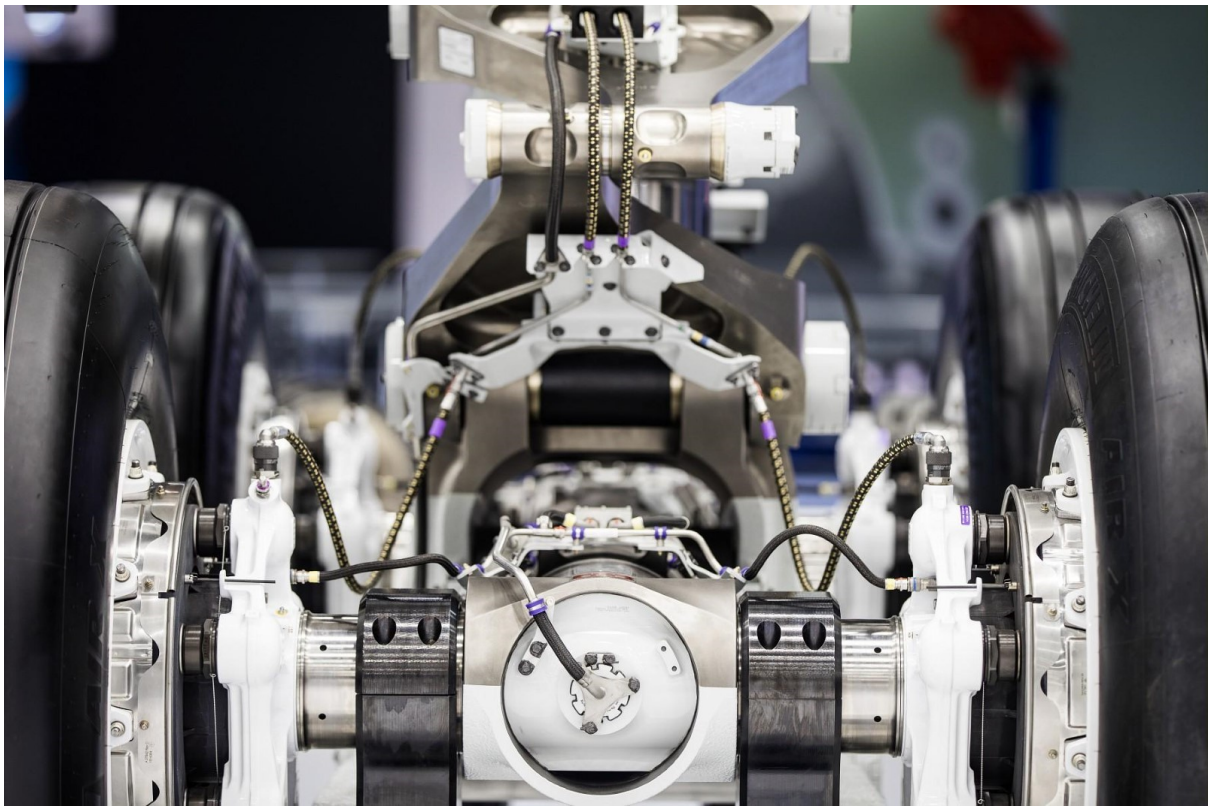
Final Report

SAFRAN LANDING SYSTEMS – TEAM 3



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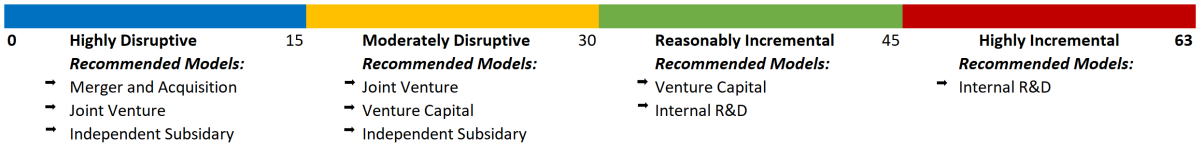
Executive Summary

Problem

Safran Landing Systems is a world leader in aircraft landing gears and braking systems. Their existing innovation funnel is very successful at generating new ideas. However, very few ever surpass TRL 6, demonstrations in relevant environments. Safran has identified a disconnect between their innovation funnel and innovation implementation strategy. They are seeking a methodology that compliments their existing innovation funnel on how to evaluate ideas and the environment required to pursue them.

Solution

We therefore developed an implementation strategy that enables Safran to evaluate their innovation and choose the most suitable innovation model to pursue further development.
The framework we propose ties in with the Innovation Funnel. Concepts are evaluated for their degree of innovation using an assessment matrix. Based on this assessment, different business models are proposed that could be considered for the innovation. For this purpose, the scale of innovation is included in the analysis to involve the concept's magnitude of disruption. The models can then be compared using a viability matrix, from which the most suitable model can be selected and implemented.



Challenges & Mitigation

Innovation is fostered in a supporting environment and, depending on its scale, causes disruption on a more local or global level. Structural and cultural obstructions hinder this process. Some can appear in the process of the proposed innovation models. We therefore create awareness of obstructing company characteristics and recommend beneficial practices to tackle them. Our goal is to pave the way for a smooth implementation of our proposed models to support the innovative process of SLS.

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1. Introduction

1.1. Company Overview

Safran Lading Systems (SLS) is a multinational company that operates 23 research and design, manufacturing, and service sites with 7,000 employees in 8 countries worldwide. It was founded in 1995 as a joint-venture between Messier and the Dowty-Group as Messier-Dowty to develop and manufacture a universal aircraft landing gear to drive cost reductions. After several additional acquisitions and mergers, SLS is now a division of the French stock corporation Safran S.A.

Safran Landing Systems specialises in the development, manufacturing, and maintenance of aircraft landing gears. Their product portfolio includes fully integrated main and nose landing gears, aircraft braking systems as well as systems and equipment for landing gears. SLS supplies clients in the commercial, military and business-aviation sector. Their predominant expertise is in developing landing gear for short, medium, and long-range aircrafts with capacities between 40 and 400+ passengers.

1.2. Problem Statement

Safran Landing Systems is a world leader in medium and large aircraft landing gears and braking systems, and for years has been a pioneer in terms of advanced aerospace-relevant technology. Its innovation funnel is responsible for producing countless innovative ideas that are then narrowed down and explored further using the Trade Readiness Levels (TRL) approach. However, few selected ideas surpass Trade Readiness Level 6 which is the Demonstration in Relevant Environment phase, and achieve TRL 9, the Commercial Operation phase. In other words, Safran has identified a disconnect between their innovation funnel and current idea/project tracking methodology. The company is seeking another methodology that compliments the existing innovation funnel on how to assess and evaluate innovative ideas and the environment required for them.

