Title: Financial and Strategic Framework for Contract Manufacturing Decisions: Evaluating Incremental Costs in the Pharmaceutical Industry

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Executive Summary

This thesis develops a strategic and financial framework to help big pharmaceutical companies decide how to operate as contract manufacturers and to calculate a data-driven minimum price for contract manufacturing offers. Big pharmaceutical companies face substantial idle capacity in their production sites due to the growth of competitors in the price-competitive generic and contract manufacturing market. Research and development setbacks and patent expiration on previously high-volume products further reduce internal production demands. This results in higher per-unit costs and compressed margins as the fixed costs remain.

The recommended strategy is to monetize idle capacity as a premium contract manufacturer to produce for external clients. A big pharma company can highlight its competitive advantage which enables them to compete on customer value creation rather than on price alone. Moreover, the thesis emphasizes that a clear strategic position on the level of importance of contract manufacturing for the business is essential, because each option requires distinct governance, investment and client selection rules, plus an efficient inquiry assessment process.

To compete with the market and to know the minimum price, production costs for an offer need to be calculated. Therefore, product costs are defined from a traditional accounting perspective and contrasted with decision-relevant costing, which defines incremental costs as the additional costs occurring compared to an alternative decision. Methodologically, the financial framework follows three steps to classify production site costs in their cost categories, to define relevant incremental costs in comparison of a base case scenario and to construct incremental cash flows over the contract horizon. The cash flows are discounted to define the floor price and sensitivity analysis support to manage long-term prediction uncertainty. Any price above the floor price generates positive contribution and dilutes fixed costs.

A worked example applies the method to a ten-year offer with staged volumes and explicit assumptions on transfer costs, capital expenditures and materials. The example also classifies site costs into those relevant or irrelevant for the business case. The weighted average cost of capital of 4.54% is calculated based on peer analysis. With the discounted cash flow, the model sets the net present value to zero at a floor price of 335€ per kilogram active ingredient.

Practically, companies should benchmark the floor price against market offers to set a competitive price to the client. Second, they should favor shorter initial contract terms and careful contract drafting to avoid unexpected costs. Third, by maintaining a clear strategic vision for production sites and the importance of CMO activities, following the financial framework, companies ensure idle capacity is converted into value while sustaining strategic control and managing risk.

Table of Contents

List of Figures

List of Tables

List of Abbreviations

ABC	Activity-based costing
API	Active pharmaceutical ingredient
BCG-Matrix	Boston Consulting Group - Matrix
CAPEX	Capital Expenditures
CAPM	Capital Asset Pricing Model
CMOs	Contract Manufacturing Organizations
DCF	Discounted Cash Flow
EBIT	Earnings before interest and taxes
FOCF	Free operating cash flow
GMP	Good Manufacturing Practices
IFRS	International Financial Reporting Standards
IP	Intellectual Property
IT	Information Technology
KG	Kilogram
KPI	Key performance indicator
NPV	Net Present Value
PV	Present Value
R&D	Research and Development
WACC	Weighted average cost of capital
YTM	Yield-to-Maturity

1. Problem Statement

Most of the big pharmaceutical companies are facing the challenge of idle capacity. Their manufacturing capacities often exceed the demand by approximately 40% (Tso & Jacob, 2012, p. 86). As most larger companies were founded before globalization (Gibson, 2024), those companies used to build their own facilities to produce new drug products. As well, they were and still are nowadays largely vertically integrated companies and take part in the whole "pharmaceutical manufacturing process, from drug discovery to regulatory affairs, to manufacturing, to marketing" (Gibson, 2024, p. 2). According to Gibson, a company spends on average up to two billion dollars to launch a new product on the market and invests yearly up to 20% of its revenues in research and development (R&D). Other sources even indicate a higher amount of up to three billion dollars (efpia, 2025). During the process of research and development, only about two out of every 10,000 substances tested pass all stages of development and enter the market (efpia, 2025; Gibson, 2024). Many of the stages bury a high risk of failure starting from initial substance discovery, over the three clinical trials, to regulatory approval and ultimately production, marketing and distribution. However, investment decisions for production and launch activities need to be made before the product is regulatory approved. Therefore, it is possible that a production site invests in its capacity and outsources products to provide room for the new product and in the end the product failed in the last study. Then the production site is left with high idle capacities which create fixed costs (Pisano, 1997).

Patents for new products last around 20 years on average. The R&D process, however, can take up to 12 years already (Umbrex, 2025). If the R&D productivity is rather low, the pipeline has gaps or a product for example fails, it creates overcapacity (Tso & Jacob, 2012). Another reason for overcapacity is the loss of a patent. After the launch of a new drug, a company has on average 8-12 years with exclusive rights to sell a novelty drug. As the drug is sold for a high price to regain the R&D costs and the demand is driving volume, the production sites are relatively full. However, after a loss of a patent, generic companies enter the market which are selling the same product for a lower price. Therefore, the volume and the market share drop within the first year drastically. As by 2030, it is estimated that 236 billion dollar revenue from top drugs is affected from their patent loss, like Merck's "Keytruda", Bristol Myer Squibb's "Eliquis" and AbbVie's "Humira" (Umbrex, 2025). To increase R&D productivity and operational efficiency, the past has shown that mergers and acquisitions and strategic alliances are likely to occur like Pfizer-Wyeth, Merck-Schering Plough and Roche-Genentech (Tso & Jacob, 2012, p.86). Those are one more factor for overcapacity and redundant production sites.

If the variability is high and lead times are long as in the pharmaceutical industry, it is recommend having a certain amount of idle capacity as a buffer (Hopp & Spearman, 2011). It mainly creates flexibility for new products which need to be tested and prepared for launch. As production needs to be industrialized, meaning to be scaled from a laboratory to the high-volume production, it is favorable to have free capacities for tests available. Alternatively, large pharma companies could task Contract Manufacturing Organizations (CMOs) to produce novelty products. However, it might be advisable to keep the sensitive knowledge internal, especially if the company has the knowledge and the capacities to produce the product themselves. With a third party, they would be reliable on their production schedule and might

have difficulties to up- or downsize the production depending on how successful the launch of the new product is.

Starting late 1970s, the industry was growing and introduced new players. Apart from the big pharma companies with strong focus on R&D, specialized pharma companies with focus on one specific therapeutic area were founded. As well as generic drug manufacturers who concentrate on off-patent drug production and, more recently, biotechnology companies with innovative biological or genetic solutions were founded. (Umbrex, 2025, p. 10). If a big pharma company decides not to manufacture in-house for efficiency reasons, it can outsource production to CMOs. CMOs have the advantage that they can bundle the production of many different companies and use economies of scale for a high-volume and low-cost production. Many of those CMOs are in China and India (Umbrex, 2025), because of favorable labor costs and a growing demand for healthcare products from the Asian population (efpia, 2025, p. 4). Both generic companies and CMOs are more efficient and charge a lower price to clients for producing products which creates high competition for big pharma companies. The major difference lies in their cost structures. CMOs' main purpose is to be a service provider for other companies to produce pharmaceutical products. Therefore, they have little overhead costs as they only focus on one step of the value chain in the pharmaceutical industry. They often only own the production site, hire direct personnel for production and have a small number of managers and purchasers. As the assets for the production cause high fixed costs, they try to fill their production lines fully and have no idle capacity to generate economies of scale (Hopp & Spearman, 2011). In combination with the low costs, they can charge a lower price compared to the big pharma companies which have R&D costs, potential efficiency issues and more overhead costs to include in their calculations.

To mitigate the idle capacity issue of big pharma companies and to cover for costs created by idle capacity, many pharmaceutical companies such as Pfizer's CentreOne (Pfizer CentreOne, 2026) and Sanofi's Active Ingredient Solutions (Pharmaceutical Technology, 2026) started to reach out to the market and offer their capacity to produce as a CMO drug products for others (Tso & Jacob, 2012). As they are competing directly with traditional CMOs, they face the major question on how much they can charge the client to cover the incremental costs of production, ideally a part of their fixed costs and to be competitive against the CMO. This thesis aims to discuss the strategic decision of big pharma companies to act as CMOs and to elaborate a method on how to set a price for production by distinguishing fixed and flexible costs and using incremental costs to calculate a business case with a positive net present value.

2. Strategic Discussion

2.1 Competitive Advantages

“Competitive advantage grows fundamentally out of value a firm is able to create for its buyers that exceeds the firm’s cost of creating it.” (Porter, 1985, p. 3). Part of this concept are the two fundamental strategies of differentiation and cost leadership. Differentiation refers to offering unique products or services which are perceived as superior and for which customers are willing to pay a premium price. The product does not necessarily only have higher quality, but it can also have an advantage on product features, technology, reliability, product safety, brand reputation or service features (Porter, 1985). On the other hand, companies with cost leadership as a strategy can offer their products to the customer for the lowest costs in the industry. They achieve this through, for example, structural cost advantages, high volumes and accordingly economies of scale, process efficiency and learning effects and tight cost control mechanism (Porter, 1998).

Big pharma companies generally follow the strategy of differentiation. They have unique and superior competitive advantages cumulated over decades, which lead to excellence in an end-to-end value chain. They have strong R&D and provide novel therapies on the market. This is safeguarded by patents which makes it exclusive for customers to buy and for the company to set the price high. Additionally, as they are fully integrated and experienced, they can manage regulatory processes well, set-up manufacturing processes according to the highly regulated Good Manufacturing Practices (GMP) and commercialize safe and clean drugs with a good reputation globally. Those capabilities are key to success apart from the drug discovery. This can be seen in the fact that many smaller highly focused biotechnology start-ups end up cooperating with a big pharma company once they find a novelty substance (Henderson et al., 1999). Following the differentiation method, Novartis for example launched in the USA in 2019 a drug against rare childhood spinal muscular atrophy (SMA). Patients only need one shot for the treatment as it replaces the mutant gene with a working copy. Novartis follows the value-based pricing approach in which the price is reflecting the perceived or estimated value and compares it to “the sum of the best alternative price and the therapy’s differential value” (Manders et al., 2025). Therefore, the drug has a price of 2.125 million US Dollar which reflects half the costs of the ten-year alternative treatment available (Taylor, 2019). In this case, the ultimate benefit of the drug is the cure of the disease through the convenient application through one shot.

Generic companies or CMOs follow the cost leadership principles. The production of drugs, especially the active pharmaceutical ingredient (API) of each final product, is a commodity activity. Mainly, because companies have limited differentiation in their manufacturing capabilities, use similar technologies and compete against many players in the market. More than half of the “global generic API outsourced market” (Tso & Jacob, 2012, p. 2) is covered by Asian players. Their location in China and India is part of their structural cost advantages for low labor costs. To drive economies of scale, CMOs need to capitalize on large volumes to scale production and have a high usage of capacities. Through that, they have a chance to compete with competitors and increase their profitability. As they have a high utilization, it is possible to generate learning effects and through the cost pressure of the generic industry it is enforced to drive efficiency programs and process improvements (Tso & Jacob, 2012). As CMOs

are compared to big Pharma companies specialized and solely focused on production, it is not needed to invest in R&D or marketing activities. Following the cost-based pricing approach which includes mainly the costs of producing the goods, CMOs are enabled to sell for a cheaper price to the customer as they face lower total costs (Manders et al., 2025, p.5).

2.2 Value Creation as a CMO

Following Porter's competitive advantage definition, value is the buyer's willingness to pay minus the firm's cost of performing activities (Porter, 1985). The value of big pharma companies is to provide innovative medicines, safely produced and regulatory accepted. However, as R&D productivity is decreasing and production capacities are idle, a company should consider applying their value-creating activities to a new market and monetarize not only their products but their capabilities. According to the theory of Teece et al. from 1994, companies achieve superior performance in related markets. This is since common technological and market characteristics are shared and through enterprise learning deep knowledge can be built up and applied. Aside from the main asset of a company, complementary assets like distribution systems or manufacturing plants are built to support the main activity. Those assets are rarely "completely specialized to a particular product" (Teece et al., 1994, p.20) and therefore, the knowledge can be extended to other areas.

