hotel industry considering multiple day stays. *Operations Research Journal, 43*(3), 427–443.

Boardman, A. E., Greenberg, D. H., Vining, A. R., & Weimer, D. L. (2001). *Cost-benefit analysis*. New Jersey: Prentice Hall Inc.

Cohen, S., & Roussel, J. (2005). *Strategic supply chain management*. New York: McGraw-Hill.

Dolan, R. J., & Simon, H. (1996). *Power pricing: How managing price transforms the bottom line*. New York: Free Press.

Edgeworth, F. Y. (1888). The mathematical theory of banking. *Journal of the Royal Statistical Society, 51*(1), 113–127.

Emeksiz, M., Gursoy, D., & Icoz, O. (2006). A yield management model for five-star hotels: Computerized and non-computerized implementation. *Hospitality Management, 25*, 536–551.

Jauncey, J., Mitchell, I., & Slamet, P. (2007). The meaning an management of yield in hotels. *International Journal of Contemporary Hospitality Management, 7*(4), 23–26.

Jones, P., & Hamilton, D. (1992). Yield management: Putting people in the big picture. *The Cornell HRA Quarterly, 33*(1), 88–95.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decisions under risk. *Econometrica, 43*, 263–271.

Kahneman, D., Knetsch, J., & Thaler, R. (1986). Fairness and the assumption of economics. *Journal of Business, 59*(4), S285–S300.

Kaplan, R. S., & Cooper, R. (1998). *Cost and effect: Using integrated cost system to drive profitability and performance*. Cambridge, MA: Harvard Business School Press.

Kaplan, R. S., & Norton, D. P. (1996). *The balance scorecard*. Boston, MA: Harvard Business School Press.

Littlewood, K. (2005). Forecasting and control of passenger bookings. *The Journal of Revenue and Pricing Management, 4*(2), 111–123.

Lovelock, C. H. (1984). Strategies for managing demand in capacity constrained service organizations. *Service Industries Journal, 4*(3), 12–30.

Merrifield, R., Calhoun, J., & Stevens, D. (2008). The next revolution in productivity. *Harvard Business Review, 86*(6), 73–80.

Nagle, N. T., & Holden, R. K. (1994). *The strategy and tactics of pricing: A guide to profitable decision making*. Englewood Cliffs: Prentice Hall.

Nielson, G. L., Martin, K. L., & Powers, E. (2008). The secrets to successful strategy execution. *Harvard Business Review*, 61–70.

Pareto, V. (1974). *Manuale di economia politica con una introduzione alla scienza sociale*. Milano: Società Editrice Libraria.

Phillips, R. L. (2005). *Pricing and revenue optimization*. Stanford, CA: Stanford University Press.

Porter, M. E. (1996). What is strategy? *Harvard Business Review, 74*, 61–78.

Quinn, J. B. (1980). *Strategies for change: Logical incrementalism*. Homewood, IL: Irwin.

Smith, B. C. J. F., Leimkuhler, J. F., & Darrow, R. M. (1992). Yield management at American Airlines. *Interfaces, 22*, 8.

Talluri, K. T., & Van Ryzin, G. J. (2004). *Revenue management*. New York: Springer Science and Business Media Inc.

Talluri, K. T., & Van Ryzin, G. J. (2005). *The theory and practice of revenue management*. International Series in Operations Research & Management Science (Vol. 68). New York: Springer.

Winer, R. S. (1992). A reference price model of brand choice for frequently purchased products. *Journal of Consumer Research*, 250–256.

Yeoman, I. (1996). *A conceptual model of yield management*. Edinburg: Napier University.

Yeoman, I., & McMahon-Beattie, U. (Eds.). (2004). *Revenue management and pricing*. London: Thomson Learning.

Yeoman, I., & Watson, S. (1997). Yield management: A human activity system. *International Journal of Contemporary Hospitality Management, 9*(2), 80–83.

Yeoman, I., Ingold, A., & Kimes, S. E. (1999). Yield management: Editorial introduction. *The Journal of the Operational Research Society, 50*(11), 1083–1084.

9

The Measurement of Revenue Management Policies: RevPAR and Yield Rate

RM Systems

The integration of RM systems with a company's information system requires planning and the measurement of economic and other variables on which to base the decision-making process and support corporate governance.

The variables subject to measurement and on the basis of which corporate governance must be expressed can be distinguished as internal variables of the business combination or variables external to it. Among the internal variables subject to measurement through corporate governance, the following require attention:

- the exploitation of the production capacity
- corporate profitability

Among the external variables being measured through corporate governance—as already highlighted—the following require attention:

- the potential demand
- price sensitivity by potential customers
- the behavior of competitors

Within an integrated RM system, the strategic and operational planning activities of the management can enable the making of estimates and forecasts concerning quantities such as demand, the probability of cancellations of bookings/orders/requests, the probability of customer no-shows, and the reaction of demand to corporate pricing policies. In RM systems, estimates and forecasts are particularly important because of the influence they can exert on strategic and operational planning activities.

The planning activity requires the collection of a large amount of very heterogeneous data, which is not always systematic and is obtained from different information sources inside and outside the company system.

In collecting and processing this data, the time variable takes on particular importance. RM systems often require the real-time availability of information on which the circular planning process is based. The time variable is closely related to the existing technology available within the business combination. The integrated information systems allow the coverage of the entire company production chain and can provide the company with constant availability and updating of data in real time.

The data are authoritatively considered to be the life-blood of a planning system based on RM techniques and tools (Talluri and Van Ryzin 2004: 412).

The company and management's ability to identify information sources is important. Information sources may include historical data, current data, and data projected into the future relating to projections and forecasts. The identification of information sources is a response to the need for information selection, with information needing to be appropriately selected based on the company's management requirements. The identification of information sources enables the selection of data and information that the company can use in its planning process.

The main source of information concerns the recording of data relating to sales performance, both with regard to the product/service units and with regard to revenue trends. Sales data can also be analyzed by

checking the trends—even historical—of bookings/orders/requests. Data relating to bookings/orders/requests can be collected with reference to the different classes of product/service, that is, with reference to the segmentation performed by the company itself within its RM system, or with reference to individual records called customer booking records or passenger name records (PNRs) (Tallury and Van Ryzin 2004: 413). In the first case, the company holds the overall data for each class or for each segment, while in the second case, the company holds data relating to individual customers or the sale of individual units of product/service. The possibility of using customer booking records or PNRs depends on the type of product/service being sold. In the case of the purchase of an air ticket, mobile phone card, or ticket for a concert/show/sporting event, the company can easily obtain information about the customer. In other cases, this is more difficult, especially for the sale of consumer products/services. It is possible for the company to design tools and/or procedures that would allow it to acquire such information, for example a loyalty card as offered by supermarkets.

The knowledge that the company has of its customers provides a competitive advantage. An analysis of the data collected by the company can assist with the planning of policies such as:

- policies for the localization of points of sale
- investment policies
- communication and marketing policies
- personnel and recruitment policies

The knowledge that the company has influences choices in terms of its purchases and their consumption by its customers, which provides a bargaining power toward suppliers. This knowledge allows the company to exercise substantial power in the selection and management of its suppliers.

The competitive advantage and the greater bargaining power with suppliers increase the profitability in the balance sheet of a supermarket. The customer is rewarded with loyalty points and gifts with an economic value that usually does not seem commensurate with the economic advantage achieved by the company.

Information sources can therefore also be acquired by a company through internal procedures, including organizational procedures, or through tools such as loyalty cards, which are also common in other sectors, such as airline companies (e.g., the collection of air miles) and hotel chains.

