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INVESTIGATING ACCOUNTABILITY AND JUSTIFICATIONS IN RESEARCH AND DEVELOPMENT (R&D): AN EMPIRICAL STUDY FOR UNDERSTANDING THE INSIGHTS

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ABSTRACT:
Companies and governmental organisations use research and development as a method to innovate or enhance their goods and services. Both fundamental and applied research may be a part of the research and development process. Companies employ this technique to either develop new items or increase the efficacy of their current products. It could also try to address a particular problem with a good or service. Research and development (R&D) aids in acquiring new information, which is then used to enhance currently available items and add brand-new ones to the company's operations. R&D is a methodical inquiry with the goal of bringing innovations into the business. Research and development are used in a variety of areas and businesses. The highest R&D investment is often found in the pharmaceutical, software, technology, and semiconductor industries. Generally speaking, industries with businesses that have a lot of intangible assets report significant spending on R&D. A firm might benefit from research and development since it gives them the chance to gather important knowledge about the items used in their sector. But it may also be costly and dangerous. The goal of the research and development process is long-term progress, not instant financial gain. Due to the fact that this activity does not instantly result in a profit, there is some risk involved. The article is an empirical study to give insights into the knowledge related to R&D.
KEYWORDS: Development, Methodology, Research, Software, Technology

INTRODUCTION

The process through which a business creates new information that it may utilise to build new technologies, products, services, or systems that it will either employ internally or sell is known as research and development, or R&D. Businesses engage in research and development (R&D) when they want to produce new products or find ways to enhance the ones they already have. Larger businesses might have their own in-house research and development group that will evaluate and improve items or procedures prior to use in the marketplace. However, many businesses contract out this work to universities in order to access their knowledge and cutting-edge research equipment since they lack the capacity to do it themselves.

Due to industry competition and demands, some businesses invest significantly more than others in R&D. For instance, a consumer technology business will spend a lot of money on product design research in order to create devices that are more appealing than those of its rivals. To achieve future growth, keep up with changes in their sector, and lower production costs, businesses of all sizes must engage in research and development. Brunel University London, for instance, is a top-tier research organisation committed to providing solutions to a wide range of organisations of all kinds. We have academics from a variety of areas who are helping our business partners greatly.

When people hear the term "R&D," they frequently conjure up images of technology and pharmaceutical enterprises, but other businesses, such as those that manufacture consumer goods, also devote time and money to this endeavour. For instance, substantial research and development went into the numerous varieties of a spaghetti sauce brand's basic product, such as "Chunky Garden," "Four Cheese," and "Tomato Basil Garlic." Research and development is a major expense for businesses because it is essential to the expansion and development of the enterprise. This approach is employed by manufacturers of consumer goods to expand their product line-up. R&D

expenditures are often highest in the pharmaceutical, technology, and semiconductor industries. The procedure is referred to as RTD (Research and Technological Development) in Europe.

While the R&D process varies from company to firm and greatly depends on the industry to which it belongs, all of them adhere to the same core concepts. When performing research and development, two main models are used. Large corporate organisations typically do have a separate department devoted to R&D activities. In the first model, engineers create new items. Engineers make up the majority of the department's workforce, and they conduct in-depth research. The second approach involves scientists or researchers who work in industry. The department conducts applied research in technological, industrial, and scientific sectors to create new goods or enhance those already on the market. Additionally, it might try to fix a problem or enhance a process. The general return on investment is rather unknown because research may fail several times before the team achieves the desired result. The companies must estimate risk-adjusted return. To introduce breakthroughs and provide the newest technologies, businesses invest billions of dollars in R&D efforts. The R&D team is made up of qualified, skilled, and experienced individuals who can provide the best answers and original concepts. Any company that develops and sells a good or service, whether it be software or spark plugs, makes some sort of R&D investment.

BASIC VS. APPLIED RESEARCH

- **Basic research:** The goal of basic research, sometimes referred to as fundamental research, is to better our comprehension of a specific issue or phenomenon by tackling important issues. Basic research can undoubtedly assist a corporation in learning new information, but because it is mostly conducted for its own purpose, the financial rewards are uncertain. As a result, major firms, academic institutions, and governmental organisations are typically responsible for carrying out this kind of research and development.
- **Applied research:** To gain information, applied research is also conducted. It is carried out with a specific purpose, use, or product in mind, in contrast to fundamental research. Applied research is pragmatic, focusing on developing realistic answers for contemporary issues, as opposed to basic research, which is theoretical.
- **Development Research:** This research combines applied and fundamental research. After gaining information and comprehension of a certain activity or subject from basic and applied research, this study will be put into practise.