Although main activities and target customer groups of big pharma companies and CMOs differ, the markets are still related to each other. Where big pharma companies are fully integrated from drug discovery to commercialization, CMOs solely focus on the manufacturing service. However, with the addition of some complementary assets like a service culture mindset, the implementation costs to expand their market and offer manufacturing services as a CMO to other companies are rather low. Big pharma companies can provide their manufacturing capacities, technical and regulatory expertise and global network to clients. They can attempt to position themselves as premium CMOs highlighting their decades of long expertise to compete against the cost leadership CMOs with a higher price. However, the price still needs to be set right to be able to compete and therefore, in the following chapters, a method on how to define relevant costs will be provided. Through their expertise and unique competitive advantage of regulatory excellence, a global supply chain and the highest production standards, they are providing a premium service and potentially reducing the total costs a customer faces versus a traditional CMO. This is advertised as well by Pfizer's CentreOne CMO Unit: "Our robust tech transfer process helps to ensure a rapid start, while our advanced process analytical technology maximizes efficiency and minimizes cost – accelerating your product through critical milestones to the patients who depend on it" (Pfizer CentreOne, 2026). Further, Sanofi's Active Ingredient Solutions is highlighting their premium capabilities build up for decades and offering "innovative, efficient and safe solutions, high-quality products and premium customer service" as well as customer's total cost reduction through, "continuous improvement of manufacturing processes to optimize output" (Pharmaceutical Technology, 2026).

2.3 Opportunities and Risk as a CMO

Through applying their competitive advantage, the willingness-to-pay of a customer might be higher compared to a traditional CMO. To analyze the opportunities and value capturing potential for a big pharma company, the costs of activities need to be analyzed. Apart from the actual calculation which will follow in chapter three and four, the general strategic and high-level financial advantages can be highlighted. In producing for external companies, the firm has a higher asset utilization. Although this can lead to a higher wear and tear of the machines, in the pharmaceutical industry a major part of maintenance is preventive. In regular cycles the equipment has inspections and part replacements to avoid failure of equipment and to follow GMP of the pharmaceutical industry. Through more produced volume, those fixed costs can be diluted. From a risk diversification perspective, it can be highlighted that the CMO business is a new revenue stream and additional income apart from revenue through own products can be generated. The strategic importance of this revenue stream will be discussed in the following chapter 2.4. If the production unit is short to medium term idle because of lacking new products, CMO products allow the production unit to keep running and not get fully depreciated. Moreover, no production personnel need to be laid off and therefore, their expertise stays within the company. Ultimately, the R&D volatility of a big pharma company can be better balanced (CMO Manager, 2026).

Apart from those advantages, there are risks to consider when deciding for the CMO business as a market opportunity. The different business models once as a service providing CMO versus product ownership as a big pharma company require a different mindset. As a big pharma company, one offers highly innovate R&D products directly to the patient and can set the price relatively free. A CMO on the other hand actively needs to acquire clients who would like to produce their products with them. The prices are defined mostly by the competition and the cheaper the CMO can offer products with a good quality the more attractive it is. Also, contract business is more restricted to the details of a contract. If a certain volume is promised at a specific time, it needs to be delivered by then, otherwise a penalty might follow. Finding the right business parter is fundamental in the CMO business and especially for a big pharma company acting as a CMO. It would be, for example, not ideal if a big pharma company produced the product of the direct competitor. There are intellectual property issues and strategic restrictions to consider. The client should also be financially stable as contracts last between five to ten years and both the producer and the client are committing for a volume and potential investment needs. Regarding investments the company strategically needs to decide the importance of the CMO business and if investments are wanted. If yes, the contract with the client could define the payment of the investment by the client. Alternatively, the costs can be included in the Net Present Value (see chapter three) analysis to set the price in a way that the investment is repaid after the end of the contract term. In the strategic deployment of the CMO business, it also needs to be discussed how to manage internal supply risks. A contract partner is obliged to fulfill its liabilities. Therefore, if own products are increasing their production volume, there needs to be a proper decision matrix on which product to prioritize. As a last risk, the dilution of the corporate strategy or mission can be mentioned. A big pharma company's mission is generally to provide innovative products to cure patient's diseases. If it starts to provide manufacturing services to create profit, it does not support its own mission. However, as it is still producing drugs which ultimately cure patient's disease, the risk of losing their mission with the right

strategic deployment is rather low. As well the risk of losing a good reputation and image as a premium brand producer towards customers is rather low, as it is not public knowledge who is producing which product (Confidential Pharma Company, 2026).

To be successful as a premium CMO the competitive advantage needs to be sustainable in terms of consistency, defensible and difficult to imitate (Porter, 1985). In this case as the manufacturing capacity is not the competitive advantage, big pharma companies have some advantages which cannot be easily duplicated short-term and most likely long-term as well. Traditional CMOs will eventually be able to compete on regulatory excellence with the amount of experience they gain. However, a global supply chain and production network will remain unique for big pharma companies as well as the deep technical knowledge they have built over decades and their service level approach in which they are trying to improve production and minimize total costs for the client.

2.4 Strategic Roadmap

Further strategic decisions must be made before establishing a well-structured organization and implementing processes. To avoid losing the strategic focus of the organization, a big pharma company needs to decide on how important the CMO business should be. This is important, because “[t]he essence of strategy is choosing what *not* to do” (Porter, 1996, p.70). There are three options, the first of which is the opportunistic CMO approach. This strategy aims to temporarily fill gaps in capacity utilization, primarily to balance employee numbers and dilute fixed costs. A straightforward way to achieve additional utilization is by short-term expansion of existing business, which can involve seeking opportunities to sell one’s own products to a generic company or to continue production for a client after they acquire portions of one’s brands. The second option is to strategically utilize capacities on empty production lines. Through this, a constant revenue stream can be generated, and machines do not need to get fully depreciated when own products cannot use the line. The last option is a dedicated CMO business unit in which the CMO business is seen as a strategic pillar to generate profits. In this scenario it can happen that new capacity needs to be built up, for example, if the volume of own products is increasing and many new clients for the CMO business can be acquired. If this is wanted, internal transfer pricing rules need to be implemented, capacity reservation rules and resolution mechanism defined, and potentially a capacity allocation committee founded. Furthermore, great negotiation skills need to be developed, and proper pricing mechanisms defined. It needs to be analyzed whether it is even possible for a big pharma company to have a profitable CMO business or only to have a positive contribution margin while competing in a generic and price sensitive market. Especially if new machine investments are required, because the production lines are fully utilized or need to be replaced, additionally fixed costs are added (Confidential Pharma Company, 2026).

After the general decision on how important the CMO business for the company is, a decision matrix to evaluate potential offers following the example of a BCG Growth-Share matrix can be developed (Kaufmann, 2021). The two relevant dimensions in this case are the production line capacity and technology and the product and client. First, production lines available on the whole network need to be analyzed. If a line is substantially utilized now or mid-term or reserved for upcoming launches, the line is not available for contract manufacturing. As well, if there is a plan to dismantle the line due to technical

Figure 1: Decision Matrix

issues, substantial investment needs or to use the machine space for new equipment with different technology, the line is not qualifying for CMO business. In all the other cases, the production line is available and gets a high and preferred rating. The second axis of the matrix is the product and client. The product and the client need to be a good fit, and the available production lines need to be able to fulfill the technological requirements. If little investment is needed or the investment is covered by a financially stable client, it is a preferred contract. As well as predictable demands, short-term commitments and higher margins are favorable.

After those strategic decisions a company needs to find the proper communication and advertisement channel to announce their availability to do CMO business. The intuitive way is to use existing networks and active stakeholder management. Important stakeholders can be small- and medium-sized enterprises, the contacts of a consultant, the internal departments of procurement, contract business and business development and licensing. A company can also position itself at a fair or conference, make advertisements to their current customers or suppliers and internally create awareness to employees, so that through word-of-mouth effects requests are reaching the company. However, a more strategic and entrepreneurial approach recommends understanding first the market and the customer in detail, by segmenting the market and building a customer persona before the appropriate way of acquiring the customer is defined (Aulet, 2024).

“Successful organizations understand the importance of implementation, not just strategy, and, moreover, recognize the crucial role of their people in this process” (Pfeffer, 1998, p.16). As manufacturing is multi-dimensional, the right teams from the different departments need to be onboard to assess an inquiry and an assessment process needs to be set up to avoid too many resources are occupied every time there is an inquiry. Therefore, the company should have a pre-assessment phase in which it performs a sanity check and requests additional information if required. The team should also assess the strategic-fit, including relevant factors like product complexity, product territory, competition to own products, financial stability of the client and intellectual property issues. After that, in the technological-fit assessment, potential production lines can be proposed and the second layer of assessments can start. In that phase, the potential production site assesses the feasibility of the production, technical requirements, and provides cost estimates and resource requirements. For instance, the engineering and manufacturing departments need to indicate if they already have all the knowledge and equipment needed to produce or if an investment is needed. Additionally, the quality department analyzes the regulatory demands and requirements for the transfer of the product as well as the analytical method to validate the products. Supply chain management should indicate what the

maximum production volume is in correlation with existing demands and the finance department needs to analyze the production costs. This topic will be detailed in the following chapters because as elaborated previously, the CMO market is price sensitive and the company cannot follow standard allocation and costing rules.

If the assessment of the production site is positive, the proposal goes into the final assessment phase and into the decision circle. Part of this team is a representative from the production site, the legal department, contract business, supply chain management, procurement, quality and finance. The team reviews the proposal from the site and performs a sanity check. Then they need to define the product price to the client (Confidential Pharma Company, 2026).

To elaborate a price, a company can build on a combination of four approaches. As elaborated in chapter 2.2 a big pharma company has unique competitive advantages compared to low-cost CMOs and can charge a price premium for their expertise. They can create additional value compared to client's alternative options through, for example, improving the production process, avoiding transportation costs and higher regulatory expertise. The second approach is the cost-plus model which uses the unit costs of production delivered by the site assessment as a starting point. On the production costs an appropriate margin needs to be added which will be the result of a comparison to the market. Depending on the technology, the number of competitors and market insights from the internal procurement department, a company can gain an understanding on a realistic market price for the product. The last approach is called market-minus, which starts with the wholesale price of the client's product, takes assumptions on the client's margin and concludes the maximum price the client is willing to pay. Part of those considerations should include an analysis of the best alternative for the client compared to the own offer and understanding the client's interests and priorities. The combination of all four approaches enables the company to set a price or a price range which can be used for negotiations with the client (Fuliginous Management Consulting, 2025).

Following contract negotiations, which include the price and further contract details, a timeline is defined for the technical transfer and the start of production. Internally, the business model including the physical material flow and master data structure needs to be set-up and the manufacturing process including the quality and regulatory requirements implemented (CMO Manager, 2026).

As the whole discussion and the attractiveness of the offer is defined by the price the company charges, the following chapter will focus on the analysis of the cost structure in the production site. As well, it will elaborate on which costs are relevant for such decision to create a positive contribution margin and dilute fixed costs while creating a net present value positive business case.

3. Costing Framework for CMO Decisions

3.1 Cost Classifications

There are multiple ways to classify costs from an Accounting and Controlling perspective. However, this thesis only focuses on the definitions of direct and indirect costs as well as fixed and variable costs. It is important to classify costs and to allocate these to the product to define the cost structure each product has.

Direct Costs can be traced easily and accurately to a cost object. A cost object is for example the production of one kilogram of drug product or a batch of active ingredient. Common direct costs allocated to a product are material costs, as it is clearly defined which ingredients are needed to produce.