1.3. Intended Audience & Objective

As the Vice President of Product Development and Research and Technology (R&T) related activates at Safran Landing Systems, Kyle Schmidt represents the company as our primary client. The objective of this project from Kyle is to find and tentatively develop a methodology that compliments SLS's innovation funnel on how to evaluate ideas and peruse them based on three requirements including implementable at regional levels, scalable and adaptable, and focus on the approach to implement such a methodology. Ideally, the solution will be used by employees like Aakash, an R&T project lead interview at SLS, to evaluate new innovative ideas.

1.4. Scope

Since this project is only interacting with Safran Landing Systems Canada, the scope of the project will on focus on the Canadian use of the methodology and will not consider situations outside of Canada. As a result, several factors considered will be tailored: including Canadian law, tax incentives, and potential funding. In addition, the project aims to find the most well-balanced innovation portfolio based on fixed criteria and will not focus on the details of implementation.

2. Background

2.1. Innovation Today

The word 'Innovation' means using new technologies or approaches to thinking to add value to an existing idea or product and to make substantial changes in society. It is obvious that over the past decades, innovation has become the most fundamental way to combat critical risks and threats. It has brought significant changes and improvements to the society we live in. Innovation is important since it fosters growth regarding different aspects. For example, innovation helps to increase market share and revenue/customer growth. One critical aspect of innovation is that it allows the adaptability of different ideas, thoughts, and actions. It also helps to differentiate businesses from another. Innovation means identifying underserved areas in the marketplace, successfully implementing a solution, producing new business avenues. Lastly, innovation also helps to stimulate employees. Although crucial for growth, most innovative ideas and projects fall short when it comes to their execution.

When innovative ideas fail, it reflects the fact that being innovative is important, but being a great innovator is not easy. It is crucial to bring those ideas to reality with successful market planning. The most frequently seen situation is the potential for companies to fall susceptible to the innovator's dilemma. The innovator's dilemma is not just about market leaders falling victim to new disruptive technologies but also how their successes can become their largest obstacle in the face of evolving markets. They choose not to invest in new areas deemed of little importance as they are generally low margin, niche markets that are not entirely applicable to their existing customer base. These niche markets evolve and grow until they impact the market share of the existing incumbents and subsequently result in a substitution of markets leaders with braver innovative enterprises.

2.2. Current SLS Practices

As briefly mentioned earlier, Safran Landing Systems currently possess an innovation funnel, which is the mechanism they use to continuous produce new innovative ideas. Once narrowed and refined, selected ideas are evaluated and tracked using the TRL assessment tool. Trade Readiness Level tool, also known as TRL Scale is used to describe the different stages of pre-commercial development. It starts from Level 1, the basic principles observed, and the report phase to level 9, where the actual technology is proven through successful deployment in an operational setting and commercial operation phase. Figure 1 illustrates the graphical representation of the TRL assessment scale, with TRL 1 starting in the lower left corner.

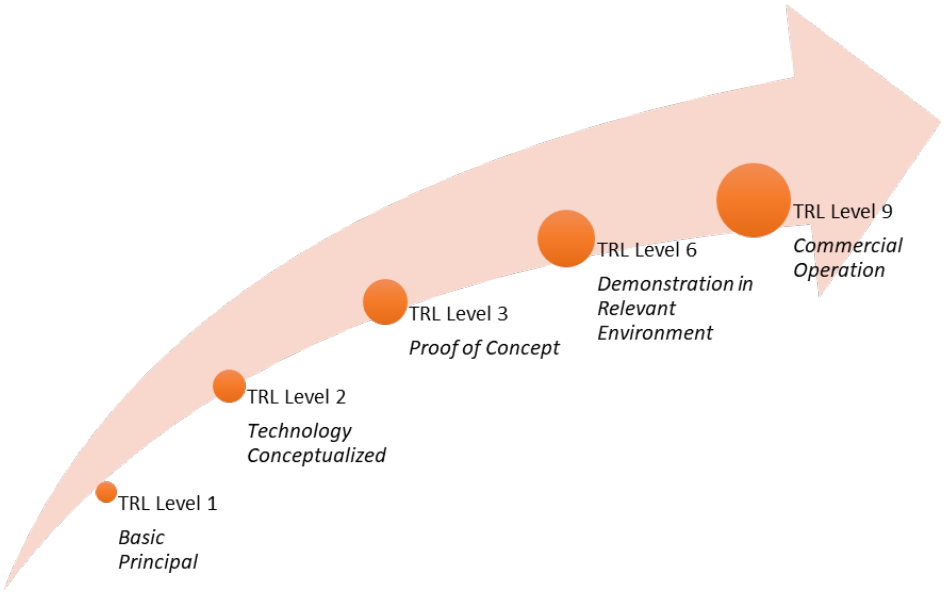

Figure 1: Trade Readiness Levels

However, as selected ideas are evaluated through TRL scale level by level, it has been noticed very few ideas and projects surpass TRL 6, which is the system and/or process prototype demonstration in a simulated environment phase. Various activities including testing the model or prototype in a simulated or laboratory environment take place at this stage.

2.3. Business Case and Impact

Eastman Kodak can be seen as a prime example of the innovator's dilemma. For more than a century, Kodak dominated the analogue film market before eventually filing for bankruptcy. It was shaken by a disruptive technology: digital photography. Ironically, if they had not disregarded the emergence of digital photography, they would still enjoy a dominant share of the market. As a matter of fact, they invented the first digital camera. The issue was that Kodak failed to evaluate the innovation's value and feared that it would undermine their current profitable business model. Safran Landing Systems, the client of this project, is concerned about potential disruptive technologies that could threaten its core business and wants to ultimately avoid a 'Kodak situation'.

In general, successful companies prefer to concentrate their resources on activities that guarantee high earnings, allow them to compete in sizable markets and that meet customers' current needs. However, this can result in them missing the opportunity to ride the next wave of innovation as disruptive technologies are often of no use to existing customers of the company. Nevertheless, disruptive innovation can ultimately create new competitors that overtake the market and eventually push the market leader aside.

2.4. Safran Interviews

To better under SLS's problem and identify possible solutions that align with their needs, the team conducted an interview with a Project Lead within SLS's Research & Technology department, providing more insights into SLS's daily operations

The lead told the team that there is only one person who currently oversees innovative activities at the Toronto site. The disadvantage of having only one person in charge is that they don't have expertise in everything and thus sometimes do not know whether the company would truly benefit from certain innovations.