Importance of Research and Development

1. Productivity of goods and services produced, traded, or provided by a company has increased as a result of R&D.
2. After analysis of costs, such as manufacturing/selling/general expenses, where expenses can be lowered to a particular level so that income or profitability may be enhanced, it has increased the income or profitability of an entity.
3. Some governments offer tax incentives to industries and other entities to encourage the growth of their products and services.
4. Effective research and development (R&D) boosts consumer confidence in a company's goods and services.
5. With the help of research and development, an organisation can create a new business plan and identify prospects.
6. Following market research on the basis of the current market situation, the company can grow its customer base. The company's sales and profitability will rise as a result. What do customers anticipate from the products and services the business offers?
7. The business wants to take out a loan before giving the lender the necessary paperwork. Then, after gathering all the necessary information and understanding, management should analyse the lender's profile, future predictions regarding changes in interest rates, which country's economy is having an impact on the lender's business, etc.
8. Successful R&D projects can boost the long-term returns on investments made in the entity.
9. An organisation can utilise its people resources to the fullest extent possible.

10. It can manage risks like operational risk, management risk, and financial risk.

Limitation of Research and Development

1. The company's costs have gone up as a result of research and development. Both positive and negative results are possible.
2. The entity will need to hire separate labour, which will drive up the cost of the business.
3. Research and development (R&D) is a very challenging process that requires highly skilled and certified human resources.
4. It may result in artificial results.
5. Sales volume and revenue will not increase if R&D efforts fail.
6. Product costs are increased by the R&D expense, and increases in product pricing can cause a fall in sales volume, whether an entity experiences favourable or bad consequences.

Need for investing in research and development

While improving a company's bottom line is the primary purpose of research and development, there are many other reasons why businesses engage in R&D.

- **Develop new and enhanced products:** Innovation research can assist you in meeting client requests for new and improved products that solve their problems more quickly and easily, whether you're launching a new business or looking to extend your current offers.
- **Improve business efficiency:** R&D can help you learn more about your production procedures, organisational structure, and position in the market. This knowledge can then be used to provide insights that boost productivity by getting rid of time-wasting inefficiencies and allocating resources to the initiatives that will have the greatest positive effects.
- **Cut costs:** Research and development can be profitable in other ways as well. Actually, a lot of businesses concentrate their R&D efforts on enhancing currently used technologies and procedures for internal usage, which lowers the overall cost of bringing your items to market.
- **Stay competitive:** Research and development are excellent ways to do this.

R&D AND ACCOUNTING

When it comes to research and development, there are no assurances and it's highly unlikely to result in an immediate financial gain. A corporation will frequently spend a lot of money looking for a better process, product, or medication yet never see a return on the investment. R&D is not an asset in this sense; rather, it is a commercial expense. Because of this, it is required by general accounting principles and practises that the majority (but not all) of costs related to research and development be recorded as an expense when it is incurred. Nevertheless, by utilising federal tax advantages and deductions intended to promote R&D, corporations can lessen some of the effects of R&D.

DEVELOPING AND R&D STRATEGY

Business size will affect R&D approach. Due to funding and expense constraints, R&D tends to concentrate more on product improvement in small enterprises. Larger companies may be able to invest more time and money in R&D in order to launch new goods and enhance old ones. It's vital to keep in mind that the benefits of R&D are frequently long-term, so your investment may not immediately provide a return. R&D may assist you in creating new products, improving existing ones, and creating more effective procedures and service delivery methods.

Increased time and financial investment in R&D does not ensure success. Extensive market research to determine the demands and preferences of your target market is the key to effective R&D.

R&D AND TECHNOLOGY ACQUISITION

Technology needed for industrial uses is frequently accessible on the market, but at a cost. A business might do a "make or buy" study to determine whether or not the new R&D project is justified before starting the time-consuming and dangerous process of conducting its own R&D. The capacity to secure the innovation, as well as its timing, risk, and cost, are all deciding factors.

PROPRIETARY CHARACTERS

A technology becomes the sole property of the corporation and is worth much more if it can be protected as proprietary and protected by patents, trade secrets, non-disclosure agreements, etc. A firm is actually given a temporary monopoly to use the technology however it sees proper for 17

years when a patent is valid, usually to increase sales and profits. In this situation, a high degree of R&D work is warranted for an acceptable chance of failure over a relatively lengthy period of time (up to 10 years). Contrarily, costly internal R&D is not justifiable if the technology cannot be safeguarded, as is the situation with some software programmes, as the software may be "stolen" by an unfaithful employee or copied by a rival.