Indirect costs are not traceable in an economic way. Therefore, they are normally collected and later allocated by a cost driver (Horngren et al., 2021). In the pharmaceutical industry, indirect costs to produce the product are the production costs per machine and the personnel costs. Both costs are allocated to the product based on the hours consumed during production. The costs collected on both machine and personnel cost centers consist of direct and indirect costs. For machines, direct costs include depreciation. Indirect costs are allocated from various sources, such as energy costs measured by meters, rent for the building based on the square meters used by the machine, maintenance activities tracked through work orders and time spent by engineers, and infrastructure costs like those for the fire department allocated by square meter usage. In the personnel cost center, direct costs typically consist of the employees working on shifts, while indirect costs include overhead expenses related to production such as management staff, or the production site such as personnel from the IT department, logistics, and site management. These indirect costs are allocated based on the size of the team directly working on shift or, alternatively, through activity-based costing (ABC) as described in Chapter 3.2. Both the personnel and the machine cost center derive a cost charge based on the total costs divided by the capacity of the machine or employees in hours. Another allocation to the product is from the quality department. First, quality assurance activities and costs, for example related to regulatory documentation and the development of testing procedures, are allocated using an hour-based cost driver to quality control departments which perform the actual testing of the product. The quality control department receives as well indirect costs from the rent of the testing building and has direct costs for the testing personnel. Following the capacity logic from the production cost centers, a cost charge is calculated and based on a hourly effort classification of the products allocated according. The last indirect category in the cost structure of a product is waste and material overhead costs. For handling products and using the infrastructure of the production site like the pipelines, the exhaust gas cleaning facility or the sewage plant, costs are allocated based on a scale cost driver. The more ingredients a product needs the more material overhead costs and waste expenses are allocated (Anonymous, 2026).

A second option to recognize costs is the differentiation between variable and fixed costs. Variable costs change proportionally with the volume of the production. For every unit more produced, more costs are generated as for example material costs. If nothing is produced, no material is needed and no costs

occur. One further example is energy costs, generally the longer and the more one produces the more energy the machine needs.

On the other hand, fixed costs are not affected by the level of production in a certain interval (Horngren et al., 2021). Depreciation costs are constant if no new machine is acquired. As well, rent expenses do not change with the level of production and neither overhead personnel in the production site like the site management or quality assurance department. The production site always needs to minimize risks and follow health, safety and sustainability standards. That is why those costs stay even if production is low.

Horngren at al. defines as a third category step-fixed cost. Step-fixed costs are fixed costs within a narrow range of activities. Production, engineering or quality testing personnel can work, maintain and test until a specific threshold. If production is lower than this threshold, the costs remain fixed. If there is one more unit than the threshold though, new personnel need to be hired, and the costs jump accordingly.

3.2 Cost Allocations to define Product Costs

Product costs are those costs that are attached to the product. To achieve accurate product costing, indirect costs need to be allocated to the product based on cost drivers. Under the International Financial Reporting Standards (IFRS), it is required for a correct inventory valuation in the financial reports to involve all conversion costs. “The costs of conversion of inventories include costs directly related to the units of production, such as direct labor. They also include a systematic allocation of fixed and variable production overheads that are incurred in converting materials into finished goods” (IFRS Foundation, 2003, p.6). The system of how the costs are allocated can vary in their level of sophistication.

The most simplistic approach has a low level of accuracy and is not allocating the costs according to their cost drivers, but it is inexpensive to operate. One example is the single overhead rate, in which all overhead costs of the production site get dived by one cost driver like production volume or direct labor hours. This approach works well if all products consume similar amounts of the departmental overheads. In an environment with multiple products, this approach is most likely not sufficient for accurate product costing and decision-making (Drury & Tyles, 1994, p.454).

An alternative solution involves implementing multiple departmental overhead rates, where each department utilizes its own specific cost driver. This method typically relies on budgeted overhead rates, as actual costs may fluctuate from month to month. Using actual figures could lead to delays in calculating product costs, as it would require waiting until all costs are collected at the end of the month or the beginning of the following month. This approach goes in the direction of ABC, particularly when each department is focused on a single activity. In ABC the first step is to analyze which activities consume business resources. The activities can be categorized into unit-level, batch-level and brand-level activities related to a product, as well as customer and organizational related activities like technical services and office administration. Related activities can be grouped together into one cost pool or collect expenses stand-alone. For each activity a cost driver is defined as, for example, the number of setups of a machine or tests performed by a quality department. A cost rate is defined per activity and

through collecting data and tracking processes the right amount of activity is allocated to the product. The more complex a product and the more activities consumed, the more costs are allocated to the product. ABC increases the ability for precise product costing, analysis of profit margins and identification of production inefficiencies through a high level of detail (Kaplan & Cooper, 1998). Practical implementation of ABC can be resources-intensive and requires considerable documentation through the level of detail required. To track activities either time sheets or sampling employees is necessary.

The example company of chapter four developed its own costing mechanisms and implemented their own model of product costing as a combination of known costing systems. The overall goal is to allocate product costs in a way that a smart price can be set to the market, through which a contribution margin to cover the fixed costs, and ideally profit, can be generated. Each activity has a yearly capacity limit which will be used to define the cost charge. If the utilization is low, not all costs can be charged to the product, as they only consume a defined amount per unit of activity. Therefore, the available free capacity gets the rest of the cost allocated as idle costs and makes it transparent how cost efficient a production site is. It also helps increase the accuracy of the product costs as the products produced do not get the full production site costs allocated (Horngren et al., 2021). This method of full costing is the appropriate method for financial accounting purposes. However, it can be misleading in decision-making as relevant and irrelevant costs need to be separated upon a business case calculation (Horngren et al., 2021).

3.3 Incremental Costs in decision-making Processes

Decision-making is a forward-looking process in which one or more alternatives are evaluated. Therefore, the incremental costs need to be defined for each alternative. Incremental costs are the difference in total costs between two alternatives (Horngren et al., 2021). Incremental costs can also be defined as the additional costs resulting from a change in the level of activity (Drury, 2021). This goes hand in hand with Horngren, as also Drury is comparing two alternative options. Incremental costs are often variable as, for example, more raw material is needed to produce more units, but sometimes they are fixed e.g., for new machines. Step-fixed costs are getting relevant when the decision leads to a jump in capacity needs.

There are three categories for relevant costs: avoidable costs, future outlay costs and opportunity costs. Avoidable costs are costs that can be saved by not choosing a given alternative. If a company chooses to produce for an external client, avoidable costs for this activity are raw materials, additional quality testing, cleaning costs, energy and waste disposal (Drury, 2021). Future outlay costs focus on the cash flow as a result of a decision. Outlay costs are direct expenses for vendor payments, equipment purchases, lab space acquisitions or fees for services which are required to fulfill the selected option. The last category is opportunity costs, which normally arise when resources are scarce and have alternative uses. It measures the benefit sacrificed of the contribution from the best alternative option. If a decision is made for product A, which has a contribution of 300€ versus product B with a contribution of 500€, the 200€ difference needs to be declared as opportunity costs. It represents the real economic loss although no cash payment is involved (Horngren et al., 2021).

Costs which level will not change by the decision evaluated are irrelevant and excluded from the analysis. Part of irrelevant costs are sunk costs which are historical values representing past decisions with no impact on future cash flows. Examples of sunk costs are expenses for machines already bought or R&D expenses which were invested in the past. However, R&D required for the evaluated alternative is relevant. The second category are unavoidable costs, which contrast with avoidable costs. They refer to future expenses that remain constant regardless of the decisions made between different alternatives. For instance, the depreciation of an existing asset and the salaries of employees who are already working in the company are unavoidable costs in the short-term future. However, it is important to analyze the timeframe in which employee contracts can be terminated to assess when salaries of current employees become relevant. The last category is committed costs, which summarizes future costs that have been committed prior to a decision point and will not change upon the decision. Those costs result from long-term decision-making and are often linked to capacity decisions like factory buildings, lease payments or contracts (Horngren et al., 1964; Drury, 2021).

3.4 Theoretical evaluation of Floor Price under Uncertainty

To financially evaluate an opportunity like a CMO offer, a business case should be performed to see if economic value compared to the baseline is created. Therefore, the difference in the present value of future incremental cash inflows and outflows is discounted at an appropriate discount rate. This process is called Discounted Cash Flow (DCF) analysis. To assess projects and their value creation potential, the metric of Net Present Value (NPV) is used. If the NPV of a project is equal to zero it breaks-even and earns the cost of capital, if it is higher than zero it is a positive case and if it is below zero the project destroys value as investing the capital would have given higher returns (Brealey et al., 2025). As an appropriate discount rate, the weighted average cost of capital (WACC) is applied. It reflects a company's average cost of financing considering their capital structure. Therefore, it is the average return required by capital providers to invest in the project versus alternative investments with a similar risk profile (Damodaran, 2014).

The goal of a business case is to support rational capital allocations and in the CMO discussion to calculate the minimum price the company needs to charge to break-even (Brealey et al., 2025). The price is ultimately set based on multiple factors like risks, margins and competition through which the business case can turn out NPV positive. Although a project may show an accounting loss, it is still making a positive contribution in incremental terms towards the fixed costs the company faces through idle capacity (Drury, 2021). NPV is the leading key performance indicator (KPI) to assess a capital project. Apart from the key financial goals, strategic goals like client-fit, operational reliability and regulatory performance should be considered (Kaplan & Norton, 1996).

Business Cases use incremental costs and revenues over the relevant time frame of the decision. Therefore, the length of the time horizon for the evaluation of incremental costs plays a significant role as short-term less costs are relevant as long-term. Although the costs do not change their nature over time, the management ability to change them does (Horngren et al., 2021). Within two years, decisions can be made to reduce the number of employees and after around five years, capacity investment decisions or downsizing strategies can be effective. Long-term contracts can be cancelled at a certain

point, and more costs can become relevant. However, it still needs to be analyzed if they are avoidable in the context of the opportunities presented. If the costs simply become more flexible, but strategically it was decided to continue the business as it is with the contracts and plant size in the moment of the decision, the incremental costs might not change over the period of the contract. Opportunity costs, however, might arise based on the nature of the pharmaceutical business with a high volatility of new product launches. To summarize, it is relevant to understand the base case scenario against which the opportunity is getting measured to assess the cost development over a longer timeframe.

An option to handle the uncertainty of cost development based on volatile demands and fluctuating R&D productivity are real options. Real options account for the value of delaying an irreversible investment decision under uncertainty. It accounts for the value of waiting to have a higher certainty if an investment is valuable. In a production site this happens when time passes and demands are confirmed. If the demand was low, the option of investing would not be exercised, however if it was high, it can be exercised. For this decision a threshold needs to be defined. To decide for an investment today, the project value should be higher than the incremental costs and the value of the option to wait. The value of waiting can be determined based on two calculations. The first is a traditional NPV calculation with fixed data points not including any flexibility. The second calculation results in an adaptive NPV. The NPV changes based on a decision tree with multiple decision nodes and assigned probabilities. The different cash flow expectations of each option of the decision tree are discounted to the adaptive NPV. The difference between both calculations is the value of waiting (Dixit & Pindyck, 1994).

An alternative, more practical solution is to calculate new business cases for new opportunities when they occur. As it is hard to predict what the options will be in five to ten years, the base case should include all relevant and certain developments which are predictable as of the evaluation day. Based on that, the opportunity under consideration can be discussed and evaluated.

4. Applied Business Case for a CMO Offer

4.1 Introduction of the Company and Base Case Scenario

Chapter four presents a case study from a real pharmaceutical company which name remains confidential to protect proprietary information. To maintain confidentiality and avoid any identifiable conclusions regarding the specific product in question, some numerical values have been modified.

A big pharmaceutical company has excess capacity. It will not be able to fill the capacity with its own products in the next years. However, it decided strategically to keep the production site active to have the flexibility of launching quickly when a new product gets ready for the market. Based on the history of the production site, it does not only have the launch facilities needed, but also further buildings and productions units which were used for high volume productions. As those productions phased out with time due to patent losses and lower product attractiveness in the market, the fixed costs and sunk costs are left. As launch products are small volume products in the beginning, the site is starting to miss economies of scale to dilute fixed costs of the production, and the launch products are getting more expensive to produce in the site. Products of a production site need to cover also the overhead costs of the location. For safety reasons, a site normally has, for example, an internal fire fighter department, a thermal exhaust gas cleaning machine and a sewage treatment plant. Furthermore, a site has logistics and warehouses, pipelines on campus and management. New products will enable lower per unit costs for each product as the fixed costs are getting diluted.