Moreover, most testing required at TRL 6 is conducted through the test department at Safran Landing systems. However, the resources for testing are often inadequate or slow as innovative ideas come second to other on-going revenue generating operations. This makes it almost impossible for ideas to surpass the required TRLs in timely fashions. Adding to this bottle neck is many signatures often required before official signoffs are granted further hindering development of projects.

The project lead also pointed out that sometimes the management level has a reluctance to new ideas due to insignificant funding and or time. There is no lack of ideas from engineers, but there is a need for an environment that promotes innovation without a fight for money.

Lastly, the lead mentioned that it is important to find a balance between ideas and knowing which problems exist. He stated that the innovation dilemma could be split up into 2 major idea categories: one category comprises of ideas that solve problems Safran Landing Systems is currently facing and the other category focuses on disruptive ideas innovations in market segments that Safran is currently not active in. The distinction between those two is important.

After interviewing the R&T project lead, the team identified several takeaways and drafted additional requirements for the solution. First, the solution needs to create a positive environment that fosters new ideas and second, the solution should provide ease of access to the necessary required resources.

3. Innovation Theme

3.1. Scale

As suitable solutions were searched, the decision was made to focus more on the innovation theme. It was deemed critically important to identify what Safran Landing Systems' innovation ambition is and explore a well-balanced innovation portfolio based on its goal to ensure long-term survival. In addition to finding a suitable innovation portfolio, managing it is also crucial. Innovation refers to the creation that produces value and can be very. It can be as significant as the Iphone or as simply as reducing environmental waste. Companies take the initiative to invest in innovative ideas and projects along a broad spectrum of risk and reward. As in Safran's financial investing of innovation, the goal is to

construct the portfolio that produces the highest overall return that is in keeping with the reasonable appetite for risk.

To achieve the goal, the team utilized the Innovation Ambition Matrix to assess Safran's current situation. Figure 2 below illustrates the three different categories (incremental, adjacent, and disruptive) of innovation with respect to their return and risk.

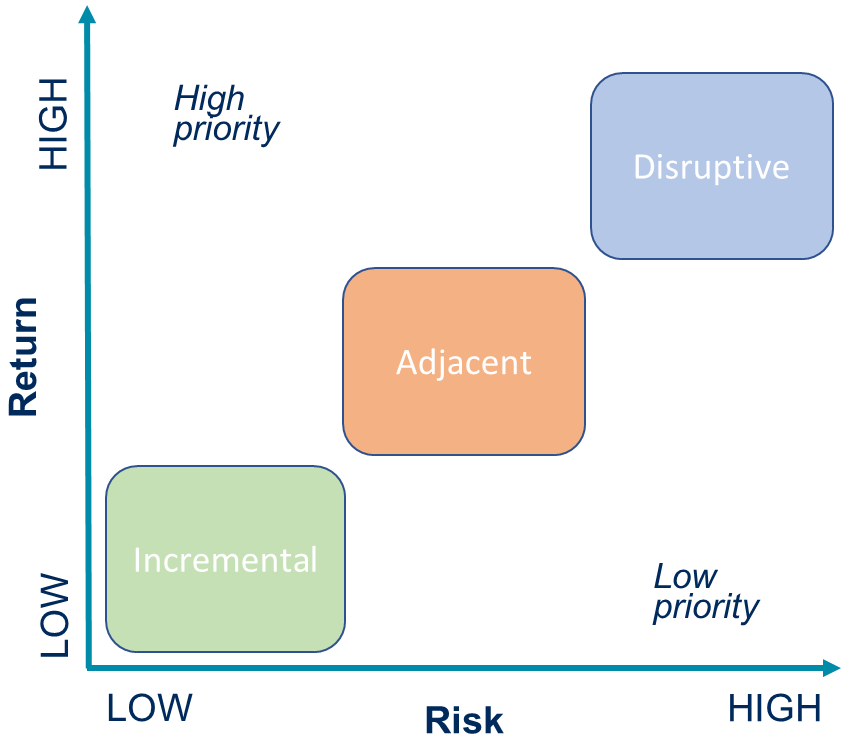

Figure 2: Risk – Return Relationship for Incremental, Adjacent, & Disruptive Technologies

3.1.1. Incremental Innovation

At the lower left position of the matrix is Incremental Innovation, and also known as the Core Innovation Initiatives of the Innovation Ambition Matrix. Incremental Innovation refers to efforts to make incremental changes to existing products and incremental inroads into new markets. Whether the incremental innovation is in the form of new packaging, slight reformulations, or added service convenience, they draw on assets the company already has in place. As shown in the matrix, incremental innovation provides companies with relatively low levels of risk with a similar level of reward.

3.1.2. Adjacent Innovation

In the middle of the matrix is Adjacent Innovation, which involves leveraging something the company does well into a new area or space. This type of innovation allows companies to draw on existing capabilities but necessitates putting those capabilities to some new users. Adjacent Innovation requires fresh, proprietary insight into customer needs, demand trends, market structure, competitive dynamics, technology trends, and other market variables.

3.1.3. Disruptive Innovation

At the opposite corner of the matrix is the last innovation category, Disruptive Innovation. Disruptive Innovations are also called transformational initiatives, designed to create new offers, if not whole new business segments, to serve new markets and customer needs. These are innovations that, when successful, make headlines. They are breakthrough and game-changing innovations that require the company to call on unfamiliar assets, for instance, building capabilities to gain a deeper understanding of customers, to communicate about products that have no direct antecedents, and to develop markets that are not yet mature. Normally, Disruptive Innovation comes with a very high risk but also high reward results.

3.2. Categorization

To efficiently find a well-balanced and suitable portfolio, it is necessary to perform categorization with a suitable criterion. The team has discussed the categorization based on seven criteria including Strategic fit, financial return, resource requirement, risk, time horizon, financial budget, and the comparison between current capabilities and new capabilities. Different parameters are used in the Innovation Assessment Matrix to evaluate the operational models. The following section discusses the potential five operational models.

4. Operational Models

For the purposes of this report, the following 5 operational models were identified and selected as the most ideal environments to explore and develop new ideas and technologies, whether incremental, adjacent, or disruptive:

1. **Existing R&T Department**: Within SLS's existing Research & Technology Department
2. **Independent Department**: Creation of a new Independent Department within SLS
3. **Joint Venture**: Creation of a partnership between SLS and other companies
4. **Merger & Acquisitions**: Merging or acquiring the technology form an existing company
5. **Venture Capital**: Investing in other companies to develop on your behalf

Figure 3 below illustrates the different relationships between degree of disruptiveness and imperativeness to innovation for the 5 models. While not always the case, these are the relationships used for the duration of the report.