An additional tool for data acquisition is a request to complete a form on the company website when a potential client wants to obtain certain information or wants to ask questions. This tool also responds to the need to discourage the forwarding of requests not supported by adequate motivation and to implement an inbound selection system.

The identification of information sources must be followed by the definition of management variables, the dynamics of which the company wants to constantly monitor. The set of management variables under analysis determines the "map of management variables" reported in Fig. 9.1.
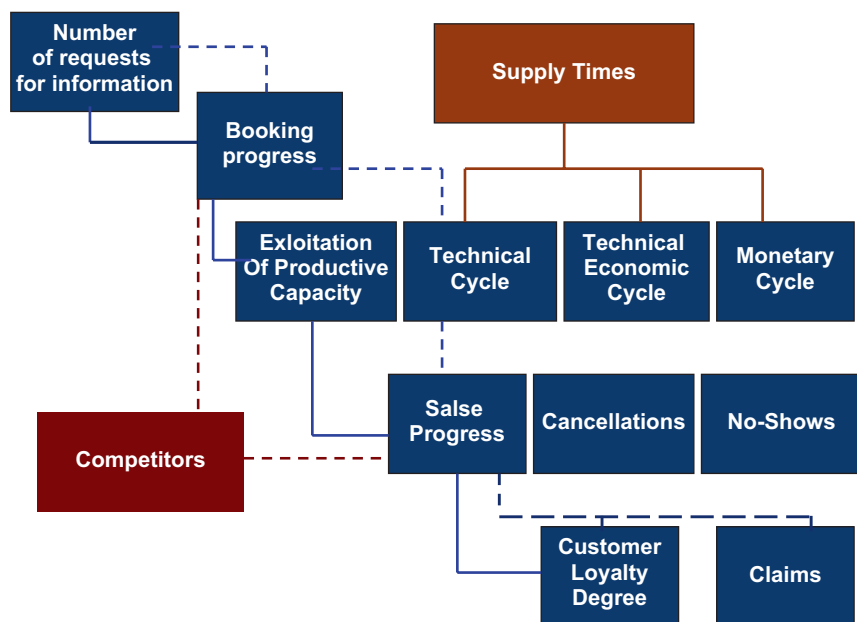
Fig. 9.1 The map of management variables

Figure 9.1 is a schematic and summarized representation of a simplified example of a "map of management variables." For the purposes of RM systems, the relevance of this figure is the distribution of variables along the entire production chain.

RM systems must allow the measurement of management trends through the monitoring of the entire production chain and through the mapping of the relationships that the company has with its suppliers, potential customers, competitors, and direct and indirect distribution channels. The measurement of the production of the product/service can then be added in an economic sense through the degree of exploitation of production capacity and through the measurement of management cycles. As shown in Fig. 9.1, the correlation between contacts and requests for information from potential customers, bookings/orders/requests, sales trends, and any cancellations and/or customer no-shows is extremely important. Other important measurements are the sales trends, an assessment of the degree of customer loyalty, and any requests for reimbursement and/or compensation for damages. Other possible correlations may include procurement times in relation to relationships with suppliers and purchase policies, and the measurement of management cycles.

The identification of information sources and the definition of a map of management variables contribute to the implementation of decision-making processes concerning the necessary forecasts for planning activities (Talluri and Van Ryzin 2004: 416).

The forecasts in many cases rely on estimates, which are descriptive of something that has already happened. Estimates of past phenomena can be the starting point for predictions regarding the same phenomena in the future. The forecasts can be distinguished in qualitative and quantitative terms. Quantitative forecasts require the availability of quantifiable numerical information, the availability of information relating to the past, and compliance with a principle of continuity, through which a given phenomenon or a certain trend may manifest itself again in the future. Quantitative forecasts can be distinguished in explanatory models and in historical series models. The predictions based on explanatory models assume a relationship between the variable object of the prediction and one or more independent variables.

Effective forecasting models require RM systems to rapidly process and produce information, and have a degree of simplicity and "robustness," that is, the ability to deal with large volumes of data, even heterogeneous data. "*Robustness of the forecasts is also important in practice for these same reasons. If a large number of forecasts are off widely and the system starts generating exceptions, analysts may be overwhelmed by the amount of manual intervention required*" (Talluri and Van Ryzin 2004: 434).

Indicators in RM Systems

Among the instruments that make up integrated RM systems, a significant role is played by the use of certain indicators. Indicators can be defined as all the instruments that through the application of functions of varying complexity allow the measurement and determination of one or more variables. Indicators assign a quantitative value to a variable, whatever its nature. The assignment of a value to the variable is a condition for measuring the variable itself.

Traditionally, indicators can be distinguished as either margin or quotient indicators. Margin indicators determine the value of a measured object variable through the difference between two values. An example is the contribution margin expressed by the difference between sales revenues and variable costs, or that expressed at a unitary level by the difference between the price (or unit revenue) and the variable unit cost.

The quotient indicators determine the value of the variable being measured by the ratio between two values. An example is the return on equity (ROE), which is used in the balance sheet analysis and in particular for the measurement of company profitability, and is expressed by the ratio between the profit for the year after taxes and the equity capital.

The distinction between margin and quotient indicators does not always have a substantial value. In many cases, it is a mere formal difference in the representation of the indicator, with a consequent differentiation in the reading of the values that arise from the indicator itself. In the case of margin indicators, the range of variation is from less infinite to more infinite, while in the case of quotient indicators, the variation range is from zero to infinity or from zero to minus infinity.

The indicators within the information systems can take on more managerial functions:

- as a planning, preventive, or ex ante control tool to define the objectives to be achieved, both at operational and strategic levels. The management objective can be expressed through the use of indicators
- as concurrent or feed forward control tools to compare the partial results achieved by management and the objectives system through the analysis of deviations. The analysis of the deviations conducted periodically may allow the company to review the objectives or define corrective actions for the achievement of the objectives
- as a final or ex post control tool to compare the results achieved with the objectives. The final results can contribute to the definition of the new planning process
- as tools for comparison and analysis in time and space, through benchmarking techniques and tools

In all cases, indicators are indispensable tools for any management planning and control system, both with reference to the management variables on which management control and strategic control are based and with reference to qualitative variables.

Indicators are also widely used for the analysis of financial statements (Caramiello 2003). A budget analysis is a fundamental technique for acquiring knowledge and an understanding of business management trends. The content of a management plan can be understood through a critical examination of the value system expressed in the financial statements. The analysis of company management through financial statements provides clues about performance that must then be interpreted by company management. It is a historical-perspective tool and enables an assessment of management in the past and how best to design future management. In the budget analysis, the indicators must be read together, that is, they must be reported in units and must serve as a unitary reading of the budget itself.

In integrated RM systems, indicators have a multidimensional nature, as shown in Fig. 9.2.
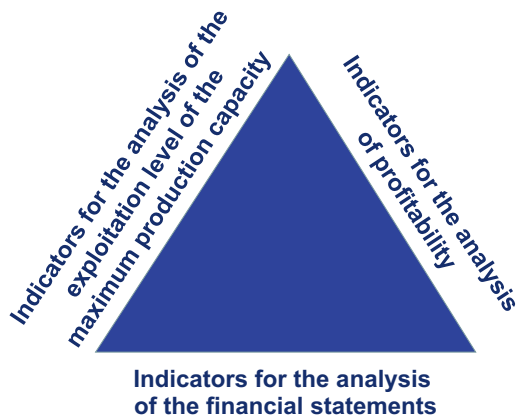
Fig. 9.2   The indicators of integrated RM systems

Figure 9.2 highlights the integration between the commonly used indicators in the budget analysis and the indicators related to RM systems. The latter can be divided into two main categories: activity indicators and financial economic indicators.