To assess a potential solution for idle capacity like CMO business, the base case scenario needs to be defined. The base case of the production site is positive long term. Although it experiences a decrease in production utilization in the short to medium term, it expects to get new products on the site, which is the reason for keeping the site operating.
However, there are three production lines which have rather specialized equipment. The products on those lines are at the end of the life cycle, and the idle capacity is increasing over the next three to five years before the lines will be idle. This leads to an opportunity to either shut down the production line or to use it for external CMO business. In the base case scenario, it is assumed that the line will be shut down at the end of 2029 and some of the personnel will be laid off. As the production lines are in a building complex with other active productions, only one employee per production shift can be reduced, which amounts to five employees in a five-shift model. Due to lower testing demands, one employee in the quality department can be laid off. The fixed costs of depreciation will continue, same as the site management team, and other overhead costs to keep the production site running like the above-mentioned fire fighter department, thermal exhaust gas cleaning machine and sewage treatment plant.

4.2 Introduction of the CMO Opportunity

The company decided to handle the idle capacity through CMO business and started to build up a strategy on how to position itself in the market. Therefore, it looks for new third-party products to transfer to the site to increase the contribution margin to the site’s expenses. As shared, revenue and development agreements are getting more popular in the industry. Therefore, one way of getting a request to manufacture for a third party is through a collaboration partner.

In this business case, a big pharma company collaborates with a small start-up from the US and supports in the initial agreement the clinical trial process and the approval process from world wide's health agencies. The contract allows the big pharma company to sell the product worldwide apart from US under licensing fees. In this initial agreement, no production agreement was signed, and the start-up appointed a different external CMO to produce the products for them. The product develops after launch very well, indicating that the initial production capacity of the external CMO will be insufficient. To meet market demands, a second source of supply needs to be found and qualified. Here, the big pharmaceutical company sees its chance to make an offer to their collaboration partner as it has idle capacity and only a minor amount for capital expenditures (CAPEX) is needed to produce this product. It starts negotiations with the start-up and will need to discuss the conditions of an offer and contract. This includes setting a price for a defined volume request for a ten-year period. As elaborated above, the mechanics on how to set a specific price are handled in the strategy or marketing team. In this NPV analysis, the goal is to define the floor price. Every price higher than the floor price will have a positive contribution margin towards diluting the fixed costs.

Table 1 below presents essential information of the contract to be used in the calculations. However, a deep analysis of the production costs in accordance with the previously outlined guideline is necessary and will follow in chapter 4.3. The contract term will be ten years, the tax rate for the relevant country is 25% and 2% inflation rate is assumed and applied to all cost variables in the calculation in chapter 4.5.

Category	**Information**
Contract Term	10 years
Tax Rate	25%
Inflation	2%
Transfer Costs	1,000,000 €
Investment in CAPEX	2x 4,000,000 €
Depreciation of the new CAPEX	Linear for 10 years
Material Costs	170 € / kg
Production Volume	2025: 0 kg 2026: 7,500 kg 2027: 17,500 kg 2028: 22,500 kg 2029/2030: 27,500 kg 2031: 23,000 kg 2032 21,000 kg 2033: 17,000 kg 2034: 14,000 kg

Table 1: CMO Offer Details for DCF Calculation

The production site has already started analyzing that the transfer of the product costs one million euro, which includes costs for training personnel to operate the new production process, for the creation and

submission of all required documents and the certification of the first production. As well it is required that existing machines are modified and new pipelines are installed to be able to produce the new product. This investment of capital expenditures in machines and machine parts will cost four million euros in 2025 and the same amount in 2026. The planned production starts with a starting volume of 7.5 tons in 2026. The volume will peak in 2029 and 2030 at 27.5 tons and then start to decrease according to the life cycle of the product. The material costs of 170€ per kg were given from procurement in collaboration with the manufacturing department.

The risk of the business case is rather low. The product has a strong market demand with increasing sales volumes, which is the reason for the negotiations with the big pharma company to be the start-up's second supplier. Furthermore, the client's reliability is strong due to the existing business relationship between the two companies. If the company calculates the floor price correctly and no unforeseen costs will occur, the business case will likely be positive, and the company will be able to dilute fixed costs. After the NPV calculation reveals the floor price, a competitive price to the client needs to be set. Therefore, the company can compare the product's market value or if available the price from the first CMO to the floor price. There is an opportunity that the production volume increases if the market demand continues to grow. The numbers in table 1 display a base case scenario, but it is possible to calculate with a low or high case scenario as well to understand the sensitivity of the production and costs.

4.3 Analysis of the incremental Production Costs

Following the theoretical framework, the costs of the production site are further analyzed. The following table 2 highlights if each cost category is incremental and relevant in the business case calculation compared to the base case scenario.

During production, indirect material costs of 10€ per kg production occur, for example for gloves and clothing for the personnel or solvents to clean the machine. Labor costs are step-fixed costs and therefore cannot be decreased immediately, as a certain number of employees are needed per shift. However, compared to the base case in year five, the costs of five employees are avoidable, because they could have been reduced. The same principles are valid for quality department employees, as they can do analysis until a specific threshold. Compared to the base case, there would have been low testing demands starting year 2030 and one employee could have been reduced. For Quality Assurance, costs depend mainly on the contract details. If no new methods need to be developed and certified as in this case, the incremental costs are minor and are assumed to be zero. Energy costs are directly related to production, however even if there is no production, energy costs remain for the building. The first part is relevant to the business case, but the second is unavoidable and therefore irrelevant. Energy costs are often indirectly allocated in the finance department. But at the machine there is a meter for electricity and other energy consumptions installed which measures the costs per month. In the first year, the machine will operate for two months, costing around 300,000€. Subsequently, in 2029, it is projected to run with the expected volumes for eight months at an inflated price of nearly 1.3 m€.

Cost Category	Classification	Incremental	Value
Material Costs	Variable + direct	Avoidable	170€ / kg
Indirect Material Costs	Variable + indirect	Avoidable	10€ / kg
Labor Production	Step-fixed + direct	Avoidable	100,000t€ / employee
Energy Costs	Variable + indirect	Avoidable	150,000€ / month
Maintenance	Variable + indirect	Avoidable	25,000€ / month
Labor Quality Department	Step-fixed + indirect	Avoidable	110,000€ / employee
Quality Assurance costs	Step-fixed + indirect	Unavoidable	-
Deprecation of current machines	Fixed + direct	Irrelevant	-
New machine investment	Fixed + direct	Future Outlay Costs	2 x 4 mio €
Depreciation of new machine	Fixed + direct	Avoidable	10% of investment /year
Waste Expenditure	Variable + indirect	% of volume	300€ / ton
Site Management	Fixed + indirect	Unavoidable	-
Fire fighters	Fixed + indirect	Unavoidable	-
Sewage treatment plant	Fixed + indirect	Unavoidable	-
Gas cleaning facility	Fixed + indirect	Unavoidable	-
Pipelines	Fixed + indirect	Unavoidable	-
Warehouse Building	Step-fixed + indirect	Unavoidable	-
Labor Warehouse	Step-fixed + indirect	Avoidable	100,000€ / employee
Information Technology	Fixed + indirect	Unavoidable	-
Building Rent	Fixed + indirect	Unavoidable	-
Transportation of finished goods to client	Step-fixed + direct	Avoidable	2,000€ / truck
CMO coordinator	Step-fixed + indirect	Avoidable	130,000€
Other management cost	Variable + direct	Avoidable	10,000€

Table 2: Cost Classifications

While maintenance is preventive and in regular cycles the equipment has inspections and part replacements to avoid failure of equipment, replacements can be needed earlier through a higher wear and tear. To account for this risk and expense, relative to the machine's operational time to produce the client's product, maintenance expenses are included in the calculation. Starting 2029, in the base case the machine would be shut down. Therefore, the full annual expense will be allocated to the product to ensure continued compliance of the machine with GMP. Any new investments required represent future outlay costs and are relevant to the analysis. Additionally, the depreciation associated with these new investments will also be a relevant factor to consider due to its tax shield in the profit and loss statement. The remaining depreciation of the production line is considered irrelevant to the current decision-making. Waste is produced in relation to production and the part which is not internally disposed needs to be externally disposed with a contractor. This costs 300€ per ton and it is expected to create one ton of waste every five tons of products produced. The sewage treatment plant, gas cleaning facility and the

pipelines are sunk cost in terms of the machines themselves and unavoidable for the operation. There is no external warehouse which needs to be used to manage the incoming materials or the finished goods, and the internal warehouse has enough storage capacity to manage the volume. Therefore, the cost category is irrelevant. While the storage capacity is sufficient, an additional employee is required to manage local operations, including documentation, testing and handling of incoming products, during the peak volume phase between 2028 and 2032. Information Technology (IT) costs are irrelevant as no new IT system needs to be implemented. The rent for the production building is also irrelevant as the line shares the space with other active lines. Outside of the production site, there are additional costs for the transportation of the goods to the client. For each truckload, which accommodates five tons of product, a fee of 2,000€ is charged. A new CMO coordinator needs to manage the strategy of the CMO business and the contact with the client, representing a future outlay cost. The category is step-fixed as one coordinator can manage up to six contracts simultaneously. However, for the first contract, the total annual salary of 130,000€ must be accounted for in the initial year. Beginning in year two, the coordinator will allocate their time between two contracts, and assuming proportional business growth, the associated costs will decrease accordingly in the subsequent years. Furthermore, other management costs include travel expenses for negotiations and legal fees for the contract establishment. No further overhead or central costs will increase.

4.4 Weighted Average Cost of Capital Calculation

To perform a DCF Analysis with the evaluation of the net present value, the WACC needs to be derived. The WACC is calculated by adding (Cost of Equity * (Equity/ (Debt + Equity)) to (Cost of Debt * (Debt/ (Debt + Equity)) * (1 - Tax Rate)) (Brealey et al., 2025). To evaluate the Cost of Equity, the Capital Asset Pricing Model (CAPM) can be used. Therefore, one should sum the return of the risk-free rate to the multiplication of the beta of equity by the market risk premium (Sharpe, 1999). The market risk premium is the expected return of the market minus the risk-free rate and according to general assumptions averages around 5.5% (Damodaran, 2014). For the risk-free rate, a German government bond yield can be used as it is displaying a rather low risk. The current yield for a 10-year bond is 2.67% (Financial Times, 2025).

As this example is based on an anonymous big pharma company no information of the beta is available. That is why a beta is calculated in the following through a peer comparison. Table 3 shows company information as of 31st of December 2024 of pharmaceutical companies. The peer group is restricted to large, big research-driven pharmaceutical companies with global operations and diversified therapeutic portfolio. Novartis (Exchange-Rates.org, 2025b; Novartis, 2025; yahoo finance, 2025c), Roche (Exchange-Rates.org, 2025b; Roche, 2025; yahoo finance, 2025d), Sanofi (Sanofi, 2025; yahoo finance, 2025e), Merck KGaA (Merck, 2025; yahoo finance, 2025b) and GSK (Exchange-Rates.org, 2025a; GSK, 2025; yahoo finance, 2025a) are among the top global pharma firms by R&D expenditure, revenue scale and geographic footprint. These companies share similar exposure to clinical development risk and patent lifecycle management which can lead to idle capacity and therefore an average of their unlevered beta is used for the business case. Based on yahoo finance and annual reports of the companies the share price, shares outstanding, levered beta and net debt are researched.

The market capitalization is calculated by multiplying the share price with the shares outstanding. Following, the net debt to equity ratio is calculated to unlever the company specific beta which is influenced by the capital structure of the company. To determine a comparable unlevered beta the companies' levered betas are divided by (1+ (1-tax rate of 25%) * Debt/Equity).