Timing: The ideal way to acquire the technology may be through internal or contractual R&D if the market's growth rate is slow or moderate. However, if the market is expanding quickly and rivals are swooping in, the "window of opportunity" may shut before the new entrant has developed the technology. In order to enter the market before it's too late, it is preferable to obtain the necessary technologies and knowledge.

Risk: The technical success of R&D cannot be guaranteed, technology development is inherently riskier than technology acquisition. There is always a chance that the project won't be finished on time, that the R&D and manufacturing expenses will be greater than expected, and that the anticipated performance criteria won't be satisfied. In contrast, purchasing technology carries a significantly lesser risk because the good, service, or process can be seen and tested prior to the contract being signed.

Cost: Technology purchase is more expensive but less risky than technology development for a successful product line with a lengthy lifespan. Royalties are typically paid as "earnest money," a relatively small upfront payment, and as recurring payments based on sales. These payments continue for the duration of the licence agreement's validity. Given that these royalties could range from 2 to 5 percent of revenue, the licensee is unfairly burdened with ongoing cost increases.

R&D, however, necessitates a large upfront expenditure and hence a longer period of negative cash flow. The licence agreements could contain limiting geographic or application provisions, and other companies might have access to the same technology and compete with lower prices or more aggressive marketing. These are additional intangible expenses associated with purchasing technology. Finally, it could be risky for the licensee to be reliant on the licensor for technological advancements or even just to stay current.

MOVING AHEAD WITH R&D

R&D can be carried out internally, externally, or in collaboration with others. Because the corporation is the sole owner of the developed know-how and can prevent its unauthorised usage, in-house R&D commands a strategic advantage. R&D is essentially a learning process, and internal research helps to develop the company's research staff so they can produce even better results in the future. Typically, universities or specialised non-profit research institutions are hired to conduct external R&D. These institutes frequently have well-trained staff who have backgrounds in the subjects to be applied. The drawbacks are that the business won't learn anything from the experience and can end up depending too much on the contractor. It could be challenging to transfer the technology, and competitors might learn about it through leaks.

After antitrust regulations were loosened and financial incentives were provided to R&D consortia, joint R&D gained popularity in the United States. A consortium is made up of a number of businesses that have similar goals and work together to do research and development either independently or at a university. The benefits include decreased costs because each business does not have to invest in the same machinery, a critical mass of researchers, and information sharing across sponsors. The fact that all sponsors have access to the same R&D findings is a drawback.

R&D PROJECT SELECTION, MANAGEMENT, AND TERMINATION

Industrial R&D is typically carried out in accordance with projects, or distinct work activities, that have time and financial budgets, designated staff, and specified technical and business goals. These initiatives may start "bottom up" (from a researcher's original idea) or "top down" (from a management decision to create a new product, for example). A project's scope can range from a short-term, part-time effort by one researcher with a budget of a few thousand dollars to a lengthy, interdisciplinary endeavour lasting five or ten years with a budget of millions of dollars. As a result,

one of the more important and challenging aspects of R&D management is project selection and evaluation. Equally significant, though less so in actuality, is the topic.

SELECTION OF R&D PROJECTS

A corporation or laboratory will typically receive more requests for projects than it is able to complete. As a result, R&D managers must choose how to distribute limited finances, equipment, employees, and lab space among a variety of initiatives that are in direct competition with one another. Since starting an R&D project involves both a technical and a business choice, R&D managers should prioritise the following goals when choosing projects:

1. Increase long-term return on investment;
2. Make the best use of the physical and human resources that are at hand;
3. Maintain a balanced R&D portfolio and manage risk;
4. Encourage an environment that encourages innovation and creativity.

The process of selecting projects typically takes place once a year and involves making a list of all current projects as well as proposals for new ones, comparing and contrasting them based on both quantitative and qualitative standards, and ranking them in "totem pole" order of importance. The laboratory budget for the following year is compared to the funding requests made by each project, and the project list is terminated at the allocated amount. Projects that fall below the line are postponed until the next year or are never funded. After the official budget for the laboratory has been established, some seasoned R&D managers reserve a small portion of the allotted cash to cover any new projects that may come up during the year.

EVALUATION OF R&D PROJECTS

Because R&D initiatives have a risk of failure, their expected value can be calculated using a statistical method. The payoff anticipated—but discounted by probabilities—makes up the value. These are the likelihood that an invention will succeed technologically, commercially, and financially. If the reward is $100 million, with a 50% technical success rate, a 90% commercial success rate, and an 80% financial probability, then the expected value is $36 million, which is $100 discounted by 50%, 90%, and 80%, respectively.