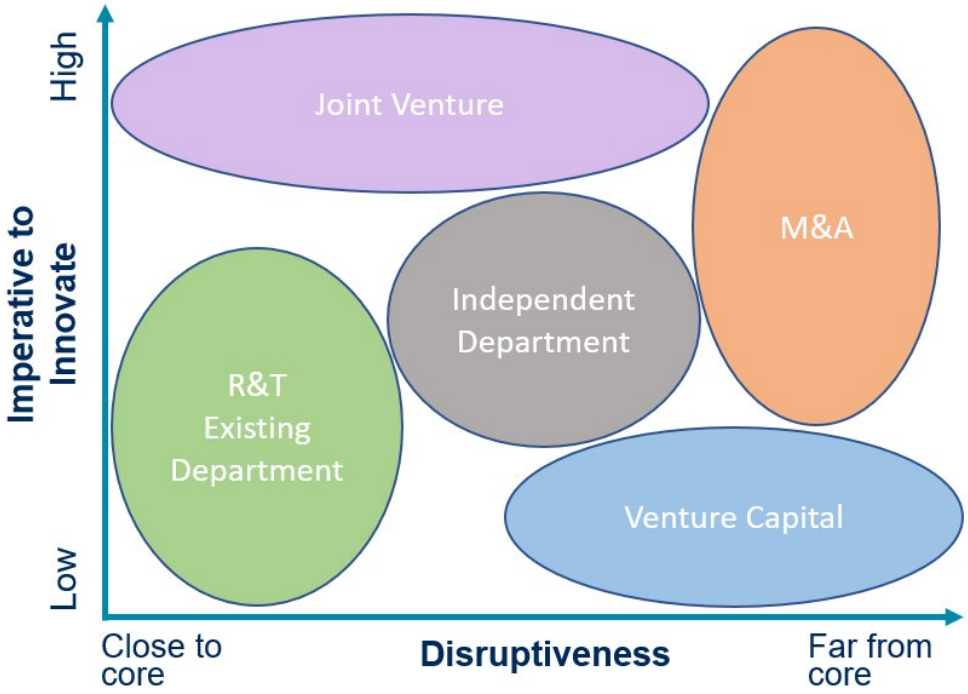

Figure 3: Imperativeness - Disruptiveness Relationship of the Different Operating Models

Sections 4.1 to 4.5 highlight and compare the advantages and disadvantages of the 5 operational models proposed.

4.1. Existing Research & Technology Department

The notion of exploring a new technology within SLS's existing R&T Department is the status-quo solution used for this report. It is underpinned by the idea, minimal change is required, and takes advantages of the current structures and resources in place, and therefore offers the quickest solution to start exploring a new technology or idea. Because minimal change occurs, it is the most financially attractive solution of the 5. It also offers some of the highest proprietary protection as the only involved personnel will be internal SLS employees. With all this said, this environment is susceptible to existing employee biases and cognitive ways of thinking as it relies strongly on the use of SLS's resources (personnel, equipment, & facilities). This avenue also become a hindrance for tax incentives and public funding as there are generally imposed requirements by government agencies of eligible corporations to be of Canadian stature.

The utilization of SLS's existing R&T department for technological developments is generally more suitable to short- and medium-term timeframes with small and medium budgets.

4.2. Separate Independent Department

The downfalls of becoming susceptible to existing biases and cognitive ways of thinking utilizing SLS's existing R&T department, the premise of creating a new separate independent department for the explicit purpose of exploring new technologies looks to mitigate. The creation and use of a new independent department allows for the construction and tailoring of processes and rules that are best

suited for exploring and developing new ideas and technologies. Employees in the department will be shielded from core business operations providing additional development freedom. They will also be able to act in better interest in the development of the technology without fear of oversite. The second advantage of this avenue is that although run independently, it would similarly still be able to utilize SLS equipment and facilities. Unfortunately, it also falls susceptible to the same tax incentives and funding hindrance of SLS being a solely owned foreign company.

The creation of a separate independent department within SLS for technological developments is suitable for all technological timeframes with medium and large budgets.

4.3. Joint Venture

The operational model of a joint venture environment primarily looks to capitalize on the abundance of facilities, equipment, personnel, and most importantly knowledge that would co-exist as a result. This model would see SLS partner with other tier 1 or 2 manufacturing suppliers, or even totally unrelated organizations, to jointly develop the proposed technology. The priority of this model by local, provincial, and federal governments means there are significantly more tax incentives and public funding opportunities, especially if SLS is to partner with smaller local companies. This combined with financial costs being distributed among all members makes this operational model one of the most financially attractive. With this said, the trades off this such environment is the less directional control that results from having multiple members. There are developmental risks member's interests may go against Safran's or diverge during the technological developments.

The creation and utilizing of joint ventures SLS are apart of for technological developments is generally more suitable for longer-term technological timeframes with larger budgets.

4.4. Merger/Acquisition

The premise of SLS conducting mergers or acquisitions (primarily acquisition) to explore new technologies focuses on the notions of offering the quickest theoretical return-on-investment and way of obtaining additional non-biased knowledge and employees. Acquiring the technology and knowledge allows SLS to minimize the management, time, and resources they would otherwise have to dedicate to the development of new ideas. SLS would only be responsible for continuing to develop the technology if still immature. The drawback to such model is the high financial risk SLS would be subject to. Also, acquiring the knowledge or technology still does not guarantee a successful outcome, only an initial advantage. The second main disadvantage to the mergers and acquisitions model are the non-existent tax incentives and public funding that are otherwise available for the other operational models.

Mergers and Acquisitions for the use of developing and exploring new ideas and technologies are suitable to all timeframes and budgets.

4.5. Venture Capital

The last operational model explored to develop a technology for this report is venture capitalism. It looks to capitalize even further upon the notion of minimizing required SLS resources as highlighted in

the merger and acquisition operational model. The premise is it would see SLS invest in other companies, and they would continue to develop the technology on their behalf. This type of model provides the highest exposure to new and emerging fields. There also happens to be large amounts of public funding available if SLS focuses their company investment type on initial startups. Although providing some of the highest chances for return, it also incorporates some of the highest risks. Venture capitalism requires large upfront financial expenditures with an uncertain return on investment. Also, as SLS would most often only be a minority stakeholder, they will be forgoing complete directional control. They are only investing in the principal of the idea.

The venture capital notion of SLS investing in other companies to continue to develop technologies of interest on their behalf is generally most suitable to medium and long timeframes with medium and high financial budgets.