The activity indicators mainly concern the production process in the economic sense and the degree of exploitation of production capacity. The economic and financial indicators concern the maximization of profitability at the various levels of company management, that is, by management level, business unit, product/service, customer, distribution channel, and geographic area.

The activity and economic financial indicators that make up the RM systems must be closely interrelated and integrated with the indicators used for balance sheet analysis and performance measurement. The indicators must be linked to unity and systematicity, because only a single indicator system can allow the company and its corporate governance to achieve the management objectives, and through them to achieve optimization in the exploitation of production capacity and the maximization of corporate profitability.

The RM indicator system, shown in Fig. 9.2, can be used by company management both for planning or preventive control activities and for feed forward and final control activities.

Through the continuous monitoring of management variables along the entire production chain, RM systems allow companies to conduct simulations and adopt decisions, projecting the consequences derived from the management variables involved in the planning process and control. The use of RM systems in decision-making processes allows corporate governance to predict the impact of its policies on the degree of exploitation of production capacity, pricing policies, market response, and finally on the profitability of the business and the management balance.

RevPAR and Yield Rate

The RevPAR and the yield rate are among the most widely used indicators within RM systems.

RevPAR measures corporate profitability based on pricing policies and the level of exploitation of the company's production capacity. The prerequisite for calculating company profitability through the RevPAR is that the latter should be closely related to two levers:

- the first lever is represented by the exploitation of production capacity
- the second lever is represented by the company's dynamic pricing policies, that is, by the economic conditions in which the company manages to sell/place its products/services in the market over time

Exploitation of production capacity can be measured using indicators to measure the degree of use of the production process in an economic sense. Exploitation of production capacity can be total or partial. In the case of total exploitation of the production capacity, the indicator used can assume a value equal to one or, in percentage terms, 100%. In the case of partial exploitation of the production capacity, the indicator used can assume a value between zero and one or, in percentage terms, between 0% and 100%, excluding the extremes.

The calculation of the degree of exploitation of production capacity presupposes the definition of the variables through which the company

can determine the level of use. In the case of service companies, which are often considered to be labor-intensive, the critical factors for determining the production capacity can be represented by human resources, and therefore the critical variable for measuring the degree of exploitation of the production capacity will be man hours. In the case of manufacturing companies, which are considered to be capital-intensive, the production capacity will be closely linked to the degree of utilization of the plants and machinery, and therefore the critical variable for measuring the degree of exploitation of the production capacity will be production volumes or business volumes.

The impact of pricing policies on company profitability is linked to the full price (or rack rate) that the company practices for the sale/placement of its products/services, and the differences between it and the actual prices with which the company succeeds in placing the product/service units on the market. The full price, or rack rate, must take into account all company costs and a percentage profit for the company, that is, it responds to the full cost logic.

Maximum profitability is achieved by selling all the units produced or available for the product/service at the maximum price, that is, at the full price or rack rate. The company's ability to put in place pricing policies to maximize its profitability can be calculated through the average revenue (AvRev):

$$AvRev = (total\ sales)/(units\ sold\ of\ product/service)$$

The AvRev is expressed by the ratio of the total sales revenue to the units sold by product/service and provides a representation of the company's dynamic pricing, that is, the price policies implemented by the company over a given period of time. It is a weighted average and as such is a descriptive representation of the dynamic pricing policies. More information can be obtained with other statistical tools.

The efficiency of pricing policies can be measured by the deviation between the rack rate and the AvRev:

$$Offset = Rack\ Rate - AvRev$$

The maximum profitability achievable by the company occurs when the volume of activity expresses the maximum quantity obtainable by the company itself with the exploitation of its potential production capacity, and all the product/service units obtained are sold/placed at the full price or rack rate.

The sales revenues are listed as the sum of the products among all the product/service units sold and the corresponding sales/placement prices:

$$\text{Sales revenue} = \Sigma U_i * P_i$$

with the list running from 1 to n, with n being when the maximum production capacity is reached.

Maximum profitability occurs when the full price or rack rate equals the average sales revenue, calculated from the weighted average of all the product/service units sold:

$$\text{Rack Rate} = \text{AvRev}$$

From this, it can be derived that if:

$$\text{Activity Volume} = \text{Maximum Production Capacity}$$

the available product/service units are the same as the product/service units obtainable through the exploitation of the entire company production capacity

$$\text{Unit of product/service available} = \text{Unit of product/service obtainable}$$

If all available product/service units are sold at full price or rack rate, the company achieves its maximum profitability, which is expressed by:

$$\text{Business Profitability} = \text{Product/Service Unit Available} * \text{Rack Rate}$$

The RevPAR allows the company to measure the impact on the corporate profitability of the following deviations:

- deviation exploitation of production capacity
- pricing policies deviation

The first deviation can be expressed by the difference between the product/service units obtained and the product/service units obtainable, or, more commonly, by the ratio of the product/service units obtained to the product/service units obtainable, or of the product/service units sold to the product/service units available. This deviation can be called the "occupancy rate" (Occ.Rate):

$$Occ.Rate = Units\ obtained/Units\ obtainable$$

or:

$$Occ.Rate = Units\ sold/Units\ available$$

The second deviation, as already highlighted, can be expressed by the difference between the rack rate and the AvRev.

The RevPAR is calculated as the product of the AvRev and the Occ. Rate:

$$RevPAR = AvRev * Occ.Rate$$

The RevPAR indicates maximum profitability if it equals the rack rate and fluctuates between the maximum value, represented by the rack rate, and zero:

$$0 \leq RevPAR \leq Rack\ Rate$$

The closer the RevPAR is to the rack rate, the smaller the gap between RevPAR and the rack rate, and the greater the economic efficiency of the company, as expressed by high corporate profitability. The further the RevPAR moves away from the rack rate, the greater the gap between the RevPAR and rack rate and the lower the company's economic efficiency, as expressed by low company profitability.

The economic efficiency of the company can therefore be measured through an indicator that is able to measure the deviation in terms of the margin between the RevPAR and the rack rate:

$$\text{Economic efficiency} = \text{RevPAR} - \text{RackRate}$$

An analysis of the RevPAR allows a company to understand the causes attributable to the non-exploitation of the maximum production capacity and/or the non-sale of product/service units at full price or rack rate, which would indicate the non-achievement of maximum profitability for the company.

An analysis of the RevPAR also allows the company to measure the effect on company profitability of the impact of the non-exploitation of production capacity and the impact of dynamic pricing policies aimed at practicing price levels lower than the rack rate.

The use of the RevPAR during the check phase is particularly useful for the company to determine if, in the face of stagnant sales, it is opportune to increase sales through a reduction in price levels. The RevPAR allows the measurement of the impact of this decision on company profitability:

- if the reduction of the price level increases sales and company profitability, the company has the potential to adopt this decision
- if reducing the price level increases sales but does not increase company profitability, the company may not have the potential to adopt this decision
- if by reducing the price level sales do not increase, the company will not improve its profitability by adopting this decision

In the first case, the company profitability increases because a decrease in the price level corresponds to a more than proportional increase in sales. In the second case, the company profitability does not increase because a reduction in the price level corresponds to a less than proportional increase in sales. The correctness and effectiveness of the decision can be determined by calculating the RevPAR before and after the effects arising from the decision are realized.