Company	Share Price (€)	Shares Outstand. (m)	Market Cap. (b)	Net Debt (m€)	Net Debt/ Equity	Levered ß	Unlevered ß
Novartis	94.41	1,920	175.19	28.6	0.16	0.44	0.39
Roche	271.95	690	187.55	18.49	0.09	0.17	0.16
Sanofi	93.14	1,250	116.43	8.77	0.08	0.37	0.34
Merck KGaA	139.95	447	62.58	7.16	0.11	0.73	0.66
GSK	32.68	2,050	66.99	15.84	0.24	0.23	0.19

Table 3: Beta Calculation of Comparable Companies

The average of the unlevered betas is 0.35. To apply the average unlevered beta to the anonymous company, its debt to equity ratio is required. As this information is not available due to confidentiality reasons, a theoretical capital structure needs to be defined. The capital structure can be based on the peer-group average debt to equity ratio, the median or an assumed target leverage consistent with the broader industry. In this case, the median of 0.11 is chosen to minimize outlier debt to equity ratios. The Hamada equation is applied to the average unlevered beta of the comparable companies and the assumed capital structure of the anonymous big pharma company (Hamada, 1972). Hence, the unlevered beta of 0.35 is multiplied with (1+(1-tax rate of 25%) * debt to equity ratio of 0.11). The levered beta of the anonymous company results in 0.38. According to CAPM, 2.67% for the risk-free rate is added to the multiplication of 0.38 with 5.5% as the market risk premium. The cost of equity equals 4.74%.

For the cost of debt calculation, the two options are to analyze current bonds of each company and their corresponding yield to maturity (YTM) or to analyze the credit rating of the peer group. The coupon rate, the price as percentage of par, the outstanding amount and in most cases the YTM of each bond are available online on the website Trade View (e.g.,Trading View, 2026c). The market value of a bond is calculated by multiplying the price by the outstanding amount. If the bond's currency is not euros, the market value is converted to euros. For nine bonds, the YTM is calculated based on the price, coupon and years until maturity. To compute a company's weighted average cost of debt, each bond's YTM is multiplied with its market value. Then the results are summed and ultimately divided by the company's total market value of debt. Table 4 shows the results for each company and detailed data for the calculations are provided in appendices 1 to 5. To obtain the peer group YTM of 3.6%, each company's average YTM is weighted again. The credit rating of the companies is ranging from AA to A which corresponds to a credit spread of 0.6% to 0.85%. According to the credit spread and the risk-free rate, the costs of debt were calculated as displayed in table 4 (NYU; Damodaran, 2025). The average cost of debt is 3.4% according to the credit rating approach. As the example company could be in a less

strong credit situation and the YTM approach tends to be more accurate, 3.6% as cost of debt is selected for the WACC calculation.

Company	Average YTM	Credit Agency Rating	Cost of Debt
Novartis	3.66%	AA- (Fitch) = 0.6%	2.67%+ 0.6% =3.27%
Roche	3.77%	AA (Fitch) =0.6%	2.67%+ 0.6% =3.27%
Sanofi	2.92%	AA (S&P) =0.6%	2.67%+ 0.6% =3.27%
Merck KGaA	2.92%	A (S&P) =0.85%	2.67%+ 0.85% =3.52%
GSK	4.03%	A (S&P) =0.85%	2.67%+ 0.85% =3.52%

Table 4: Cost of Debt of Comparable Companies

Ultimately, based on the calculated costs of equity, the net debt to equity ratio, the costs of debt and the tax rate the WACC can be calculated to 4.54%: 4.74%*(1 / (1+0.11)) + 3.6%*(0.11/ (1+0.11)) * (1-0.25).

4.5 Applied Discounted Cash Flow Analysis

The following figures 2 and 3 illustrate the business case calculation, while appendix 6 to 9 provide the formulars used in the calculation. The offer is for ten years with the production volume as mentioned above. The goal is to define the minimum price the company needs to charge to avoid losses. Therefore, with the help of goal seek function, after all assumptions and numbers are inserted, the NPV is set to zero by changing the floor price in 2026. The price is projected to increase in line with a two percent inflation rate, and the costs outlined in the rows below will follow a similar trend. The raw material cost is determined based on the volume required and a price of 170€ per kg. For around 7,500 kg, the manufacturing department anticipates a production time of two months. Consequently, the monthly energy costs of 150,000€ are multiplied by two. Energy costs are developing according to the volume and the production time. In 2027, production is expected to last four months, followed by six months in 2028 and eight months in both 2029 and 2030. After this period, production will gradually decrease to six months and then four months. Maintenance expenses are 25,000€ per month and will be allocated in accordance with the production schedule until the end of 2029, when the machine is projected to be discontinued in the base case. At that point, the full maintenance costs will need to be covered by the product to ensure compliance with GMP. Waste is calculated based on the volume. New machine parts and invested CAPEX will depreciate over a period of ten years. Therefore, the first depreciation expense of 400,000€ starts in 2025, based on the initial investment of four million euros. This amount will increase to 800,000€ over the subsequent nine years with the second investment of four million euros in year 2026. In the final year only the remaining 400,000€ of the second investment will be depreciated. These values are reflected in the calculation to capture the tax benefit generated from the resulting lower earnings before interest and taxes (EBIT). Net Sales minus product and overhead cost, lead to the EBIT. For a discounted cash flow calculation, the free operating cash flow (FOCF) is needed. That is why taxes are added for a tax benefit or deducted for a tax payment as they are cash relevant. Depreciation is non-cash relevant and added back on the EBIT. Inventory is binding cash which cannot be invested, hence the difference between each year is analysis relevant. Ultimately, the investment which causes the new depreciation is cash and decision relevant and deducted from the net cash flow resulting in the

FOCF. The FOCF shows how much cash flow is available each year. Though, the value needs to be discounted to the day of the decision with the WACC of 4.54% to understand the real value of the offer compared to investing the money in the market. The cumulation of the present values of the FOCF should lead to a positive net present value at the end of the contract term to indicate a value creating project. In this calculation, with the goal seek function of excel the NPV was set to zero to define the cost of production and the minimum price at 335€.

The minimum price can develop according to the inflation or a price index which needs to be defined in a potential contract. To increase accuracy of the assumptions, a sensitivity analysis can be done by changing the incremental costs by, for example, 10-20% up and down. This will support the decision-making process of setting the final price to the client.

	2025	2026	2027	2028	2029	2030
Quantity / Volume		7,500	17,500	22,500	27,500	27,500
Floor Price		335	342	348	355	362
Net Sales		**2,511,225**	**5,976,715**	**7,838,035**	**9,771,417**	**9,966,846**
Raw Materials		1,300,500	3,095,190	4,059,121	5,060,370	5,161,578
Indirect Material		76,500	182,070	238,772	297,669	303,622
Labor Production						552,040
Energy Costs		306,000	624,240	955,087	1,298,919	1,324,897
Labor Quality						121,449
Maintenance		51,000	104,040	159,181	216,486	331,224
Waste Expenditures		459	1,092	1,433	1,786	1,822
Transportation		3,060	7,283	9,551	11,907	12,145
Labor Warehouse				106,121	108,243	110,408
Product Costs	**0**	**1,737,519**	**4,013,915**	**5,529,265**	**6,995,380**	**7,919,185**
Transfer Costs	1,000,000					
New Depreciation	400,000	800,000	800,000	800,000	800,000	800,000
CMO Coordinator	130,000	66,300	45,084	34,489	28,143	23,922
Other Management Costs	10,000	10,200	10,612	11,262	12,190	13,459
EBIT	**-1,540,000**	**-102,794**	**1,107,104**	**1,463,019**	**1,935,704**	**1,210,280**
Tax Rate	25%	25%	25%	25%	25%	25%
Taxes	385,000	25,699	-276,776	-365,755	-483,926	-302,570
+- Depreciation	400,000	800,000	800,000	800,000	800,000	800,000
Gross Cash Flow	**-755,000**	**722,904**	**1,630,328**	**1,897,265**	**2,251,778**	**1,707,710**
Delta in Inventory		1,737,519	2,276,396	1,515,350	1,466,115	923,805
Net Cash Flow	**-755,000**	**-1,014,615**	**-646,068**	**381,915**	**785,663**	**783,905**
Investments	4,000,000	4,000,000				
Free Operating Cash flow	**-4,755,000**	**-5,014,615**	**-646,068**	**381,915**	**785,663**	**783,905**
Present Value of FOCF	-4,755,000	-4,796,838	-591,171	334,287	657,819	627,843
NPV (cummulated PV of FOCF)	**-4,755,000**	**-9,551,838**	**-10,143,009**	**-9,808,723**	**-9,150,904**	**-8,523,061**

Figure 2: DCF Calculation 2025 - 2030

	2031	2032	2033	2034	2035
Quantity / Volume	23,000	21,000	17,000	14,000	
Floor Price	370	377	385	392	
Net Sales	**8,502,626**	**7,918,532**	**6,538,445**	**5,492,294**	
Raw Materials	4,403,295	4,100,808	3,386,096	2,844,320	
Indirect Material	259,017	241,224	199,182	167,313	
Labor Production	563,081	574,343	585,830	597,546	
Energy Costs	1,013,546	1,033,817	702,996	717,056	
Labor Quality	123,878	126,355	128,883	131,460	
Maintenance	337,849	344,606	351,498	358,528	
Waste Expenditures	1,554	1,447	1,195	1,004	
Transportation	10,361	9,649	7,967	6,693	
Labor Warehouse	112,616	114,869			
Product Costs	**6,825,197**	**6,547,118**	**5,363,646**	**4,823,919**	
Transfer Costs					
New Depreciation	800,000	800,000	800,000	800,000	400,000
CMO Coordinator	26,940	30,945	36,257	43,331	
Other Management Costs	15,157	17,410	20,399	24,379	
EBIT	**835,332**	**523,059**	**318,143**	**-199,335**	**-400,000**
Tax Rate	25%	25%	25%	25%	25%
Taxes	-208,833	-130,765	-79,536	49,834	100,000
+- Depreciation	800,000	800,000	800,000	800,000	400,000
Gross Cash Flow	**1,426,499**	**1,192,294**	**1,038,607**	**650,499**	**100,000**
Delta in Inventory	-1,093,988	-278,080	-1,183,472	-539,726	-4,823,919
Net Cash Flow	**2,520,486**	**1,470,374**	**2,222,079**	**1,190,225**	**4,923,919**
Investments					
Free Operating Cash flow	**2,520,486**	**1,470,374**	**2,222,079**	**1,190,225**	**4,923,919**
Present Value of FOCF	1,931,032	1,077,582	1,557,757	798,154	3,158,537
NPV (cummulated PV of FOCF)	**-6,592,029**	**-5,514,448**	**-3,956,691**	**-3,158,537**	**0**

Figure 3: DCF Calculation 2031 - 2035

As a next step, the strategy department needs to analyze the price in the market and the willingness to pay from the client through market research and analysis of the competitive advantage versus other CMOs like described in chapter 2.4. After a comparison of the minimum price calculated in the DCF with the market data, an attractive price including a margin can be defined. In reality, the company was aware that the market price was approximately 600€ per kilogram, making it feasible to negotiate a price in that range. Prior to the negotiations, a reservation price was defined with a potential zone of agreement between 500€ to 630€ incorporating a margin, competitive advantages and market data. A reservation price of 500€ was established, which allowed negotiation flexibility, facilitating the opportunity to secure the contract and following the goal of idle cost dilution while maintaining a high overall margin ranging between 34% and 44%. By using the final price of 600€ per kilogram in the DCF analysis, the value of the contract was calculated to be 30 million euros.

5. Conclusion

This thesis demonstrates a practicable path for big pharmaceutical firms to evaluate and, where appropriate, monetize idle production capacity through contract manufacturing while protecting strategic priorities and controlling financial risk. The central message is that the decision to act as a CMO is not primarily a financial exercise but a strategic one that requires clear positioning, an operational evaluation process of inquiries and valuation based on decision-relevant incremental cash flows rather than full product costing.

At the strategic level, a company must first decide how important CMO activities should be and which of three strategic options to adopt: opportunistic (fill short-term gaps), strategic utilization (steady contribution from spare lines) or a dedicated CMO business unit (long-term strategic pillar). Either way, a framework needs to be developed on how to handle the business. It should include topics like governance, acceptable client profiles and contract terms, a position on potentially required investments, an analysis on which machine lines are idle and rules for prioritizing internal versus external production when capacity is scarce. It is important to explicitly leverage and communicate the company's durable competitive advantages like regulatory expertise, process quality and global supply networks. This supports to capture client's willingness-to-pay for a premium CMO beyond cost-driven Asian CMO competitors.