5. Methodology

In this section looks to explain the methodology in further detail. Its goal looks to compliment Safran's existing innovation funnel on how to access and evaluate innovative ideas and the environment required to pursue them. More specifically, a road map is given that provides a step-by-step guide on how to set the innovation strategy in motion. Ultimately the goal of this implementation strategy is to recommend a viable operating model for each specific innovation idea. The implementation strategy encompasses 5 steps, as shown in Figure 4 below.

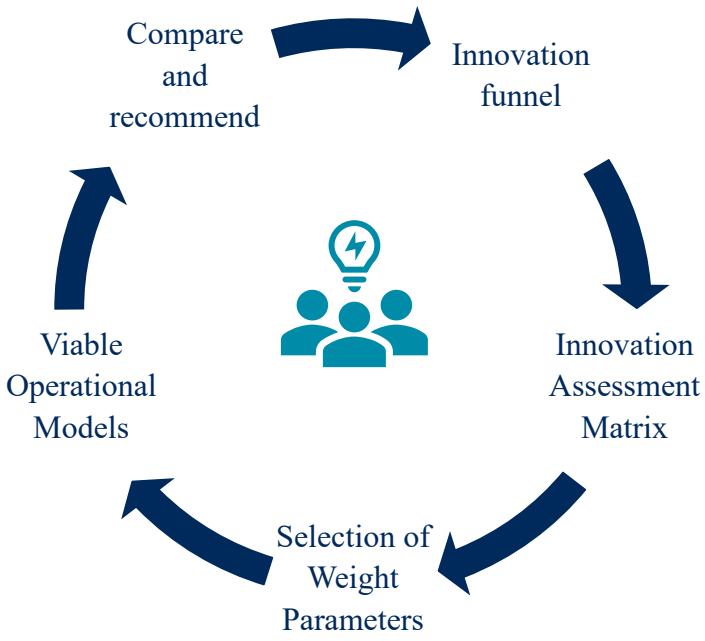

Figure 4: Implementation Strategy Road map

The first step in the strategy is the use of the existing innovation funnel to screen the innovative ideas for viability and profitability. Innovation ideas that don't fit within the current innovation headspace are removed from the potential list of ideas. This ensures that only the best ideas move on to the next phase of the road map. The following steps give an outline on how to explore and scale the selected ideas and then ultimately come to the best environment to proceed the specific idea in.

In the second step, the innovation assessment matrix, which is discussed in detail in Section 6.1, determines the scale of the innovation based on seven different parameters. As explained in Section 3.1 above, the 3 different scales are incremental, adjacent, and disruptive innovation. It is important to distinguish between the different types of innovation to ensure that the innovation portfolio is balanced across multiple dimensions.

Next, based on the scale of innovation the viable operating models are narrowed down as the operating model is core to the success of a company's innovation strategy. This is accomplished by using the innovation assessment matrix in conjunction with a weighting parameter. The weighting parameter is crucial as it account for the relevancy of each of the seven different parameters based on the type of

innovation being evaluated. After this step, the operational model recommendations scale outlines the best business models for a particular idea.

Once the most viable models are known, the operational model viability matrix can be used to compare the applicability of these viable operational models. This matrix will allow Safran to narrow down to one single operating model. The chosen operating model can then be exploited to accelerate and scale the particular innovation idea.

6. Solution Framework

The solution framework comprises an innovation assessment matrix that could evaluate a novel idea on eight critical parameters and recommend suitable business models. Recommendations are made by utilizing a robust scale formulated as part of this framework to suggest viable operational models based on the score achieved by a technology under contention. It lays down a structure for the innovation team to support and scale innovation from a regional level up to the global stage by following this methodology. The framework has been developed after carefully analyzing the approaches undertaken by various companies across the industry for bringing novel technologies from R&D stage to becoming an industry standard. Essential components of this framework are discussed in detail below and represented using the figure below.

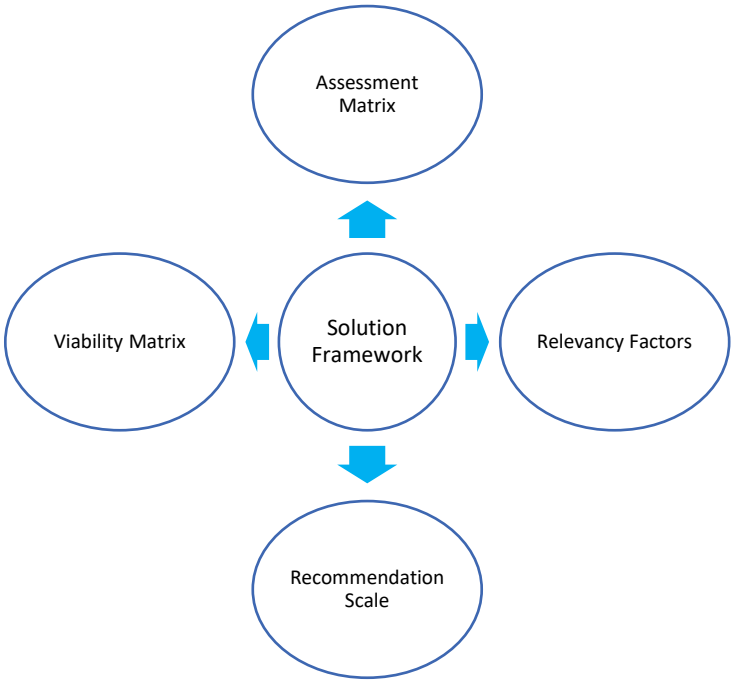

Figure 5: Components of solution framework

6.1. Innovation Assessment Matrix

The assessment matrix is the first component of the solution framework which adjudges the level of innovation based on seven identified parameters impacting implementation decisions. These seven parameters are rated against three different levels where level 3 represents the most favorable outcome and level 1 signifies the least favorable. Each company has its own working culture and financial standing which dictates their risk-taking abilities and commitment level. Therefore, the innovation assessment matrix helps them recognize the scale of innovation prior to making any decisions. To develop a better understanding of the scope of this matrix, evaluations parameters are discussed below:

1. Strategic Fit – The extent to which an opportunity can utilize a company's current capabilities and resources for realizing their current goals and long-term vision is regarded as the Strategic fit. It assesses whether the opportunity will impact their future endeavors and up to what degree this can be aligned with the innovation.

2. Financial Return – Financial return is defined as the money made/lost on an investment over a period of time. In other words, it is the expected change in price of an asset, project or investment over time that could be expected out of a novel idea, if the company decides to pursue it.