The use of the RevPAR is often accompanied by the calculation of the yield rate. The yield rate is calculated as the ratio of the RevPAR to the rack rate:

$$Yield\ Rate = RevPAR/Rack\ Rate$$

or:

$$Yield\ Rate = (AvRev * Occ.Rate)/Rack\ Rate$$

The yield rate is not measured in terms of a margin, but as the quotient between the RevPAR and the rack rate. The yield rate is an expression of the company's economic efficiency. From a management perspective, the value of the yield rate complements what has already been highlighted by the RevPAR. The two indicators are closely related to each other.

In measuring corporate profitability, the impact of the monetary or financial cycle on the economic dimension is often overlooked. The monetary or financial cycle ends with the collection of the price paid by the customer and is in favor of the company. The time of collection does not always correspond to the time of sale. The difference in terms of time between the sale and collection of price—that is between the end of the business cycle and the end of the financial cycle—determines the costs to the company.

The amount of these costs is not always shown in the financial statements in the income statement, and their extent varies depending on two closely related dimensions:

- the level of indebtedness of the company
- the average cost of third-party capital, that is, the debt borne by the company itself

The two dimensions are more closely related to each other as the level of corporate debt increases, that is, an increase in the company's appeal to third-party capital. It is reasonable to expect an increase in the cost of third-party capital, that is, the cost of indebtedness. This increase is due to the increase in the risk borne by lenders to the company, that is, the risk linked to the level of indebtedness itself.

A modest recourse to the capital of third parties gives a company greater contractual power when it needs to access financing. This greater bargaining power is resolved in favor of the company, providing the possibility of accessing loans under more advantageous economic conditions. The economic conditions of any access to finance are linked to the risk, in this case a lowering of risk, for the lender.

The time interval between the end of the economic cycle or sale and the end of the monetary or financial cycle—that is, collection of the amount due—can be managed by the company in different ways:

- the company may consider a reasonable and physiological range and not charge the customer any additional cost compared to the selling price of the product/service. In this case, the company still incurs a cost regarding the payment extension, but the remuneration of this cost is included in the sale price of the product/service
- the company may consider this a non-physiological interval and attribute interest payable for deferment of payment to the customer, or it may grant the same customer economic incentives (i.e., discounts) to induce them to link the payment to the sale or to anticipate the payment itself. If the company applies interest as an expense to the customer, the customer allows the company to recover the cost it incurs by deferring payment. This recovery is achieved if the extent of the interest charged to the customer is consistent with the average cost of minority capital paid by the company itself

In both cases, it is not certain that the customer will respect the payment terms. In this case, the company will incur additional financial charges related to the delay in collection with respect to the term agreed with the customer. In case of a further delay in collection over the agreed payment term, the company can:

- on the basis of established contractual conditions, charge the customer with a passive interest for the delay suffered
- not immediately apply any charge to the customer for the delay

In the first case, the company recovers all or part of the cost incurred due to the additional delay in payment.

In the second case, the profitability of the company is affected, delaying the collection of the sale price. The measurement of the negative impact of this on company profitability depends on two variables:

- the time variable, that is, the number of days' delay between the agreed payment term and the actual collection of the company credit
- the average cost of third-party capital that the company has to bear. This requires an analysis of the company's financial structure, that is, a determination of the ratio between equity and third-party capital and the measurement of the level of company capitalization

The two variables are closely related to each other because an extension of the time interval requires the company to expand its use of third-party capital, with a consequent increase in its costs. The greater the efficiency of collection, the less the company will need to recourse to third-party capital, with a reasonable and corresponding reduction in the cost of debt.

Taking these considerations into account can enable a company to measure the impact that financial management, with reference to the collection and efficiency of payments and/or credit, has on economic management.

This measurement can be used to determine to what extent the inefficiency of the monetary or financial cycle affects the company's profitability:

Place μ as the weighted average cost of third-party capital payable by the company and determine it based on an analysis of the company's financial structure.

Place $\Sigma\hat{C}$ as the sum of receivables past due and not collected by the company.

The daily inefficiency of the monetary or financial cycle can then be measured by the following indicator:

$$\text{Impact of money cycle inefficiency} = \mu * \Sigma\hat{C}$$

The amount obtained measures the daily cost borne by the company due to the inefficiency of its monetary cycle.

Considering t' to be the number of days between the expiration of the credit and its collection, the cost of a delay in collection is represented by:

$$\text{Total cost of money cycle inefficiency} = \mu * \Sigma\hat{C} * t'$$

From this it follows that the rate of inefficiency of the company monetary cycle, measured over a period of time, is represented by the ratio between the total credits accrued and expired in the period considered and the receivables expired and regularly paid under the agreed terms and conditions:

$$\text{Rate of inefficiency of the monetary cycle} = \frac{(\Sigma\text{Crediti} - \Sigma\breve{I})}{\Sigma\text{Crediti}}$$

From which the margin of inefficiency of the monetary cycle is obtained:

$$\Sigma\hat{C} = \Sigma\,\text{Credits} - \Sigma\breve{I}$$

If the company is efficient in managing its own monetary cycle, this difference is equal to zero because, over the period of time considered, the company has collected all its credits. If the company is inefficient, the margin measures the receivables expired and not collected within the terms agreed with the customer. The rate of inefficiency of the monetary cycle is therefore given by the ratio between the margin of inefficiency and the sum of credits accrued in the period of time considered.

In RM systems, particular attention must also be given to the management of the monetary or financial cycle, to relate the economic dimension to the financial dimension of management. This integration affects the company's profitability and its level of optimization.

The Use of the RevPAR and the Yield Rate

The RevPAR and the yield rate may have different uses within information systems and within RM systems.

They can contribute to the management planning process, supporting corporate governance in defining the objectives to be achieved.

This is shown by a hotel chain with many hotels in a particular area, or an airline operating on more than one route. Corporate governance can establish a minimum and standard RevPAR as a goal to be achieved for each hotel or on each route. The RevPAR becomes an important lever to promote competition within the same company. Competition is introduced regarding the profitability of an individual hotel or individual section that can have positive effects on the overall profitability of the company itself.

The same indicators can contribute to the process of controlling company profitability, both globally and analytically. The control function assumes an importance as a partial or concurrent control that allows the company to carry out corrective actions and as a final or ex post control for the measurement of its managerial performances.

In this regard, the role that the following indicators have when comparing the profitability of the various companies within the company is important:

- products/services
- customers
- geographical areas
- distribution channels
- sales channels
- agents and representatives

These are accounting aggregates, for which the company must design and build an adequate system of analytical accounting. The use of the RevPAR and the yield rate with reference to accounting aggregates, and not only at the global level of the company, presupposes an integration between the RM system and the analytical accounting system. The absence of analytical accounting complicates these analyses. This integration can be carried out within the company information system.

In tourism companies, the integrated analysis between the RM system and analytical accounting can guide corporate governance when determining the allotment of shares to be reserved for tour operators for the sale of their products/services. The same issue may be a concern for companies operating in other sectors when they measure and compare the sales capacity of their agents and/or representatives, or compare the effectiveness of sales in the various distribution channels, or make comparisons with regard to their customers or geographical areas in which the company offers its products/services.

These comparisons are useful for creating competitive dynamics within the company and have positive effects on the overall profitability of the company. This activity can also be useful in enabling the company to operate certain policies, such as customer incentives. The allotment of shares responds to incentive needs.