Operationalizing the strategy requires an efficient, layered inquiry and decision process. A rapid initial screening should assess strategic fit, client financial stability, intellectual property and territorial constraints, product complexity and internal capacity. A decision matrix that rates production lines by availability and technology against client and product fit is a practical tool to prioritize opportunities and to identify when investments are necessary. Promising opportunities then move to a site-level technical and regulatory feasibility analysis that quantifies required investments, transfer costs and resource needs, so that the minimum price per kg of product can be calculated. Cross-functional teams of production, quality, supply chain, finance and legal should work together, consolidate findings and produce a well-documented offer rationale.

From a costing and valuation perspective, offers must be priced using decision-relevant incremental costs which depend on the compared alternative and discounted cash flow analysis. The standard accounting rules for product costing cannot be followed, because many sunk and irrelevant costs are included there. The thesis shows how to classify costs (direct/indirect, fixed/variable, and step-fixed) and to separate avoidable costs, future outlays and opportunity costs from sunk, unavoidable and committed items when comparing an opportunity to a clearly defined base case. At this point, finance depends on the outcome of the strategic discussion on the importance of the CMO business and the future of machine lines which have idle capacity.

After classifying the costs depending on the information given, the incremental cash flows over the contract horizon should be discounted at an appropriate weighted average cost of capital to derive a defensible floor price. To calculate the cost of equity of the WACC, the market values of comparable companies should be considered. For the cost of debt, the own credit rating and outstanding bonds are

an indication. If the net present value of the case equals zero, no loss is to be expected if a manager sets the floor price as their minimum acceptable bid. Therefore, prices above this level generate a positive contribution margin toward diluting fixed site costs. If the price is even higher compared to the full costing approach, also from an accounting perspective, a positive contribution is made. The practical example in this thesis is calculated over a ten-year horizon, uses a calculated WACC of 4.54% based on peer comparison and derives through a DCF a floor price of 335€ per kg active ingredient.

Given that forecasts and the value of flexibility drive outcomes in the pharmaceutical industry, this thesis recommends complementing DCF floor price calculations with sensitivity analysis, real-option thinking and contractual mechanisms that limit risks. Real options serve as a crucial mechanism, even though their value can be challenging to assess, as they raise awareness of the potential loss of opportunities for in-house production expansion and rapid product launches if the CMO business is pursued. Conducting sensitivity testing on volumes and incremental costs helps to quantify price ranges, thereby improving the negotiation position. Also, short initial contract terms can reduce long-term forecasting risks. The contract design should also address CAPEX allocations, minimum volumes, performance metrics and liability provisions so that hidden costs and operational risks are minimized.

The thesis identifies several important limitations. Results are sensitive to long-term volume and cost assumptions and to market price dynamics. The industry-specific strategic literature is relatively sparse, so empirical market benchmarking and ongoing information gathering are essential. In addition, scenarios for the return of internal demand, for example, if R&D productivity increases or a new product requires the same lines, must be explicitly modelled and embedded into allocation rules. The practical example focused on defining the minimum price for the example offer, however the discussion on market prices is outstanding. A second area for further research is the definition of contract details. It is important to define the contract well, to not be surprised by unexpected costs through contractual gaps.

To translate the framework into operational decisions, the immediate next steps for companies are to strategically define how important the CMO business should be and what goal it should achieve. Secondly, to build the inquiry and cross-functional review process. To support business case calculators, a company should implement a cost-classification template and a workflow on how to gather important information for a DCF analysis. Ultimately, contract templates can minimize operational risk and provide pricing strategies. Executed with discipline, this approach enables pharmaceutical firms to monetize idle capacity in a way that contributes to fixed-cost dilution, preserves strategic control and limits risk.

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Appendix

Appendix 1: Bond Information of Novartis and Calculation of Market Value (Trading View, 2026c)

Bond Name	Outstanding Amount	Currency	Market price (% of Par)	YTM	Market Value	Market Value in €
Novartis Capital Corp. 5.3% 05-NOV-2055	550,000,000	USD	96.79%	5.52%	532,345,000	514,351,739
Novartis Capital Corp. 2.75% 14-AUG-2050	1,250,000,000	USD	63.41%	5.48%	792,625,000	765,834,275
Novartis Capital Corp. 4.7% 18-SEP-2054	750,000,000	USD	88.89%	5.47%	666,675,000	644,141,385
Novartis Capital Corp. 4.4% 06-MAY-2044	1,850,000,000	USD	88.07%	5.43%	1,629,295,000	1,574,224,829
Novartis Capital Corp. 4.0% 20-NOV-2045	1,250,000,000	USD	82.94%	5.41%	1,036,750,000	1,001,707,850
Novartis Capital Corp. 5.2% 05-NOV-2045	350,000,000	USD	97.52%	5.40%	341,320,000	329,783,384
Novartis Capital Corp. 3.7% 21-SEP-2042	500,000,000	USD	82.87%	5.25%	414,350,000	400,344,970
Novartis Capital Corp. 4.6% 05-NOV-2035	925,000,000	USD	98.90%	4.72%	914,825,000	883,903,915
Novartis Capital Corp. 4.2% 18-SEP-2034	1,100,000,000	USD	97.58%	4.53%	1,073,380,000	1,037,099,756
Novartis Capital Corp. 4.3% 05-NOV-2032	925,000,000	USD	99.40%	4.34%	919,450,000	888,372,590
Novartis Capital Corp. 2.2% 14-AUG-2030	1,500,000,000	USD	92.15%	4.21%	1,382,250,000	1,335,529,950
Novartis Capital Corp. 4.1% 05-NOV-2030	175,000,000	USD	99.87%	4.10%	174,772,500	168,865,190
Novartis Capital Corp. 4.0% 18-SEP-2031	850,000,000	USD	99.48%	4.08%	845,580,000	816,999,396
Novartis Capital Corp. 3.8% 18-SEP-2029	1,000,000,000	USD	99.57%	3.90%	995,700,000	962,045,340
Novartis Capital Corp. 3.1% 17-MAY-2027	1,000,000,000	USD	99.10%	3.83%	991,000,000	957,504,200
Novartis Capital Corp. 3.9% 05-NOV-2028	700,000,000	USD	100.14%	3.75%	700,980,000	677,286,876
Novartis Capital Corp. 2.0% 14-FEB-2027	1,250,000,000	USD	98.43%	3.70%	1,230,375,000	1,188,788,325
Novartis Finance S.A. 1.7% 14-AUG-2038	750,000,000	EUR	82.41%	3.45%	618,075,000	618,075,000
Novartis Finance S.A. 1.375% 14-AUG-2030	750,000,000	EUR	94.84%	2.59%	711,300,000	711,300,000
Novartis Finance S.A. 0.625% 20-SEP-2028	500,000,000	EUR	95.75%	2.31%	478,750,000	478,750,000
Novartis Finance S.A. 1.625% 09-NOV-2026	600,000,000	EUR	99.57%	2.20%	597,420,000	597,420,000
Novartis Finance S.A. 1.125% 30-SEP-2027	600,000,000	EUR	98.32%	2.17%	589,920,000	589,920,000
Novartis AG 1.85% 18-JUN-2049	199,000,000	CHF	110.85%	1.36%	220,591,500	234,797,593
Novartis AG 1.85% 18-JUN-2040	280,000,000	CHF	109.00%	1.21%	305,200,000	324,854,880
Novartis AG 1.75% 16-JUN-2034	645,000,000	CHF	106.19%	0.97%	684,925,500	729,034,702
Novartis AG 1.05% 11-MAY-2035	325,000,000	CHF	101.20%	0.91%	328,900,000	350,081,160
Novartis AG 1.65% 18-JUN-2031	435,000,000	CHF	105.07%	0.68%	457,054,500	486,488,810
Novartis AG 0.625% 13-NOV-2029	550,000,000	CHF	100.85%	0.40%	554,675,000	590,396,070
Novartis AG 1.6% 18-JUN-2027	650,000,000	CHF	101.73%	0.33%	661,245,000	703,829,178

Appendix 2: Bond Information of Roche and Calculation of Market Value (Trading View, 2026d)

Bond Name	Outstanding Amount	Currency	Market price (% of Par)	YTM	Market Value	Market Value in €
Roche Holdings, Inc. 2.607% 13-DEC-2051	2,000,000,000	USD	61.08%	5.42%	1,221,660,000	1,180,367,892
Roche Holdings, Inc. 5.218% 08-MAR-2054	1,600,000,000	USD	97.78%	5.34%	1,564,480,000	1,511,600,576
Roche Holdings, Inc. 5.218% 08-MAR-2054	1,600,000,000	USD	98.33%	5.33%	1,573,280,000	1,520,103,136
Genentech, Inc. 5.25% 15-JUL-2035	288,450,000	USD	99.61%	5.30%	287,325,045	277,613,458
Roche Holdings, Inc. 4.0% 28-NOV-2044	650,200,000	USD	85.80%	5.19%	557,871,600	539,015,540
Roche Holdings, Inc. 4.985% 08-MAR-2034	1,250,000,000	USD	98.48%	5.15%	1,231,000,000	1,189,392,200
Roche Holdings, Inc. 4.909% 08-MAR-2031	750,000,000	USD	99.09%	5.07%	743,175,000	718,055,685
Roche Holdings, Inc. 4.79% 08-MAR-2029	875,200,000	USD	99.31%	4.95%	869,161,120	839,783,474
Roche Holdings, Inc. 7.0% 01-MAR-2039	1,120,000,000	USD	119.62%	4.95%	1,339,744,000	1,294,460,653
Roche Holdings, Inc. 4.666% 02-DEC-2035	800,000,000	USD	99.27%	4.74%	794,160,000	767,317,392
Roche Holdings, Inc. 4.592% 09-SEP-2034	1,000,000,000	USD	99.50%	4.66%	995,000,000	961,369,000
Roche Holdings, Inc. 4.985% 08-MAR-2034	1,250,000,000	USD	102.78%	4.64%	1,284,750,000	1,241,325,450
Roche Holdings, Inc. 5.593% 13-NOV-2033	1,600,000,000	USD	106.48%	4.59%	1,703,680,000	1,646,095,616
Roche Holdings, Inc. 4.374% 02-DEC-2032	600,000,000	USD	99.73%	4.41%	598,380,000	578,154,756
Roche Holdings, Inc. 2.375% 28-JAN-2027	850,000,000	USD	98.20%	4.26%	834,700,000	806,487,140
Roche Holdings, Inc. 2.076% 13-DEC-2031	2,000,000,000	USD	88.81%	4.25%	1,776,200,000	1,716,164,440
Roche Holdings, Inc. 4.909% 08-MAR-2031	750,000,000	USD	103.14%	4.22%	773,550,000	747,404,010
Roche Holdings, Inc. 5.489% 13-NOV-2030	1,250,000,000	USD	105.45%	4.21%	1,318,125,000	1,273,572,375
Roche Holdings, Inc. 4.075% 02-DEC-2030	500,000,000	USD	99.90%	4.09%	499,500,000	482,616,900
Roche Holdings, Inc. 2.625% 15-MAY-2026	1,000,000,000	USD	99.62%	4.06%	996,200,000	962,528,440
Roche Holdings, Inc. 4.203% 09-SEP-2029	900,000,000	USD	100.53%	4.04%	904,770,000	874,188,774
Roche Holdings, Inc. 0.991% 05-MAR-2026	650,000,000	USD	99.77%	4.02%	648,505,000	626,585,531
Roche Finance Europe BV 3.564% 03-MAY-2044	850,000,000	EUR	94.17%	4.02%	800,445,000	800,445,000
Roche Holdings, Inc. 4.79% 08-MAR-2029	875,200,000	USD	102.26%	4.01%	894,979,520	864,729,212
Roche Holdings, Inc. 3.625% 17-SEP-2028	650,000,000	USD	99.24%	3.92%	645,060,000	623,256,972
Roche Holdings, Inc. 2.314% 10-MAR-2027	1,250,000,000	USD	98.32%	3.90%	1,229,000,000	1,187,459,800
Roche Holdings, Inc. 5.265% 13-NOV-2026	1,100,000,000	USD	101.10%	3.88%	1,112,100,000	1,074,511,020
Roche Holdings, Inc. 5.338% 13-NOV-2028	1,250,000,000	USD	103.78%	3.88%	1,297,250,000	1,253,402,950
Roche Holdings, Inc. 1.93% 13-DEC-2028	2,000,000,000	USD	94.86%	3.84%	1,897,200,000	1,833,074,640
Roche Finance Europe BV 3.586% 04-DEC-2036	900,000,000	EUR	100.72%	3.50%	906,480,000	906,480,000
Roche Finance Europe BV 3.355% 27-FEB-2035	500,000,000	EUR	100.90%	3.24%	504,500,000	504,500,000
Roche Finance Europe BV 3.227% 03-MAY-2030	650,000,000	EUR	102.31%	2.64%	665,015,000	665,015,000
Roche Finance Europe BV 3.204% 27-AUG-2029	750,000,000	EUR	102.02%	2.60%	765,150,000	765,150,000
Roche Finance Europe BV 3.312% 04-DEC-2027	600,000,000	EUR	101.56%	2.43%	609,360,000	609,360,000
Roche Kapitalmarkt AG 1.13% 27-AUG-2040	185,000,000	CHF	98.28%	1.26%	181,818,000	193,527,079
Roche Kapitalmarkt AG 1.17% 06-SEP-2039	275,000,000	CHF	99.40%	1.22%	273,350,000	290,953,740
Roche Kapitalmarkt AG 1.95% 15-SEP-2038	230,000,000	CHF	109.55%	1.13%	251,965,000	268,191,546
Roche Kapitalmarkt AG 1.0% 25-FEB-2037	300,000,000	CHF	99.55%	1.04%	298,650,000	317,883,060
Roche Kapitalmarkt AG 1.0975% 06-SEP-2034	420,000,000	CHF	101.08%	0.97%	424,536,000	451,876,118
Roche Kapitalmarkt AG 0.8775% 27-AUG-2035	255,000,000	CHF	99.39%	0.94%	253,444,500	269,766,326
Roche Kapitalmarkt AG 1.75% 15-SEP-2033	190,000,000	CHF	106.26%	0.89%	201,894,000	214,895,974
Roche Kapitalmarkt AG 2.0% 23-SEP-2032	375,000,000	CHF	107.70%	0.80%	403,875,000	429,884,550
Roche Kapitalmarkt AG 0.75% 25-FEB-2031	625,000,000	CHF	100.60%	0.63%	628,750,000	669,241,500
Roche Kapitalmarkt AG 0.75% 24-SEP-2030	400,000,000	CHF	100.85%	0.56%	403,400,000	429,378,960
Roche Kapitalmarkt AG 0.4625% 27-MAY-2030	335,000,000	CHF	99.67%	0.54%	333,894,500	355,397,306
Roche Kapitalmarkt AG 0.985% 06-SEP-2029	250,000,000	CHF	101.64%	0.52%	254,100,000	270,464,040
Roche Kapitalmarkt AG 1.6% 15-SEP-2028	140,000,000	CHF	102.92%	0.47%	144,088,000	153,367,267
Roche Kapitalmarkt AG 0.5% 25-FEB-2027	825,000,000	CHF	100.10%	0.41%	825,825,000	879,008,130
Roche Kapitalmarkt AG 0.45% 23-MAR-2029	340,000,000	CHF	100.15%	0.40%	340,510,000	362,438,844
Roche Kapitalmarkt AG 1.5% 23-JUN-2026	425,000,000	CHF	100.47%	0.27%	426,997,500	454,496,139
Roche Holdings, Inc. FRN 13-NOV-2026	300,000,000	USD	100.41%	4.08%	301,230,000	291,048,426