3. Resource Requirement – This parameter assesses the proportion of resources required to uptake an innovation out of a company's current workforce and facilities. These resources can be in the form of machining facilities, human labor or even the software owned by the company.

4. Risk – It is one of the critical factors affecting the implementation of strategies of high-level managers as it measures the degree of exposure to a hazardous situation. Risks can vary from tangible assets in the form of financial investment, human resources and intangible assets like a company's reputation and hence should be carefully analyzed.

5. Time Horizon – This parameter assesses the time required to execute the novel idea and take it from a protype stage to in-production stage. This time is proportional to the level of commitment required from the company and hence has a major say on the implementation strategy.

6. Financial Budget – Each company has their allotted budget for research and development activities which influence their choices of innovation decisions. This metric is used to assess the monetary investment needed to support the innovation under contention by measuring it in terms of percentage of the allotted funds.

7. Current vs New Capabilities – The last factor, current vs new capabilities, is a comparative parameter utilized to recognize the competencies gap. It highlights the capabilities that needs to be nurtured to support innovation at the company which directly influence the choice of operational models.

Based on the above parameters and the different levels that could be achieved for each parameter, a preliminary scale was developed to assess the level of innovation as shown in the Figure 6 below. The scale takes attributes of each category of innovation into account for coming up with the suggested score boundaries. For example, if a disruptive idea is evaluated using the innovation assessment matrix, there is a high probability that it will not score more than 9 points and will be accurately classified as disruptive. However, to suggest business models, it is often recommended to take relevancy of each of these parameters into account based on the class of innovation being evaluated. This is why the current scale is not capable to suggest viable business models and require a new mechanism to make it more robust to factors affecting each category of innovation.

Figure 6: Innovation Assessment Scale to assess levels of innovation

The matrix shown in Table 1 describes the different levels of these parameters based on their fulfilment of company's objectives from their current situation. It helps them recognize the scale of innovation alone until it is used in conjunction with a weighting parameter to account for relevancy of each parameter to the type of innovation.

Table 1: Innovation Assessment Matrix

Parameters	Level 1	Level 2	Level 3
Strategic Fit	Unfavorable to company's current goals and long - term vision	Fits into long term vision of the company	Completely aligns with company's current and long-term objectives
Financial Return	Small, incremental increase in revenue	New streams of revenue in currently addressed business segment	Entirely new fields of revenue in new business segment
Resource Requirement	Independent innovation team with allocated facilities, financial budget	Building of a small, focused innovation team; extensive utilization of existing facilities	Allocation of few working hours, testing facilities, software licenses
Risk	Associated risk are very high in terms of company's reputation, invested capital and human resources	Risk is low in terms of company's reputation but fairly high from capital and human resources perspective	Risks involved are minimal from all perspectives
Time Horizon	Requires long-term commitment which is generally over 5 years	Commitment period is intermediate ranging between 2-5 years	Short tenure execution is possible and hence commitment period is limited to 2 years
Financial Budget	Financial expenditures > 25% of annual R&D budget	Financial expenditures 10% - 25% of annual R&D budget	Financial expenditures < 10% of annual R&D budget
Current Vs New Capabilities	Lack of experience and Skills in field of innovation	Partially present Skillset and experience for avenue to explore	Experience and Skillset needed for innovation present in company

6.2. Relevancy Factors Table

As highlighted in previous section, although the innovation matrix is a great tool for assessing the scale of innovation, it is limited in its scope. Therefore, to augment its scope towards recommending viable business models, a weighting parameter needs to be multiplied by the score achieved for each parameter. This weighting parameter assesses the relevancy of the innovation assessment factor for each category of innovation and hence produces a different scale of recommendation. For example, if an idea is disruptive, time horizon is of less importance than its financial return. Similarly, if its an incremental innovation, then current capabilities are more important in comparison to its value for a disruptive idea. This relevancy factors are shown in the figure below.

Table 2: Relevancy Factors Table

Parameters	Incremental innovation	Adjacent Innovation	Disruptive Innovation
Strategic Fit	3.0	2.0	1.0
Financial Return	1.0	3.0	3.0
Resource Requirement	3.0	2.0	2.0
Risk	3.0	2.0	2.0
Time Horizon	3.0	2.0	1.0
Financial Budget	3.0	3.0	3.0
Current Vs New Capabilities	3.0	2.0	1.0

6.3. Operational Model Recommendation

Upon applying the relevancy factors suitably for a particular class of innovation in combination with the innovation assessment matrix, a more robust scale is produced. This scale accounts for all critical factors in their right proportion and hence can be utilized to make recommendations for viable business models. The scale is developed by taking scores from the assessment matrix and multiplying them by the relevancy factors after recognizing the right level of innovation through a preliminary classification scale. There are four segments created through this scale which correctly recognizes the overlap between disruptive and incremental innovation and divides the adjacent innovation category into two separate classes. For example, if an innovation has an overlap between incremental and disruptive innovation, but its characteristics are more familiar to the disruptive category, then it will be classified as moderately disruptive, and the recommended models will also be similar to the ones recommended for disruptive innovation. The operational model recommendation scale is shown in Figure 7 below.

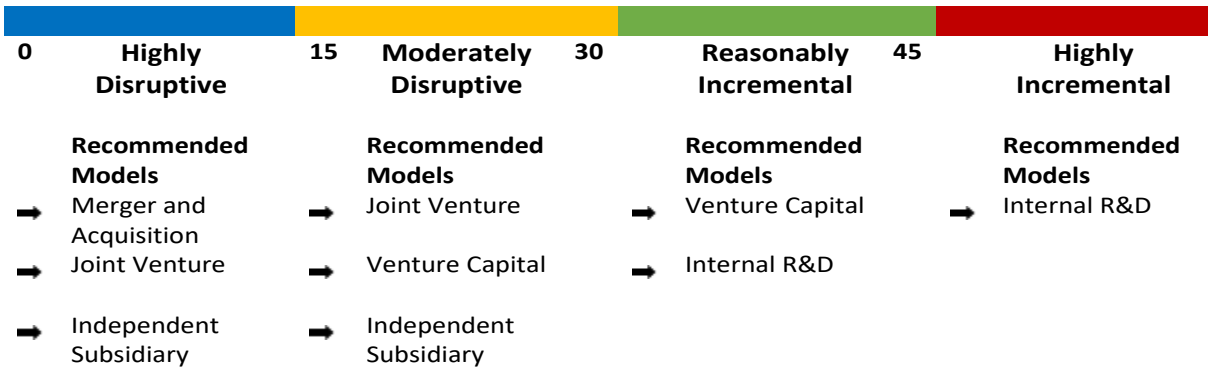

Figure 7: Operational Model Recommendation Scale

The recommendations have been made after analyzing the previous successful innovation ventures taken up by companies across all industries. For example, laser printers were brought into the market by a joint venture between Hewlett Packard and Canon, who realized the potential of this disruptive technology and chose the right operational model for mitigating the risks. Similarly, aircraft chevrons were developed by Boeing, NASA, and General Electric. Even though this technology was not entirely disruptive but could be easily classified as moderately disruptive because of the noise reduction and acoustic weight reductions achieved through it. Hence a joint venture model proved to be successful.