Consider a hotel in Italy that assigns a certain number of rooms for sale to intermediaries operating in three different countries: Holland, Great Britain, and Germany. The calculation of the RevPAR and the yield rate for each operator in each country will allow the company's management to establish which of the three operators is able to best sell the allotment of rooms received. The measure of the RevPAR and the yield rate are not influenced by the size of each operator's allotment, but by the capacity of the operator to sell at certain price levels. This information can influence the corporate governance of a company by encouraging them to increase the allotment to the operator who registers the best RevPAR and highest yield rate at the expense of the operator registering the worst RevPAR and lowest yield rate.

The use of indicators within RM systems and, more generally, within information systems depends on the company's ability to gather information and use it for statistical purposes.

The collection and processing of information requires important technological tools, with the company's software having a central role. The links that the company has through its web-based technologies with external actors have the function of linking to their processes, production, and sale/placement, enabling them to act as suppliers or distribution channels.

The use of new technologies, especially in the sale of the product/service or in establishing direct relationships with external organizations in

the sales channel of the product/service itself, can allow the company to conduct real-time monitoring of the behavior of demand according to its dynamic price policies and/or production policies.

Consider, for example, a hotel chain with three hotels in the Milanese district, located in three different areas: a hotel near Malpensa airport, a hotel near the central station, and a hotel in the center. The hotels are also differentiated by quality standards.

The company, by monitoring its sales and booking system with its own RM system can, through its dynamic pricing policies and/or through its production policies, shift the demand from one hotel to another within the same Milanese district. This appears particularly useful in periods with high demand in some locations when there is less use of other facilities.

The Internet is a tool that connects a company and a customer as well as the company and the distribution channel or a supplier. It has become indispensable for RM systems. The advantages attributable to the use of the Internet within RM systems include:

- greater accessibility to information
- support for the collection and management of information
- reduction, and in some cases the elimination, of intermediation (or disintermediation)
- shortening of the time dimension

In addition to the advantages derived from the use of web-based technologies, there are also some disadvantages for some companies. The main disadvantage concerns the control of the network by the company itself. For example, this control can impact pricing policies, with particular reference to the monitoring of individuals purchasing the product/service.

With the increasing popularity of the Internet, many companies have expanded their website to develop e-commerce policies.

To do this and to attract potential customers, as well as to counteract the activity of specialized and thematic portals, companies have developed communication policies aimed at providing a guarantee to customers of a lower price for the product/service purchased or the guarantee of

the best rack rate. The presence of specialized portals does not allow the company to be certain that the lower price is present in the network at a given moment for a specific product/service. The company, although communicating it to the potential customer, cannot be certain that the current price for purchases through their website is absolutely the lowest price present within the network. To retain customer loyalty, even in the absence of certainties, companies can commit themselves to reimburse the customer for the price paid if he/she can find the same product/service at a lower price on the network. The policy of loyalty to the website user is based on the fact that most customers, after purchasing a product/service, will not go online to look for the same item at a lower price than they have paid.

To avoid the risk of losing control of its pricing policies and to increase control over the network, some companies do not allow the purchase of an unlimited number of product/service units to the same customer.

Customer loyalty through the network can also be achieved through dynamic pricing policies aimed at rewarding those who first buy a specific product/service, in other words, reversing the advantage present in last-minute purchases and benefiting the early purchasers, that is, all the consumers who initially buy the product/service, and have a high propensity to consume or express a willingness to pay.

In conclusion, to understand the importance of RM systems within the information systems of companies, it is worth remembering the following authoritative statement:

"*The true innovation of RM lies in the method of decision making—a technologically sophisticated, detailed, and intensely operational approach to making demand-management decisions. This new approach is driven by two complementary forces. First scientific advances in economic, statistics, and operations research (…) Second, advances in information technology (…). This combination of science and technology applied to age-old demand management is the hallmark of modern RM*" (Talluri and Van Ryzin 2004: 4–5).

RM systems are a synthetic expression of the degree of efficiency of company management. The efficiency of company management is measured by optimizing company profitability, but is achieved through the unitary and systemic management of the following three main levers:

- the lever of production capacity
- the price lever
- the lever of the monetary or financial cycle

The first two levers are an expression of the economic and productive dimensions of management, while the third lever is an expression of the financial and monetary dimensions of management. The maximization of company profitability must embrace all three dimensions. To optimize its profitability, a company must be efficient in terms of the production dimension (i.e., in exploiting its productive potential), its own price pricing (i.e., with its own policies), and the management of its own monetary cycle (i.e., in the management of collections).

Only if the company is efficient in all three dimensions can the optimization of company profitability be recorded.

Whatever their nature, RM systems contribute with their own logic and their own tools to provide unity and systematicity to the management of company efficiency through the synthesis of the dimensions described.

References

Belobaba, P. (1987a). *Air travel demand and airline seat inventory control*. Ph.D. dissertation, Flight Transportation Laboratory Report R87-7, Massachusetts Institute of Technology, Cambridge, MA.

Belobaba, P. (1987b). Airline yield management. An overview of seat inventory control. *Transportation Science, 21*(2), 63–73.

Bitram, G. R., & Mondschien, S. V. (1995). An application of yield management to the hotel industry considering multiple day stays. *Operations Research Journal, 43*(3), 427–443.

Caramiello, C. (2003). *Indici di Bilancio*. Milano: Giuffré.

Cohen, S., & Roussel, J. (2005). *Strategic supply chain management*. New York: McGraw-Hill.

Dolan, R. J., & Simon, H. (1996). *Power pricing: How managing price transforms the bottom line*. New York: Free Press.

Emeksiz, M., Gursoy, D., & Icoz, O. (2006). A yield management model for five-star hotels: Computerized and non-computerized implementation. *Hospitality Management, 25*, 536–551.

Jauncey, J., Mitchell, I., & Slamet, P. (2007). The meaning an management of yield in hotels. *International Journal of Contemporary Hospitality Management, 7*(4), 23–26.

Jones, P., & Hamilton, D. (1992). Yield management: Putting people in the big picture. *The Cornell HRA Quarterly, 33*(1), 88–95.

Kahneman, D., & Tversky, A. (1979). Prospect theory: An analysis of decisions under risk. *Econometrica, 43*, 263–271.

Kahneman, D., Knetsch, J., & Thaler, R. (1986). Fairness and the assumption of economics. *Journal of Business, 59*(4), S285–S300.

Kaplan, R. S., & Cooper, R. (1998). *Cost and effect: Using integrated cost system to drive profitability and performance*. Cambridge, MA: Harvard Business School Press.

Kaplan, R. S., & Norton, D. P. (1996). *The balance scorecard*. Boston, MA: Harvard Business School Press.

Lovelock, C. H. (1984). Strategies for managing demand in capacity constrained service organizations. *Service Industries Journal, 4*(3), 12–30.

Merrifield, R., Calhoun, J., & Stevens, D. (2008). The next revolution in productivity. *Harvard Business Review, 86*(6), 73–80.

Nagle, N. T., & Holden, R. K. (1994). *The strategy and tactics of pricing: A guide to profitable decision making*. Englewood Cliffs: Prentice Hall.

Nielson, G. L., Martin, K. L., & Powers, E. (2008). The secrets to successful strategy execution. *Harvard Business Review*, 61–70.

Pareto, V. (1974). *Manuale di economia politica con una introduzione alla scienza sociale*. Milano: Società Editrice Libraria.

Porter, M. E. (1996). What is strategy? *Harvard Business Review, 74*, 61–78.

Quinn, J. B. (1980). *Strategies for change: Logical incrementalism*. Homewood, IL: Irwin.

Talluri, K. T., & Van Ryzin, G. J. (2004). *Revenue management*. New York: Springer Science and Business Media Inc.

