1) Which two projects would you advance? What would you do with the rest?

Given the information available and using rational assumptions, we suggest that CBS pursue projects RP-A and RP-C, discard RP-B and sideline RP-D. We discuss our rationale behind each candidate.

RP-A is considered the most promising candidate, justifiably so. There is a proven market for it and CBS has existing knowledge in enzA inhibitors. RP-A is the most advanced of the candidates, meaning it would likely reach market the fastest which helps alleviate long-term financial strain and uncertainty. More importantly, and in agreement with several executives, it is imperative that CBS gains momentum and builds individual market presence, despite RP-A's lack of scientific excitement. On the other hand, medical impact is not always correlated with commercial success, RP-A could be hugely profitable even in a contested market.

The least promising and highest risk candidate, RP-B, has advantages such as a strong commercial potential and strong support within CBS. However, there is both a negative track record from rival companies when attempting to develop such a drug and an excessive reliance on the passing of a legislative bill to access a key market. Scrapping RP-B will unlock valuable resources needed to pursue RP-A, RP-C and explore other directions.

We suggest CBS pursue the development of RP-C, a drug which has raised significant scientific and commercial excitement. It is a market-shaping, blockbuster opportunity. It stems from an existing, successful, drug RP-O which may require product cannibalization by CBS. There are concerns regarding contractual obligations relating to RP-O as well as high development costs. These are ameliorated by RP-A's much more advanced stage and hopefully earlier market entry, providing CBS with more certainty.

Whilst the potentially billion-dollar RP-D drug is the most innovative candidate with the highest return, it is the least developed and highest risk project. CBS is potentially best-in-class in this area however the complexity, costliness and time-sensitivity of pursuing RP-D mean we suggest CBS does not currently pursue it. Sidelining RP-D development provides a safety-net should any early-stage complications arise with RP-C. Alternatively, we encourage CBS to pursue a partnership/licensing agreement for RP-D.

From a quantitative perspective, data used in the r-NPV analysis shows RP-A and RP-C have significantly higher probabilities of reaching market, contributing to their higher expected returns compared to RP-B and RP-D [Appendix 1].

Through selectionism, CBS can seek success from two different projects. Costs are prohibitively high and failure could have negative impacts on the image and momentum of the organisation, something CEO Katherine Scott expressed concern over. Our balanced project portfolio accounts for these concerns.

Simultaneously pursuing RP-A and RP-C would require restructuring the company into autonomous project teams. Even if the projects share common tasks or processes, the drug design will be at different stages and are likely too complex for transfer of knowledge. Other combinations such as RP-B with RP-C or RP-D with RP-C are ill-advised according to the Chief Scientific Officer, either because their target markets overlap or the pressure they would pose on new infrastructure.

Joint development projects and alliances are commonplace in pharmaceuticals. Whilst they bring challenges in intellectual property, international politics and decision making, their benefits are gargantuan. Distributing costs and workload shares risk, alleviates financial

strain and empowers companies like CBS to develop drugs it would otherwise not have the capability or capacity to. An understanding of this system is essential when selecting a portfolio. Firms must decide between pursuing projects solo or establishing their placement on the partnership spectrum, ranging from pure licensing to Mergers & Acquisitions.

CBS is a serious company that produces serious drugs. Hedging risk and building momentum is paramount to its current strategic position, RP-A and RP-C are the best candidates for this.

2) What other information would have been useful before decision-making?

1. What are the financial implications to CBS regarding RP-O if RP-C is pursued? Are these accounted for in the r-NPV analysis?
2. What are the logistics of developing RP-D as a partnership, is there interest from both CBS and firms in the market? What time-sensitive related risks exist?
3. What is employee opinion on the candidates? A bar chart with their top choice would help guide decision making.
4. What are the rough timeframes of each candidate, preferably in a Critical Path Diagram or Gantt chart, so planning and forecasting of supplies, materials, labour and cash-flow could be considered?

3) What management systems/processes are needed to make good decisions?

Project portfolio selection requires quantitative analysis and assessment of strategic fit. Multi-attribute decision matrices are helpful when shortlisting significantly different projects, such as in CBS's case. Portfolio-planning is an iterative process where current and future gaps are identified and explored in line with corporate strategy. RP-A is CBS's most probable opportunity at commercial success and gaining market share in pharmaceuticals. RP-C allows CBS to innovate and create a new market, reinforcing the serious and scientific identity of the drug manufacturer.