6.4. Operational Models Viability

Although the scale in Figure 7 helps in recognizing the viable operation models for a particular innovation class, it does offer multiple options which could prove to be a hurdle for SLS innovation team. Therefore, to mitigate the conundrum and to make the right choice between recommended models, the proposed solution framework provides a comparative matrix for different models. This matrix assesses different models on seven different metrics rated from high to low. For some metrics, high rating is good while for some a lower rating is better. Therefore, the matrix has been color coded where green represents the most favorable proposition and red represents the least favorable one as shown in the table below.

Table 3: Operational Model Viability Matrix

Parameters	Merger & Acquisition	Independent Subsidiary	Joint Venture	Venture Capital	Internal R&D
Tax Incentives	Low	Medium	High	Low	Low
Alignment with company	Low	High	Medium	Low	High
Resource Requirement	Low	High	Medium	Low	Low
Risk	High	High	Medium	High	Low
Executive Management's Influence	Low	Low	Low	Low	High
Anticipated Budget	High	High	Medium	High	Low
Funding Opportunities	Low	Medium	High	Low	Low

An important attribute of this matrix is that each company can have their own preferences to the above metrics based on their current standing within the market. Hence, some factors could be less important than others for a company and their choice of preference should also be taken into account before narrowing down to a single model. SLS will have the ability to refine these preferences once in actual use.

6.5. Example

In the following, the report demonstrates the function of our innovation methodology by applying it to an exemplary innovation. For that, we chose the implementation of incorporating 3D printing into the manufacturing line at SLS. First, the innovation is rated for each of the seven evaluation parameters. Second, an estimation about the magnitude of innovation is conducted to select a set of relevancy factors. At last, the total score is calculated and the suggestions of our scale for the innovation models are reviewed regarding their viability.

For the presentation of the methodology, it is assumed that the implementation of the 3D printers has already passed through the innovation funnel and is thus considered a useful addition to the production line, so that the next step is to test the feasibility under real environmental conditions.

6.5.1. Rating

For the first parameter, strategic fit, the use of 3D printers is classified as Level 3, as their integration promises an increase in efficiency and a reduction in costs with otherwise little change. However, this is also reflected in the financial return. As it is only a change to the production line, there are no major revenue streams added, resulting in a rating of Level 1. The resource requirement was rated at level 2, as no major purchases in personnel or buildings are required to be made, but test facilities have to be built and new machines must be acquired. This is also directly related to the time horizon, which is also assigned a Level 2. Risk and financial budget are each classified as Level 3. Due to the small scale and impact of the project, there is a low financial outlay and thus also a low risk during implementation. Finally, the integration of 3D printers requires training of the staff in the use of the machines. Apart from this, there are hardly any other new requirements for the workforce, which is why new capabilities are classified as Level 3.

6.5.2. Evaluation

The values derived from the rating above are shown in Table 4. By considering all described characteristics of the 3D printing, it is categorized as incremental on the innovation scale. Therefore, the relevancy factors for incremental change are used for further rating, also shown in Table 4. With the factors applied to the rating, a total score of 49 is calculated, which strongly recommends the operational modal of being explored and implemented by SLS's existing R&T Department. Finally, the feasibility of the business model proposed by our methodology can be checked with the viability matrix Table 3. SLS's Internal R&T Department proves to be very suitable for the innovative concept. It also has low risk and low resource requirements. There are hardly any tax benefits or public fundings for this innovation model. Since it is a project with low financial costs, this is not very significant. Overall, the implementation of the concept of using 3D printers on production lines is suitable for exploring and testing using SLS's Internal R&T Department.

Table 4: Rating of Example Case

Parameters	Value	Relevancy	Total
Strategic Fit	3.0	3.0	9.0
Financial Return	1.0	1.0	1.0
Resource Requirement	2.0	3.0	6.0
Risk	3.0	3.0	9.0
Time Horizon	2.0	3.0	6.0
Financial Budget	3.0	3.0	9.0
Current Vs New Capabilities	3.0	3.0	9.0
Total			**49**

6.6. Addition Considerations

Besides being an excellent tool for an organization to assess their innovation avenues, this tool can be implemented with existing innovation funnels to maximize its impact. There are some key considerations that should be emphasized at this point.

- Companies are generally well-versed with their own market standings and need to diversify their innovation prospects to remain competitive and proactive at the same time. Incremental innovation helps them gain competitive edge over their counterparts while disruptive innovation can help capture a new frontier. Using this tool, businesses can manage their innovation portfolio effectively.

- Apart from highly incremental innovation, the developed tool will always provide multiple execution models which require them to move innovation research outside their premises. This is built into the model to minimize the influence of executive management and let innovation thrive with minimal constraints.

- Although this tool is intended for regional level, some of suggested pathways are only possible with executive level personnel backing the projects. This is often the case in joint ventures, mergers, and acquisitions, sometimes even in venture capital models. Therefore, it is recommended that C-level executives are kept in the loop, and they possess the necessary motivation to back the process for a few high-risk prospects as well.

- Rating can change with time as companies' capabilities, financial budgets and future vision also evolves. Additionally, if a substantial discovery is made while an incremental innovation, the tool can be run and possibly recommend a different pathway to take the technology further. Hence, the tool should be used to assess the innovation at various junctures for sustaining it ahead.

7. Recommendations

When it comes to innovation and the innovation models that are proposed in this report, there are challenges that can obstruct the implementation. These challenges regard different areas of businesses from vertical communication and managerial expectations to an overall innovation harming mindset. By knowing which challenges can occur, a company can actively tackle those to ultimately pave the way for innovation. Therefore, some solution strategies are considered below, that can be easily implemented, to aid in overcoming such innovation obstructions.