Winer, R. S. (1992). A reference price model of brand choice for frequently purchased products. *Journal of Consumer Research*, 250–256.

Yeoman, I. (1996). *A conceptual model of yield management*. Edinburg: Napier University.

Yeoman, I., & McMahon-Beattie, U. (Eds.). (2004). *Revenue management and pricing*. London: Thomson Learning.

Yeoman, I., & Watson, S. (1997). Yield management: A human activity system. *International Journal of Contemporary Hospitality Management, 9*(2), 80–83.

Yeoman, I., Ingold, A., & Kimes, S. E. (1999). Yield management: Editorial introduction. *The Journal of the Operational Research Society, 50*(11), 1083–1084.

10

Economic Value and Revenue Management Systems: Case Studies

Differentiation: UNA Hotels & Resorts and Accor

M. E. Porter defines differentiation as a type of competitive advantage. Differentiation is the behavior with which a company "*seeks to be unique in its industry along some dimensions that are widely valued by buyers. It selects one or more attributes that many buyers in an industry perceive as important, and uniquely positions itself to meet those needs. It is rewarded for its uniqueness with a premium price.*" (Porter 1985: 21).

UNA Hotels & Resorts

UNA Hotels & Resorts is an Italian hotel chain owned by Unipol. Unipol Gruppo S.p.A. is the second largest insurance group in the Italian market, the first in non-life business, and among the top ten in Europe. Its ordinary shares have been listed on the Italian Stock Exchange since 1990 and are included in the FTSE MIB index. Its main shareholders are key companies of the Italian cooperative movement. It has over 14,000

employees and serves nearly 15 million customers, with the largest agency network in Italy.

UNA Hotels & Resorts has 27 hotels in Italy, with four brands (the main brand and three minor brands):

1. UNA Hotel and Resorts
2. UNAWay Hotels
3. Villa Le Machere
4. Fattoria Santo Stefano.

Accor is one of the most important European hotel groups. The French company operates internationally, with numerous brands:

- RAFFLES
- Banyan Tree
- Fairmont
- SO/Sofitel
- SOFITEL
- Thalassa
- Onefinestay
- RiXos
- M Gallery
- Pullman
- Swissotel
- ANGSANA
- Adagio
- 25hours hotels
- GrandMercure
- Wuazhu Hotels Group
- The Sebel
- Novotel
- Mercure
- Mama Shelter
- Ibis
- Ibis Style

- Ibis Budget
- Hotel F1.

In the city of Milan, UNA Hotels & Resorts has 6 hotels, while Accor has 16, as shown in the following text boxes:

UNA Hotels in Milan

UNA Maison Milano
UNA Hotel Cusani
UNA Hotel Century
UNA Hotel Scandinavia
UNA Hotel Mediterraneo
UNA Hotel Malpensa

Source: www.unahotels.it

Accor Hotels in Milan

Mercure Milano Solari	IBIS Styles Milano Melegnano
Mercure Milano Centro	IBIS Styles Milano est Settala
IBIS Milano Centro	IBIS Milano Fiera
IBIS Styles Milano Centro	IBIS Styles Milano Agrate Brianza
LaGare Hotel Milano Centrale	IBIS Como
Mercure Milano Regency	IBIS Milano Malpensa Airport
IBIS Milano Ca Granda	Novotel Milano Malpensa Airport
Novotel Milano Nord Ca Granda	Novotel Milano Linate Airport

Source: https://www.accorhotels.com/it/italia/index.shtml

We analyzed all the hotels in these two hotel chains in Milan. For each hotel, the analysis included:

a) location
b) number of rooms
c) type of rooms

d) technical characteristics of each category of room
e) average room price per type
f) other services (garage, restaurant, swimming pool, etc.)
g) other factors

To perform an analysis of hotel activity, these information sources were used in addition to the official website of the two hotel chains, and other third-party sites such as TripAdvisor and Booking.com. After conducting a careful analysis of the hotel facilities, answer the following questions:

1. Which of the two hotel chains has the best differentiation policy in the city of Milan? Provide a detailed argument, with numerical evidence.
2. For Accor, analyze the IBIS Hotel CaGranda and Novotel Milano Nord CaGranda in detail. Identify the variables that Accor uses to realize its differentiation policies, considering that the hotels are located in two adjoining buildings.
3. In the UNA Hotels & Resorts case, analyze the price policies of the six hotels over the same period. The analysis should take the different types of room into consideration.

   a. Determine whether the price policies are correct or if they could generate cannibalization phenomena.
   b. An assessment should be made of the price policies applied by the six hotels, with numerical references.
   c. Determine whether it is possible to improve the management of price policies to align policies with each other, and thus make them more efficient.

The CA Hotels Case

Direct Costing and Full Costing

Cost accounting enables the analysis of specific topics related to cost centers. The cost center is an accounting aggregate to which both costs and revenues can be referred (imputed).

When the cost center also takes on an organizational value, it can be defined as a center of responsibility. The center of responsibility, in addition to being a cost center, has an organizational value for the company and is a responsible subject. The center of responsibility is always a declared center. The opposite is not true, that is, it is not true that the cost center is always a center of responsibility. What determines if a declared center becomes a center of responsibility is the organizational value of the company. As an example, for a hotel chain, an individual hotel is a center of responsibility, while a room is a cost center. For an airline, the individual country or geographic region could be a center of responsibility, while a single flight or single seat on a plane is a cost center.

In direct costing, only direct costs are charged to the cost center. Direct costs can be variable or fixed. All costs directly attributable to the cost center are direct costs. Variable direct costs are costs that, in addition to being directly attributable to a cost increase, vary according to the volume of activity or production. Fixed costs are direct costs that, in addition to being directly attributable to the cost center, are fixed, that is, they do not change as the volume of activity or production varies.

General costs are not charged to individual cost centers and are considered only at company level.

This applies in the full costing methodology; otherwise, the general costs are charged to the individual cost centers using cost drivers. The full costing methodology is more subjective than the direct costing methodology, which is more objective.

In the full costing methodology, changing the cost driver changes the result. The choice of the cost driver is subjective, and therefore the result is also subjective.

CA Hotels is a small hotel chain with three hotels: one each in Milan, Rome, and Florence. Table 10.1 presents selected data from the three hotels.

Table 10.1 CA Hotels evidences

CA Hotels	Milan	Rome	Florence
Number of rooms	30	28	18
Number of days per year	365	365	365
Occupancy rate	78%	70%	75%
ADR (average daily revenue)	€ 160.00	€ 188.00	€ 140.00

Table 10.2 CA Hotels cost structure

CA Hotels	Milan	Rome	Florence	Total amount
Seasonal staff	€ 60,000.00	€ 48,000.00	€ 40,000.00	€ 148,000.00
Housekeeping	€ 98,550.00	€ 91,980.00	€ 59,130.00	€ 249,660.00
Utilities	€ 70,000.00	€ 80,000.00	€ 60,000.00	€ 210,000.00
Other direct variable costs	€ 218,000.00	€ 205,000.00	€ 245,000.00	€ 668,000.00
Rent	€ 341,640.00	€ 349,687.52	€ 182,120.40	€ 873,447.92
Staff salaries	€ 318,000.00	€ 320,000.00	€ 270,000.00	€ 908,000.00
Marketing	€ 42,000.00	€ 55,000.00	€ 40,000.00	€ 137,000.00
Other direct fixed costs	€ 188,000.00	€ 212,000.00	€ 140,000.00	€ 540,000.00
General costs				€ 373,000.00

Considering the cost structures for each hotel and the general costs of the company given in Table 10.2, determine the following:

1. The first- and second-level contribution margin for each hotel and the overall margin for the hotel chain.
2. The overall economic result using the direct costing method.
3. The economic result for each hotel and the total economic result using the full costing method. For the input of overhead costs, use the following two cost drivers:

   a. Number of rooms.
   b. First-level contribution margin.