Current gaps can be identified by considering the portfolio and a firm's current positions against the industry. Whether it's market-leading, or at least top 5, in a relevant attribute or process, can dictate if a project should be pursued. Cascading strategic objectives is a complex process that helps redefine value proposition and further establish a significant competitive advantage. Gaps often exist within organisations between where strategic decisions are made and where knowledge and opportunities are identified. There can also be gaps between adjacent but unrelated business units (be that projects or departments). The inherent complexity can be reduced by identifying simple trade-offs and engaging key stakeholders into a portfolio deliberation. Effective bottom-up information transmission is pivotal to good decision making.

There are two fundamental approaches to managing highly uncertain projects, these are selectionism (known as parallel trialling) or learning/experimentation. Both are typically used to address intra-project problems. We extend this rationale to explain how CBS, and other firms, can motivate their inter-project decision-making. Logically, iterative learning through trial and error is unfeasible in the pharmaceuticals industry for myriad reasons (cost, time, product specificity etc.). As such, a 'waterfall' project management scheme is better suited to CBS than an 'agile' scheme; the nature of a firms work often dictates its preferred scheme, which must suit its project portfolio. Firms would also do well to identify and address project-specific difficulties separate to organisation-specific difficulties when managing projects. Sometimes, these can overlap, thus careful portfolio selection can redefine or optimize company strategy.

Some of the biggest obstacles to innovation in medium-to-large companies are office politics and lack of cultural alignment. On a surface level, CBS does not seem to struggle with any of these, evidenced by the considerable involvement of scientists in decision-making. Whilst key C-suite executives typically have a say in key decisions, CBS and similar firms could benefit greatly from assembling small committees with a handful of key personnel from all rungs of the leadership-ladder when filtering projects. Combining technical, administrative and strategic understanding with varied perspectives and viewpoints unlocks meaningful and productive discussion when objectively assessing a firm's project portfolio.

4) How would you incentivize the development teams for the projects?

Common challenges when working as a team include communication issues, conflicting schedules, free-riding or over-excitement. A high-performing team must have a patient environment in which to ask questions freely and effective channels between team(s) and management. Fewer members reduce communication overhead and decentralizing decision making can help teams focus on their tasks.

Each member must bring value to the team, have shared goals and respect for ideas. Workers relocated from RP-B and RP-D developments should be given a choice in which team to join, budgets and resources allowing, ensuring affinity. When team-members have both high-performance standards and psychological safety, they feel safe to take risks and be vulnerable in-front of each-other. This incentivizes learning by asking questions and making mistakes.

In line with management theory, high-performing managers and team leaders must create and articulate their vision, instil purpose and monitor/reward success. They are typically results oriented and technically savvy, whilst also enabling collaboration across the company. Project leaders with scientific backgrounds and personal passion for the project should be selected.

The most significant reason for project failure is a lack of defined or achievable milestones and objectives to measure progress. The phased drug-development process provides meaningful, timely and precise requirements, helping naturally guide the projects and compartmentalize the planning. Financial incentives or team-wide rewards can be offered upon reaching each milestone, perhaps independent of trial success, to acknowledge and celebrate hard work without over-emphasising approval. For example, a compensated centralised buffers ensure everybody benefits from finishing early, and that buffer is only used when essential.

Companies employ risk management strategies to mitigate potential delays across their project portfolio. To prevent congestion, especially if working on similar projects, CBS could increase capacity flexibility of a team or reduce the variability in workload. If key processes are similar, it could cross-train employees and ask performers to pool resources. However, this contradicts our suggested project-based organisational structure. These tactics may be better suited to a departmental or matrix arrangement. Such strategies must address both exogenous risks that are beyond the firm's locus of control, and endogenous risks which arise from the inner-workings of the project teams or wider organisation.

Appendix 1:

	Overall P(Success)	Revenue (£m) | Success	Max Loss (£m) | Failure	Expected Revenue (£m)
RP-A	0.29	825	-125	150
RP-B	0.16	1275	-125	100
RP-C	0.27	925	-125	160
RP-D	0.095	1675	-125	50