7.1. Challenges

7.1.1. Impatient Leadership

When it comes to innovation, two opposing objectives concur with each other: managerial expectations of short-term increases of revenue and the engineering perspective of a thorough development of the concept. Innovation requires high time efforts; only incremental innovations can be applied on short notice but generate minor financial values. From the perspective of the management level, the focus is on strong increases in sales, which, however, cannot be guaranteed by the development department. At the same time, the management is not comprehensively familiar with the progress of the project, resulting in unrealistic demands on the projects time scales. Ultimately, this can put unnecessary pressure on those responsible for the project, which can lead to mistakes and, in the worst case, early termination of the explored idea / project.

7.1.2. Inadequate Benchmarking

Another obstacle to the successful development of innovative concepts is an inappropriate assessment of progress and potential outcomes by the executive level. This includes, among other things, the time pressure described above, but also unrealistic expectations of resources spent, and an overestimation of the financial value added or the influence of the innovation on existing processes and products. These assessments are usually based on predefined performance parameters or direct comparison with competitors in similar market segments and their sales. Innovation, however, is time-consuming and the potential can often only be mapped financially after years of work, which is why management's measurement of progress and figures on an annual basis can give a false impression and can lead to the early withdrawal of management's confidence in the explored idea / project.

7.1.3. Resistance to Change

Innovation means changing existing products or processes. Fear of change can cause the attitude of a company's employees toward innovative concepts to range from skeptical to dismissive. Employees see their jobs in danger or do not want to adjust to changes in the way they work. This fear of change can be found right up to executive level management. The negative consequences of such reluctance can range from missed opportunities to the loss of an entire product line or bankruptcy, as the example of Kodak shows. As a rule, it is a company-wide rejection that is reflected in the culture and harms the business if it is not addressed.

7.1.4. Misalignment of Culture

In particular, the presented models of takeover or merger and the founding of a joint venture bear the risk of misalignment of culture. Here, different ways of managing the company, of communicating and of dealing with innovative ideas come together. Both sides insist on their usual processes and the most efficient way to achieve the desired goal is neglected. This can cause conflicts within the team and with senior managers, which can severely slow down the innovative process or even stop it altogether. Hereby, two previously well-coordinated departments can lose their full potential.

7.1.5. Lack of managerial Support

The more disruptive and distant innovation is from the company's basic business, the more financial efforts and time it requires. As described above, innovation is a key driver of a company's competitiveness, especially in aviation. For this reason, a lack of management support is a threat to the development of new ideas and thus to the company's existence in the long run. Development teams need assurance that their work can continue in the longer term, even if they cannot deliver direct results. Disruptive innovations in particular can attract the disfavor of management. These technologies have the potential to undermine a company's existing business and introduce entirely new revenue streams. This is where the innovators' dilemma becomes apparent, where management prefers the status quo and entrenched business structures and opposes innovation. The consequences can be seen in the example of Kodak.

7.2. Mitigations

7.2.1. Culture of Collaboration

As can be seen from the challenges described, management's relationship with the development teams can have a strong restraining effect on innovation. However, this barrier can be easily overcome through communication and collaboration, both vertically and horizontally. For this, it is important that the management level is continuously committed to a productive and innovation-promoting environment in the R&T department. Longer-term goals must be given more weight than daily performance indicators. At the same time, it is the responsibility of the development teams to keep their supervisors in the loop and update them regularly. Potential problems and delays must be communicated immediately. Realistic assessments of timescales allow management to plan more resiliently. In addition, collaboration between colleagues has a significant impact on the elaboration of ideas. Involving employees in the creative innovation process increases identification with the company and paves the way for the exchange of concepts.

7.2.2. Culture of Change

The anticipation of change can induce anxiety in the people affected. This uncertainty needs to be addressed directly, as it not only hinders smooth implementation, but also constricts staff creativity. Many incremental innovations regarding production or quality assurance come from the ranks of the employees who deal with them on a daily basis. It is precisely this input into the company's progress that must be supported and nurtured. Fear of negative consequences of increased efficiency must be replaced by a will to participate and excitement about possible improvements. This culture must be lived and passed on by management.

7.2.3. Adhere to an Innovation Plan

An innovation plan can be helpful in guiding and orienting innovation. The development of innovative ideas is like many processes in a company: without a clear structure, the individual tasks run disorganized and inefficiently. Obviously, concepts can arise in a wide variety of situations. This makes it even more important to create an innovation plan that can handle these ideas and integrate them into a structure. Clear guidelines and procedures give employees confidence in dealing with progressive ideas. In addition, such plans can also encourage employee participation by offering prizes for innovations. This encourages employee participation in continuous progress and their acceptance.

The methodology of implementing innovative ideas presented in this report represents such an innovation plan. It is preceded by the Innovation funnel, in which the ideas with the greatest potential are identified. To ensure the progress of the process, a classification is then made, on the basis of which suggestions are made for the further procedure with the concept.

7.2.4. Acceptance of Delays and Failures

Innovation is an unpredictable process. There are many uncertainties in the development of future-oriented technologies, and it always involves a risk that increases with the degree of disruption. Setbacks and delays are inevitable while many development processes are even based on the trial-and-error principle. Although everyone involved in R&T should be aware of many setbacks along the way, this fact should always be kept in mind. This aligns management expectations with the timescales and partial successes of the project, thus preventing unrealistic expectations. Similarly, it must be accepted that not every concept is feasible, and failure must always be anticipated. By repeatedly communicating this fact, the pressure on management and the development department can be drastically reduced, bringing the focus back to the actual innovative work.

8. Conclusions

Innovation is a critical avenue to all industries as it paves the pathway for the future of that industry. Management becomes equally relevant in ensuring the success innovation deserves by nurturing it within the right environment. Often companies fail to support their innovative capabilities due to lack of a structured methodology to guide them. Although an idea/technology can be implemented through multiple business models, its success highly depends on two major factors. Firstly, recognizing the company's current standing within the market which includes their capabilities and work culture, and secondly, the selected business model to explore and develop the innovative idea beyond traditional realms. Hence, to ensure a balance between these two factors, this report provides a solution framework outlining the methodology to counter major innovation challenges like Innovator's Dilemma.

The solution is developed in the form of a robust scale that considers many critical key parameters while assessing the scale of innovation and their relevancy to each category of innovation. Based on past data around innovation, this scale recommends the operational models which could be taken to sustain and scale innovation at a company. Among the different recommended models, a particular model always presents a better prospect from company's individualistic standpoint. Therefore, the solution caters to this need as well in the form of a viability matrix which makes a holistic approach to innovation

management. A company should always maintain a good mix of all innovation categories in their portfolio to sustain their competitive edge and progress forward at the same time. This scale takes advantage of Safran's existing innovation funnel and make appropriate recommendations to the innovation team for powering innovative concepts beyond the prototype phase.

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