Rationality and Strategy

The decision-making processes must be based on objective data and evidence of economic rationality. However, the strategic dimension must be added to the rational dimension. Sometimes choices can derogate from rational evidence in favor of the strategic dimension.

In the case of CA Hotels, the Florence hotel has a positive first-level contribution margin and a negative second-level contribution margin.

The owner of CA Hotels asked for help from a consultant to determine a future plan for the hotel in Florence. In particular, the hotel group

wants to know if, from an economic perspective, it is preferable to close the hotel or keep it.

Assuming that you are the consultant, answer the question posed by the property owner, considering only the economic dimension and not considering any evidence of a strategic nature.

Break-Even Analysis

A break-even analysis (BEA) is a simplified theoretical model that determines the break-even point expressed as a quantity in terms of the volume of activity or production at which the total costs are equal to the total revenues. At the draw amount, income is zero. For quantities less than the draw amount, income is negative. For amounts above the draw amount, income is positive. The theoretical model of a BEA is based on five simple hypotheses, which allow a graphical representation on a Cartesian plane. The simple hypotheses are as follows.

(1) The company is a single product. This makes it possible to represent the functions in two dimensions on a Cartesian plane.
(2) The quantities sold coincide with the quantities produced. This determines the absence of inventory variation or the absence of a warehouse. In this hypothesis, the x-axis of the Cartesian plane accepts the quantity (q) produced and sold as an independent variable.
(3) The selling price is constant. This makes it possible to represent the revenue function as a straight line whose angular coefficient is the constant price (p). The angular coefficient determines the inclination of the straight line.
(4) The variable cost per unit is constant. This hypothesis allows the function of variable costs to be represented as a straight line whose angular coefficient is the constant unit variable cost (cv). In this case, the angular coefficient determines the inclination of the straight line.
(5) There are no limits to the production capacity of the company. This allows the fixed costs to be represented as a line parallel to the x-axis toward infinity. Fixed costs are not fixed indefinitely, but limit the maximum production capacity. An increase in the maximum production

capacity implies that investments are made, and thus there is an increase in fixed costs. In reality, fixed costs should not be represented by a straight line that runs infinitely parallel to the x axis, but in steps representing intervals of maximum production capacity.

Fixed Costs

With regard to fixed costs, consider a 30-room hotel open 250 days a year. The maximum production capacity of the hotel on an annual basis is given by:

$$\text{Number of Rooms} * \text{Number of days}$$
$$30 * 250 = 7500$$

where 7500 is the maximum number of rooms available on an annual basis.

The maximum daily production capacity is represented by the number of rooms, that is, 30 (excluding the possibility of selling the same room several times a day).

If the hotel wants to increase its maximum production capacity (excluding the possibility of selling the same room several times a day), it can (1) increase the number of days it is open up to a maximum on an annual basis of 365, (2) increase the number of rooms, or (3) both.

An increase in the number of rooms or open days would result in an increase in fixed costs. A graphical representation of the stepped increase in fixed costs as the maximum production capacity increases is shown in Fig. 10.1.

Figure 10.1 shows how on the Cartesian plane the quantity q' is equal to n. For the 7500 available rooms on an annual basis, the fixed costs are represented by a line parallel to the x axis that originates from the point K' in the axis of the ordinate or the axis of y. As the maximum production capacity increases from q' to q", the fixed costs increase, as shown in Fig. 10.1, passing from K' to K". The increase in fixed costs from K' to K" is due to the investments that the hotel has to sustain to increase its maximum production capacity, bringing it from q' to q".

The BEA also allows simulations to be conducted as the following individual variables vary: (1) unit price, (2) variable unit cost, (3) fixed costs, and (4) quantity.

Graphical Representation of the BEA

Within the five simple hypotheses, the graphical representation of the BEA is shown in Fig. 10.2.

The function of fixed costs is represented by a line parallel to the x-axis that goes to infinity because there are no limitations on the maximum production capacity. The variable cost function is a straight line that starts from the origin (if the quantity produced is zero, the variable costs
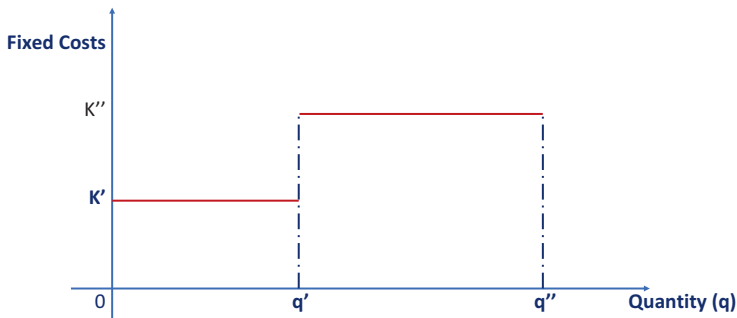
Fig. 10.1 Fixed costs
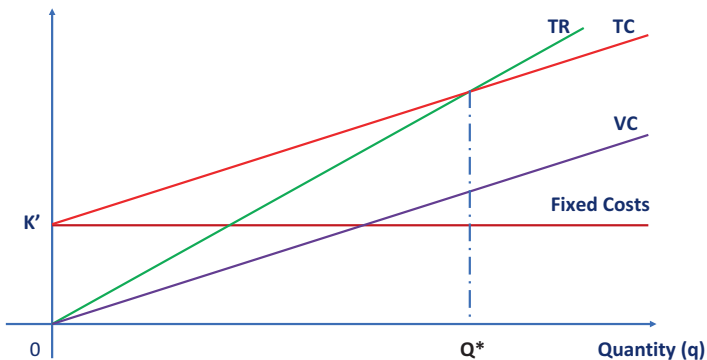
Fig. 10.2 Break-even point

are zero) and increases with an inclination (angular coefficient) equal to the unit variable cost (cv). The total cost function is the sum of the fixed and variable costs. It is a straight line that starts from K′ and not from the source, because if the quantity produced is zero, the company only supports the fixed costs equal to K′ and has no variable costs. The company grows with the same inclination as the line of variable costs, that is, with an angular coefficient equal to the unit variable cost (cv). The total cost line is therefore a line parallel to the line of variable costs having the same angular coefficient (i.e., unit variable cost (cv)), but a different order (meeting point with the y-axis). The function of total revenues is represented by a straight line that starts from the origin because if the quantity is zero, the company does not sustain revenues and grows with a price equal to the price (p).

As shown in Fig. 10.2 in correspondence with the quantity Q*, the line of total revenues meets the line of total costs. This means that it corresponds to the quantity Q*.

$$\text{Total Revenue} = \text{Total Cost}$$
$$\text{Total Revenue} = \text{Variable Costs} + \text{Fixed Costs}$$

Q* represents the break-even point, that is, the quantity at which revenues equal total costs. For quantities greater than Q*, the company has a positive profit, while for smaller quantities, the company has a negative profit.

In practice, the use of BEA requires the prior determination of costs by classifying them and differentiating between variable and fixed costs.