Appendix 3: Bond Information of Sanofi and Calculation of Market Value (Trading View, 2026e)

Bond Name	Outstanding Amount	Currency	Market price (% of Par)	YTM	Market Value	Market Value in €
Sanofi SA 4.2% 03-NOV-2032	1,200,000,000	USD	99.33%	4.31%	1,191,948,000	1,151,660,158
Sanofi SA 3.625% 19-JUN-2028	1,000,000,000	USD	99.44%	3.87%	994,400,000	960,789,280
Sanofi SA 3.8% 03-NOV-2028	400,000,000	USD	100.02%	3.79%	400,076,000	386,553,431
Sanofi SA 3.75% 03-NOV-2027	400,000,000	USD	100.21%	3.62%	400,824,000	387,276,149
Sanofi SA 1.875% 21-MAR-2038	1,250,000,000	EUR	83.32%	3.60%	1,041,500,000	1,041,500,000
Sanofi 1.25% 21-MAR-2034	500,000,000	EUR	86.22%	3.20%	431,100,000	431,100,000
Sanofi SA 3.0% 23-JUN-2032	750,000,000	EUR	100.22%	2.96%	751,650,000	751,650,000
Sanofi SA 2.75% 11-MAR-2031	650,000,000	EUR	99.25%	2.91%	645,092,500	645,092,500
Sanofi SA 2.625% 23-JUN-2029	750,000,000	EUR	99.94%	2.64%	749,535,000	749,535,000
Sanofi SA 1.375% 21-MAR-2030	2,000,000,000	EUR	95.26%	2.60%	1,905,260,000	1,905,260,000
Sanofi 1.5% 01-APR-2030	1,000,000,000	EUR	95.74%	2.59%	957,430,000	957,430,000
Sanofi 0.875% 21-MAR-2029	650,000,000	EUR	95.24%	2.48%	619,060,000	619,060,000
Sanofi 1.125% 05-APR-2028	700,000,000	EUR	97.35%	2.40%	681,415,000	681,415,000
Sanofi SA 1.0% 21-MAR-2026	1,500,000,000	EUR	99.84%	2.30%	1,497,645,000	1,497,645,000
Sanofi 0.5% 13-JAN-2027	1,150,000,000	EUR	98.38%	2.26%	1,131,335,500	1,131,335,500
Sanofi 1.75% 10-SEP-2026	1,510,000,000	EUR	99.70%	2.25%	1,505,470,000	1,505,470,000
Sanofi SA FRN 11-MAR-2027	850,000,000	EUR	99.99%	2.39%	849,915,000	849,915,000
Sanofi SA 1.25% 06-APR-2029	650,000,000	EUR	96.15%	2.54%	624,975,000	624,975,000
Sanofi SA FRN 03-NOV-2027	500,000,000	USD	100.49%	4.02%	502,450,000	485,467,190
Sanofi SA FRN 03-NOV-2028	500,000,000	USD	100.66%	4.29%	503,290,000	486,278,798

Appendix 4: Bond Information of Merck and Calculation of Market Value (Trading View, 2026b)

Bond Name	Outstanding Amount	Currency	Market price (% of Par)	YTM	Market Value	Market Value in €
Merck Financial Services GmbH 0.875% 05-JUL-2031	800,000,000	EUR	89.54%	3.00%	716,280,000	716,280,000
Merck Financial Services GmbH 2.375% 15-JUN-2030	500,000,000	EUR	98.63%	2.71%	493,165,000	493,165,000
Merck Financial Services GmbH 0.5% 16-JUL-2028	750,000,000	EUR	95.57%	2.38%	716,790,000	716,790,000
Merck Financial Services GmbH 0.375% 05-JUL-2027	600,000,000	EUR	97.28%	2.35%	583,680,000	583,680,000
Merck Financial Services GmbH 1.875% 15-JUN-2026	500,000,000	EUR	99.86%	2.26%	499,300,000	499,300,000
Merck KGaA 2.875% 25-JUN-2079	633,900,000	EUR	98.35%	2.94%	623,440,650	623,440,650
Merck KGaA 1.625% 09-SEP-2080	270,600,000	EUR	99.24%	1.65%	268,532,616	268,532,616
Merck KGaA 3.75% 24-NOV-2055	850,000,000	EUR	99.99%	3.75%	849,915,000	849,915,000
Merck KGaA 3.875% 27-AUG-2054	800,000,000	EUR	101.40%	3.80%	811,200,000	811,200,000

Appendix 5: Bond Information of GSK and Calculation of Market Value (Trading View, 2026a)

Bond Name	Outstanding Amount	Currency	Market price (% of Par)	YTM	Market Value	Market Value in €
GlaxoSmithKline Capital Plc 5.25% 10-APR-2042	477,820,000	GBP	96.53%	5.58%	461,239,646	557,777,104
GlaxoSmithKline Capital Plc 6.375% 09-MAR-2039	631,300,000	GBP	108.38%	5.46%	684,202,940	827,406,615
GlaxoSmithKline Capital, Inc. 4.2% 18-MAR-2043	500,000,000	USD	87.40%	5.33%	437,000,000	422,229,400
GlaxoSmithKline Capital Plc 1.625% 12-MAY-2035	750,000,000	GBP	75.03%	5.06%	562,725,000	680,503,343
GlaxoSmithKline Capital, Inc. 6.375% 15-MAY-2038	2,750,000,000	USD	111.95%	5.05%	3,078,625,000	2,974,567,475
GlaxoSmithKline Capital, Inc. 4.875% 15-APR-2035	750,000,000	USD	100.78%	4.77%	755,850,000	730,302,270
GlaxoSmithKline Capital Plc 5.25% 19-DEC-2033	574,170,000	GBP	104.38%	4.58%	599,318,646	724,756,039
GlaxoSmithKline Capital, Inc. 4.5% 15-APR-2030	850,000,000	USD	101.54%	4.09%	863,090,000	833,917,558
GlaxoSmithKline Capital Plc 3.375% 01-JUN-2029	1,000,000,000	USD	97.87%	4.06%	978,700,000	945,619,940
GlaxoSmithKline Capital Plc 1.25% 12-OCT-2028	750,000,000	GBP	93.11%	4.00%	698,325,000	844,484,423
GlaxoSmithKline Capital, Inc. 3.875% 15-MAY-2028	1,750,000,000	USD	100.16%	3.81%	1,752,800,000	1,693,555,360
GlaxoSmithKline Capital Plc 4.315% 12-MAR-2027	400,000,000	USD	100.58%	3.77%	402,320,000	388,721,584
GSK Capital BV 3.25% 19-NOV-2036	600,000,000	EUR	96.66%	3.63%	579,960,000	579,960,000
GSK Capital BV 3.125% 28-NOV-2032	700,000,000	EUR	99.73%	3.17%	698,110,000	698,110,000
GSK Capital BV 2.875% 19-NOV-2031	700,000,000	EUR	98.87%	3.09%	692,090,000	692,090,000
GlaxoSmithKline Capital Plc 1.75% 21-MAY-2030	750,000,000	EUR	95.80%	2.80%	718,500,000	718,500,000
GlaxoSmithKline Capital Plc 1.375% 12-SEP-2029	500,000,000	EUR	95.63%	2.66%	478,150,000	478,150,000
GSK Capital BV 3.0% 28-NOV-2027	500,000,000	EUR	100.96%	2.45%	504,800,000	504,800,000
GlaxoSmithKline Capital Plc 1.25% 21-MAY-2026	1,000,000,000	EUR	99.70%	2.27%	997,000,000	997,000,000
GlaxoSmithKline Capital Plc 1.0% 12-SEP-2026	700,000,000	EUR	99.25%	2.26%	694,750,000	694,750,000
GlaxoSmithKline Capital Plc FRN 12-MAR-2027	600,000,000	USD	100.38%	3.84%	602,280,000	581,922,936