In order to determine the likelihood of technical success and the payoff as well as the chances of commercial and financial success, project evaluation must be carried out along two distinct dimensions: technical and business. The predicted cost of the technical effort can be compared with the expected value of a project once it has been decided. Given the risks, the cost could not be worth the predicted value given the company's typical rate of return on investment.

It goes without saying that these statistical methods of evaluation are only as good as the assumptions used when developing them. However, businesses employ these assessments when a lot of projects are vying for the same funding and a systematic strategy is required to make decisions.

MANAGEMENT OF R&D PROJECTS

R&D project management mostly adheres to the concepts and techniques of project management. The R&D projects are risky, and it is challenging to generate an appropriate budget in terms of technical milestones, expenses, and time to completion of the various activities. This is an important caution in comparison to standard engineering projects. Budgets for research and development should be treated as provisional at first and gradually refined as more data becomes available as a consequence of the preliminary work and the learning process. In the past, several R&D projects have gone over their projected and planned completion dates and budgeted spending amounts, often with fatal results. In the case of R&D, tracking technical advancement and achievement of goals is typically more crucial than tracking costs over time.

TERMINATION OF R&D PROJECTS

Due to the political effects on the laboratory, project termination is a touchy matter. A project should, theoretically, be abandoned for one of the following three reasons:

1. The environment changes, making the new product less appealing to the company due to new regulations, competing products, or price reductions;

2. Unexpected technical challenges arise, and the laboratory lacks the resources to resolve them; or 3. The project veers dangerously off schedule and corrective actions are withheld.

There is frequently a desire to allow a project to continue, expecting for a miracle breakthrough that rarely occurs, due to organisational inertia and the fear of upsetting senior academics or executives with pet projects.

Theoretically, an ideal number of projects ought to be started, and this number ought to be progressively decreased over time to allow place for additional worthy ventures. Additionally, a project's monthly cost is far lower in the early phases than it is in the later stages, when more staff and resources have been committed. Therefore, from the perspective of financial risk management, it is preferable to waste money on multiple young, promising ventures as opposed to a few mature "dogs" with little payback and high expense. In reality, many labs find it challenging to begin a new project because all the resources have already been allocated, and they also find it challenging to end a project for the reasons mentioned above.

TAX ADVANTAGES FOR R&D

From 1981 until 2004, firms had the option of deducting research and development costs from their income thanks to the R&D tax credit. The tax credit was extended in 2004 and continued through 2005, but it was not included in the tax legislation enacted in May 2006. This result, which no doubt pleased many who believed that government support for business development was inappropriate, fuelled those who believed the credit to be of national significance to work towards its reinstatement.

SMALL BUSINESS AND R&D

Public perceptions of research and development in the media and in the general public imply large corporations, expansive testing grounds, wind tunnels, and crash dummies flailing around as cars crash into walls. R&D is connected to the pharmaceutical sector, miraculous treatments, laser eye surgery, and ultra-rapid air travel. Undoubtedly, a significant portion of the money spent on formal research is spent by huge corporations—often on quite little upgrades to items that are already performing admirably—and by the government on weaponry and space travel. The splendour and the power so demonstrated before our eyes on television do not serve to remind us that the important research and development on which much else is based has been and continues to be the labour.

CONCLUSION

Research and development are frequently managed internally by a company's internal department, but they can also be outsourced to a specialist or a university. Large multinational corporations may perform all three, and some of the outsourced work may be carried out abroad so that the business can benefit from the talent and local market expertise available there. Small business owners that have an innovative product idea but lack the design or technical personnel necessary to develop and test solutions may find outsourcing R&D to be particularly intriguing. On the lowest scale, a solopreneur who provides software as a service is an example because they occasionally outsource the R&D and subsequent software development.

Research and Development plays a critical role in the innovation process. It’s essentially an investment in technology and future capabilities which is transformed into new products, processes, and services. In industry and technology sectors R&D is a crucial component of innovation and a key factor in developing new competitive advantages. As per 0000-0002-9764-6048 One company in particular has devoted itself to R&D and as a result constantly soars ahead of its competition. If you want a great example of an innovative firm. When it comes to R&D and innovation Intel is the Holy Grail Company. This absolutely massive company entered the market with a bang, slid back slightly in the early 2000s but from 2006 onward has been doing spectacular.

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