The Mathematical Representation of the BEA

From a mathematical perspective, the BEA starts from a position of equality between total revenues and total costs. At the point of equality, the company reaches an economic break-even. The break-even point is the amount at which the total revenue equals the total costs:

$$\text{Total Revenue} = \text{Total Costs}$$
$$\text{Total Revenue} = \text{Variable Costs} + \text{Fixed Costs}$$

where:

- the total revenue (TR) function is given by: $Y = p * q$
- the variable costs (VC) function is given by: $Y = cv * q$
- the fixed cost (FC) function is given by: K'
- the total cost function is given by the sum of variable and fixed costs: $Y = cv * q + K'$

From which we obtain the break-even point equation:

$$\text{Total Revenue} = \text{Variable Costs} + \text{Fixed Costs}$$
$$p * q = cv * q + K'$$

Taking the quantity (q) as an independent variable, to find the draw amount, we have:

$$p * q - cv * q = K'$$

from which we group the independent variable (q):

$$q * (p - cv) = K'$$
$$q* = K'/(p - cv)$$

The break-even point is given by the ratio of fixed costs (K') to the difference between price (p) and unit variable cost (cv). The difference between unit price and variable cost (p − cv) in the denominator represents the *unit contribution margin*. Therefore, the break-even point is given by the ratio of fixed costs (K') to the unit contribution margin.

The *unit contribution margin* is the price capacity after hedging the unit cost of covering fixed costs, that is, contributing to the coverage of fixed costs. It appears evident that the unit contribution margin is a multiplier, by which (if positive) the increase in the quantity produced/

sold by the company first reaches an economic equilibrium and then creates profit. The unit contribution margin is a lever of company profitability.

The unit contribution margin can also be negative, in which case it represents a lever that destroys wealth, and therefore may lead the company to bankruptcy.

The multiplier effect of the unit contribution margin is linked to the company's ability to create economies of scale by increasing the volume of activity/production.

The Unimib Travel Case

The Milano Bicocca University tour operator organizes a trip in December for Christmas shopping in New York. The trip includes three nights in New York, with three dinners included in the tour package. The costs of the trip are shown in Table 10.3.

Based on the data shown in Table 10.3, proceed with the following:

1. Define which costs are fixed and which costs are variable, explaining the reasons.
2. Using the classification of the costs referred to in point (1), assuming a sale price for the tour package of € 2600, determine the number of customers that Unimib Travel requires to reach the break-even point. For greater security in the correct setting of the problem, consider that the total costs (variable costs + fixed costs) amount to € 7220.

Table 10.3 Unimib TO—evidences

Flight ticket	€ 1500.00
Hotel room for night	€ 140.00
Dinner (cost for dinner per person)	€ 40.00
Transfer from and to airport	€ 1000.00
Tourist guide from Milan to NY	€ 800.00
Visa (per person)	€ 40.00
Insurance (per person)	€ 130.00
General cost	€ 1000.00

3. On the basis of the cost structure classified in point 1 and assuming a minimum number of 11 customers, determine the price at which to sell the tourist package per person to reach the break-even point.
4. Returning to point 3, to determine the sale price, include Unimib Travel's desire to make a profit of € 3000.

The Hotel Vittoria Case

Hotel Vittoria is a four-star hotel located in the center of Milan, with 122 rooms. The average daily room (ADR) cost is € 135.

For one week (week 46 in the calendar year), Hotel Vittoria has the reservations shown in Fig. 10.3.

For the same week, Hotel Vittoria receives the following additional requests for availability:

1. A group arriving for a performance in Milan that requests 22 rooms. Check in Tuesday, check out Friday. Price per room is € 108.00.
2. A group arriving for a company meeting that requests 30 rooms. Check in Tuesday, check out Wednesday. Price per room € 109.00.
3. A group arriving for a tour in Milan that request 36 rooms. Check in Wednesday, check out Friday. Price per room € 85.00.

The booking office of the Hotel Victoria can accept only one request. For each booking request, determine:

1. The daily employment rate and the employment rate for the following three days: Tuesday, Wednesday, and Thursday.

Hotel Vittoria – Week n. 46

Description	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Occupancy
Room Sold out		90	85	80				255
Request from a Group								
Request from a Group for a meeting								
Request from a Tourist Group								

Number of Rooms: 122
ADR: Euro 135,00

Fig. 10.3 Hotel Vittoria week n. 46

2. The average room revenue for each of the three days.
3. The RevPAR and the yield rate.

Assume the following:

a) Individual customers produce an extra revenue of € 7 per person with a double occupancy rate of 1.1.
b) The group that made the booking to participate in the performance in Milan produces an extra revenue of € 6 per person with a double occupancy rate of 1.2.
c) The group that made the booking for the corporate event produces an extra revenue of € 7 with a double occupancy rate of 1.3.
d) The group of tourists that made the reservation request produces an extra revenue of € 3 per person with a double occupancy rate of 1.8.
e) There are fixed daily costs of € 2500 and variable costs of € 11.5 per person per day.

Determine which of the three booking requests is preferable.

The Hotel Piccadilly Case

Hotel Piccadilly is a four-star hotel located near the Termini Station of Rome, with 99 rooms. It has an internal restaurant managed by an external company, a bar, a garage for customer's cars, and three meeting rooms that can hold up to 90 people each.

The average room price is € 85.00. For one week (week 32 in the calendar year), Hotel Piccadilly has the reservations shown in Fig. 10.4.

Hotel Piccadilly – Week n. 32

Description	Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Occupancy
Room Sold out	33	44	40	33	25	20	25	220

Number of Rooms: 99
ADR: Euro 85,00
Rack Rate: Euro 190,00

Fig. 10.4 Hotel Piccadilly week n. 32

Considering the data shown in Fig. 10.4, for week 32 in the calendar year, determine:

a) The weekly occupancy rate.
b) The weekly total revenue.
c) The RevPAR of the week.
d) The yield rate of the week.

The situation at Hotel Piccadilly is not satisfactory. The property owner wants to increase the occupancy rate of the hotel. The business director therefore decided to change the pricing policy through the differentiation/segmentation of customers:

a) Individual customer in a single or twin use room: € 85 per night/room.
b) Price per agreement with travel companies: € 70 per night/room.
c) Price for groups: € 50 per night/room.

The adoption of the new price policy seems to have worked. In the first two days, bookings increased as follows—Monday: 30 rooms booked for individual customers; 25 rooms booked for a company convention; 30 rooms booked for groups. Tuesday: 20 rooms booked for individual customers; 30 rooms booked for a company convention; 40 rooms booked for groups.

For each of the two days, determine:

1. The occupancy rate.
2. The average daily revenue.
3. The daily total revenues.
4. The RevPAR.
5. The yield rate.

The manager of the hotel intends to further increase the occupancy rate for better profitability and decided to also differentiate the rooms as follows: 40 superior rooms, with a living room and balcony on the garden at an average daily revenue of € 99.00; 59 classic rooms at an average daily revenue of € 75.00.

Hotel Piccadilly – Week n. 46

Description	Tuesday	Wednesday	Thursday
Front Office Manager	Luc	Pierre	Marc
Superior Room	25	30	33
Classic Room	50	40	38
Fixed Cost	425,00 €	425,00 €	425,00 €
Variable Costs per room	8,90 €	8,90 €	8,90 €

Fig. 10.5 Hotel Piccadilly week n. 46

In one week (week 46 in the calendar year), on Tuesday, Wednesday, and Thursday, the three front-office managers received the reservations shown in Fig. 10.5.

Considering the data shown in Fig. 10.5, which of the three front-office managers performed best in terms of profitability for the company? Give economic evidence for your answer.

Reference

Porter, M. E. (1985). *Competitive advantage. Creating and sustaining superior performance* (p. 14). New York: The Free Press, A division on Macmillan Inc.

Index