Appendix 6: Business Case Calculation with Formulars 2025 - 2027

	A	B	C	D	E	F	G
1							
2	**Variables**				**2025**	**2026**	**2027**
3	Inflation	2%		Quantity / Volume		7,500	17,500
4	WACC	5%		Floor Price		335	342
5				**Net Sales**		**=Qty * Floor Price**	**=Qty * Floor Price**
6				Raw Materials		=(170*(1+Inflation)^(1))*Qty	=(170*(1+Inflation)^(2))*Qty
7				Indirect Material		=(10*(1+Inflation)^(1))*Qty	=(10*(1+Inflation)^(2))*Qty
8				Labor Production			
9				Energy Costs		=(150000*2)*(1+Inflation)^(1)	=(150000*4)*(1+Inflation)^(2)
10				Labor Quality			
11				Maintenance		=(25000*2)*(1+Inflation)^(1)	=(25000*4)*(1+Inflation)^(2)
12				Waste Expenditures		=(Qty/5000)*300*(1+Inflation)^(1)	=(Qty/5000)*300*(1+Inflation)^(2)
13				Transportation		=(Qty/5000)*2000*(1+Inflation)^(1)	=(Qty/5000)*2000*(1+Inflation)^(2)
14				Labor Warehouse			
15				**Product Costs**	**=SUM(E6:E14)**	**=SUM(F6:F14)**	**=SUM(G6:G14)**
16				Transfer Costs	1,000,000		
17				New Depreciation	=Investments 2025/10	=∑(Investments) / 10	=∑(Investments) / 10
18				CMO Coordinator	130,000	=130000/2*(1+Inflation)^(1)	=130000/3*(1+Inflation)^(2)
19				Other Management Costs	10,000	=Other Mgt Costs*(1+Inflation)^(1)	=Other Mgt Costs*(1+Inflation)^(2)
20				**EBIT**	**=Product Cost - SUM(E15:E19)**	**=Product Cost - SUM(F15:F19)**	**=Product Cost - SUM(F15:F19)**
21				Tax Rate	25%	25%	25%
22				Taxes	=EBIT*(-Tax Rate)	=EBIT*(-Tax Rate)	=EBIT*(-Tax Rate)
23				+- Depreciation	=New Depreciation	=New Depreciation	=New Depreciation
24				**Gross Cash Flow**	**=EBIT+Taxes+Depreciation**	**=EBIT+Taxes+Depreciation**	**=EBIT+Taxes+Depreciation**
25				Delta in Inventory		=Product Cost (Current - Previous Year)	=Product Cost (Current - Previous Year)
26				**Net Cash Flow**	**=Gross Cash Flow - Δ**	**=Gross Cash Flow - Δ**	**=Gross Cash Flow - Δ**
27				Investments	4,000,000	4,000,000	
28				**Free Operating Cash flow**	**= Net Cash Flow - Investments**	**= Net Cash Flow - Investments**	**= Net Cash Flow - Investments**
29				Present Value of FOCF	=FOCF/(1+WACC)^(0)	=FOCF/(1+WACC)^(1)	=FOCF/(1+WACC)^(2)
30				**NPV (cummulated PV of FOCF)**	**=(PV of FOCF)**	**=∑(PV of FOCF)**	**=∑(PV of FOCF)**

Appendix 7: Business Case Calculation with Formulars 2028 - 2030

Variables	
Inflation	2%
WACC	5%

	2028	2029	2030
Quantity / Volume	22,500	27,500	27,500
Floor Price	348	355	362
Net Sales	**=Qty * Floor Price**	**=Qty * Floor Price**	**=Qty * Floor Price**
Raw Materials	=(170*(1+Inflation)^(3))*Qty	=(170*(1+Inflation)^(4))*Qty	=(170*(1+Inflation)^(5))*Qty
Indirect Material	=(10*(1+Inflation)^(3))*Qty	=(10*(1+Inflation)^(4))*Qty	=(10*(1+Inflation)^(5))*Qty
Labor Production			=500000*(1+Inflation)^(5)
Energy Costs	=(150000*6)*(1+Inflation)^(3)	=(150000*8)*(1+Inflation)^(4)	=(150000*8)*(1+Inflation)^(5)
Labor Quality			=110000*(1+Inflation)^(5)
Maintenance	=(25000*6)*(1+Inflation)^(3)	=(25000*8)*(1+Inflation)^(4)	=(25000*12)*(1+Inflation)^(5)
Waste Expenditures	=(Qty/5000)*300*(1+Inflation)^(3)	=(Qty/5000)*300*(1+Inflation)^(4)	=(Qty/5000)*300*(1+Inflation)^(5)
Transportation	=(Qty/5000)*2000*(1+Inflation)^(3)	=(Qty/5000)*2000*(1+Inflation)^(4)	=(Qty/5000)*2000*(1+Inflation)^(5)
Labor Warehouse	=100000*(1+Inflation)^(3)	=100000*(1+Inflation)^(4)	=100000*(1+Inflation)^(5)
Product Costs	**=SUM(H6:H14)**	**=SUM(I6:I14)**	**=SUM(J6:J14)**
Transfer Costs			
New Depreciation	=∑(Investments) / 10	=∑(Investments) / 10	=∑(Investments) / 10
CMO Coordinator	=130000/4*(1+Inflation)^(3)	=130000/5*(1+Inflation)^(4)	=130000/6*(1+Inflation)^(5)
Other Management Costs	=Other Mgt Costs*(1+Inflation)^(3)	=Other Mgt Costs*(1+Inflation)^(4)	=Other Mgt Costs*(1+Inflation)^(5)
EBIT	**=Product Cost - SUM(F15:F19)**	**=Product Cost - SUM(F15:F19)**	**=Product Cost - SUM(F15:F19)**
Tax Rate	25%	25%	25%
Taxes	=EBIT*(-Tax Rate)	=EBIT*(-Tax Rate)	=EBIT*(-Tax Rate)
+- Depreciation	=New Depreciation	=New Depreciation	=New Depreciation
Gross Cash Flow	**=EBIT+Taxes+Depreciation**	**=EBIT+Taxes+Depreciation**	**=EBIT+Taxes+Depreciation**
Delta in Inventory	=Product Cost (Current - Previous Year)	=Product Cost (Current - Previous Year)	=Product Cost (Current - Previous Year)
Net Cash Flow	**=Gross Cash Flow - Δ**	**=Gross Cash Flow - Δ**	**=Gross Cash Flow - Δ**
Investments			
Free Operating Cash flow	**= Net Cash Flow - Investments**	**= Net Cash Flow - Investments**	**= Net Cash Flow - Investments**
Present Value of FOCF	=FOCF/(1+WACC)^(3)	=FOCF/(1+WACC)^(4)	=FOCF/(1+WACC)^(5)
NPV (cummulated PV of FOCF)	**=∑(PV of FOCF)**	**=∑(PV of FOCF)**	**=∑(PV of FOCF)**

Appendix 8: Business Case Calculation with Formulars 2031 - 2033

Variables	
Inflation	2%
WACC	5%

	2031	2032	2033
Quantity / Volume	23,000	21,000	17,000
Floor Price	370	377	385
Net Sales	**=Qty * Floor Price**	**=Qty * Floor Price**	**=Qty * Floor Price**
Raw Materials	=(170*(1+Inflation)^(6))*Qty	=(170*(1+Inflation)^(7))*Qty	=(170*(1+Inflation)^(8))*Qty
Indirect Material	=(10*(1+Inflation)^(6))*Qty	=(10*(1+Inflation)^(7))*Qty	=(10*(1+Inflation)^(8))*Qty
Labor Production	=500000*(1+Inflation)^(6)	=500000*(1+Inflation)^(7)	=500000*(1+Inflation)^(8)
Energy Costs	=(150000*6)*(1+Inflation)^(6)	=(150000*6)*(1+Inflation)^(7)	=(150000*4)*(1+Inflation)^(8)
Labor Quality	=110000*(1+Inflation)^(6)	=110000*(1+Inflation)^(7)	=110000*(1+Inflation)^(8)
Maintenance	=(25000*12)*(1+Inflation)^(6)	=(25000*12)*(1+Inflation)^(7)	=(25000*12)*(1+Inflation)^(8)
Waste Expenditures	=(Qty/5000)*300*(1+Inflation)^(6)	=(Qty/5000)*300*(1+Inflation)^(7)	=(Qty/5000)*300*(1+Inflation)^(8)
Transportation	=(Qty/5000)*2000*(1+Inflation)^(6)	=(Qty/5000)*2000*(1+Inflation)^(7)	=(Qty/5000)*2000*(1+Inflation)^(8)
Labor Warehouse	=100000*(1+Inflation)^(6)	=100000*(1+Inflation)^(7)	
Product Costs	**=SUM(K6:K14)**	**=SUM(L6:L14)**	**=SUM(M6:M14)**
Transfer Costs			
New Depreciation	=∑(Investments) / 10	=∑(Investments) / 10	=∑(Investments) / 10
CMO Coordinator	=130000/6*(1+Inflation)^(6)	=130000/6*(1+Inflation)^(7)	=130000/6*(1+Inflation)^(8)
Other Management Costs	=Other Mgt Costs*(1+Inflation)^(6)	=Other Mgt Costs*(1+Inflation)^(7)	=Other Mgt Costs*(1+Inflation)^(8)
EBIT	**=Product Cost - SUM(F15:F19)**	**=Product Cost - SUM(F15:F19)**	**=Product Cost - SUM(F15:F19)**
Tax Rate	25%	25%	25%
Taxes	=EBIT*(-Tax Rate)	=EBIT*(-Tax Rate)	=EBIT*(-Tax Rate)
+- Depreciation	=New Depreciation	=New Depreciation	=New Depreciation
Gross Cash Flow	**=EBIT+Taxes+Depreciation**	**=EBIT+Taxes+Depreciation**	**=EBIT+Taxes+Depreciation**
Delta in Inventory	=Product Cost (Current - Previous Year)	=Product Cost (Current - Previous Year)	=Product Cost (Current - Previous Year)
Net Cash Flow	**=Gross Cash Flow - Δ**	**=Gross Cash Flow - Δ**	**=Gross Cash Flow - Δ**
Investments			
Free Operating Cash flow	**= Net Cash Flow - Investments**	**= Net Cash Flow - Investments**	**= Net Cash Flow - Investments**
Present Value of FOCF	=FOCF/(1+WACC)^(6)	=FOCF/(1+WACC)^(7)	=FOCF/(1+WACC)^(8)
NPV (cummulated PV of FOCF)	**=∑(PV of FOCF)**	**=∑(PV of FOCF)**	**=∑(PV of FOCF)**

Appendix 9: Business Case Calculation with Formulars 2034 - 2035

	A	B	C	D	N	O
1						
2	**Variables**				**2034**	**2035**
3	Inflation	2%		Quantity / Volume	14,000	
4	WACC	5%		Floor Price	392	
5				**Net Sales**	**=Qty * Floor Price**	
6				Raw Materials	=(170*(1+Inflation)^(9))*Qty	
7				Indirect Material	=(10*(1+Inflation)^(9))*Qty	
8				Labor Production	=500000*(1+Inflation)^(9)	
9				Energy Costs	=(150000*4)*(1+Inflation)^(9)	
10				Labor Quality	=110000*(1+Inflation)^(9)	
11				Maintenance	=(25000*12)*(1+Inflation)^(9)	
12				Waste Expenditures	=(Qty/5000)*300*(1+Inflation)^(9)	
13				Transportation	=(Qty/5000)*2000*(1+Inflation)^(9)	
14				Labor Warehouse		
15				**Product Costs**	**=SUM(N6:N14)**	
16				Transfer Costs		
17				New Depreciation	=∑(Investments) / 10	=Investments 2026 /10
18				CMO Coordinator	=130000/6*(1+Inflation)^(9)	
19				Other Management Costs	=Other Mgt Costs*(1+Inflation)^(9)	
20				**EBIT**	**=Product Cost - SUM(F15:F19)**	**=Product Cost - SUM(F15:F19)**
21				Tax Rate	25%	25%
22				Taxes	=EBIT*(-Tax Rate)	=EBIT*(-Tax Rate)
23				+- Depreciation	=New Depreciation	=New Depreciation
24				**Gross Cash Flow**	**=EBIT+Taxes+Depreciation**	**=EBIT+Taxes+Depreciation**
25				Delta in Inventory	=Product Cost (Current - Previous Year)	=Product Cost (Current - Previous Year)
26				**Net Cash Flow**	**=Gross Cash Flow - Δ**	**=Gross Cash Flow - Δ**
27				Investments		
28				**Free Operating Cash flow**	**= Net Cash Flow - Investments**	**= Net Cash Flow - Investments**
29				Present Value of FOCF	=FOCF/(1+WACC)^(9)	=FOCF/(1+WACC)^(10)
30				**NPV (cummulated PV of FOCF)**	**=∑(PV of FOCF)**	**0**

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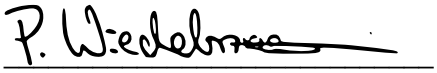

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