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«Management of innovation projects»

(supporting lecture notes for ащкушпт students of
specialization "Management of innovative activity")

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INTRODUCTION

Innovation is everywhere. In the world of goods (technology) certainly, but also in the realm of words: innovation is discussed in the scientific and technical literature, in social sciences like history, sociology, management and economics, and in the humanities and arts. Innovation is also a central idea in the popular imaginary, in the media, in public policy and is part of everybody's vocabulary

This suggests three questions. First, **why** has innovation acquired such a central place in our society or, put differently, where precisely does the idea of innovation come from? To many, innovation is a relatively recent phenomenon and its study more recent yet: innovation has acquired real importance in the twentieth century. In point of fact, however, innovation has always existed. The concept itself emerged centuries ago. This suggests a second question: why did innovation come to be defined as **technological innovation**? Many people spontaneously understand innovation to be technological innovation. The literature itself takes this for granted. More often than not, studies on technological innovation simply use the term innovation, although they are really concerned with technological innovation. However, etymologically and historically, the concept of innovation is much broader. How, when and by whom did its meaning come to be "restricted" to technology? Third, why is innovation generally understood, in many milieus, as **commercialized innovation**? It is hard today to imagine technology without thinking of the market. One frequently hears of innovations that are marketed by firms, but other types of innovation are either rapidly forgotten or rarely discussed. By contrast, every individual is to a certain extent innovative; artists are innovative, scientists are innovative, and so are organizations in their day-to-day operations.

To answer these three questions, this paper looks at innovation as a **category** and at its historical development. The paper is not a history of innovation itself (or innovations), neither a contextual history. It looks rather at the representations of innovation and the discourses held in the name of innovation, namely since the term first appeared in the Middle Ages: how the public, innovators themselves, and academics, and particularly the theories of the latter, have understood innovation and talked about it.

Innovation is often also viewed as the application of better solutions that meet new requirements, unarticulated needs, or existing market needs. This is accomplished through more effective products, processes, services, technologies, or business models that are readily available to markets, governments and society. The term "innovation" can be defined as something original and more effective and, as a consequence, new, that "breaks into" the market or society. The word “innovation” is used widely and inconsistently in media and business literature. Looking to the Latin roots of the word, “in-nova-tion” literally means “in a new way.” Innovation can be defined as the successful conversion of *new* concepts and knowledge into *new* products, services, or processes that deliver *new* customer value in the marketplace.

TOPIC 1. INNOVATION PROJECT AS OBJECT OF MANAGEMENT

1.1. Concept of "innovative project", types of innovative projects and their common features.

1.2. Project innovation and traditional project management.

1.1. Concept of "innovative project", types of innovative projects and their common features.

The close bond between the management of projects and innovation was well understood in the 1950s when pioneering organizations created new structures, techniques, and processes to manage complex and highly uncertain research and development projects in technologically advanced weapons and defence-related industries. Over subsequent decades, there have been some points of convergence when researchers investigated the nexus of innovation and project management, such as Japanese product development practices in the 1980s. But in the main, the literatures on project and innovation management followed distinct, largely self-contained trajectories of theoretical, professional, and practical development. In recent years, however, there has been a strong convergence and cross-fertilization of ideas between innovation and project management. A new wave of research is investigating the different ways in which organizations use projects to manage the uncertainties associated with innovation processes and outcomes.

Innovation is everywhere. In the world of goods (technology) certainly, but also in the realm of words: innovation is discussed in the scientific and technical literature, in social sciences like history, sociology, management and economics, and in the humanities and arts. Innovation is also a central idea in the popular imaginary, in the media, in public policy and is part of everybody's vocabulary. Briefly stated, innovation has become the emblem of the modern society, a panacea for resolving many problems, and a phenomenon to be studied. The quest for innovation is so strong that some go so far as to suggest that drugs like Ritalin and Adderall, used to treat psychiatric and neurological conditions, should be prescribed to the healthy as a cognitive enhancement “technology” for improving the innovative abilities of our species.

The term "innovation" can be defined as something original and more effective and, as a consequence, new, that "breaks into" the market or society. The word “innovation” is used widely and inconsistently in media and business literature. Looking to the Latin roots of the word, “in-nova-tion” literally means “in a new way.” Innovation can be defined as the successful conversion of *new* concepts and knowledge into *new* products, services, or processes that deliver *new* customer value in the marketplace.

A 2013 survey of literature on innovation found over 40 definitions.

Economist Joseph Schumpeter (1883-1950), who contributed greatly to the study of innovation economics, argued that industries must incessantly revolutionize the economic structure from within, that is innovate with better or more effective processes and products, as well as market distribution, such as the connection from the craft shop to factory.

The chief exception is Schumpeter's own Capitalism, Socialism, and Democracy. Much has been published on innovation and entrepreneurship, usually with a nod in Schumpeter's direction but no more. Even a work like Yusif A. Sayigh's Entrepre-neurs of Lebanon, which ostensibly takes Schumpeter's concepts as its starting point, actually deals with entrepreneurs as people - their edu-cation, religion, opinions, even the number of their children - to the neglect of what was central to Schumpeter's analysis, innovating activity and its impact.

At the time Business Cycles was written, work on Kuznets cy-cles - the long swings of fifteen to twenty years - was still at an early stage. Since then a large amount of statistical and a small amount of analytical work has gone forward. Those who have made the principal efforts to explain Kuznets cycles, Matthews and Abramovitz, have not seen fit to draw on Schumpeter's work but have resorted to an incom-plete and essentially aggregative tool, the capital-stock adjustment principle. (It is ironic that a generation of economists that tegards disaggregation as a shining virtue has underestimated the theory of such a staunch opponent of aggregation as Schumpeter. In our heart of hearts, we prefer the aggregates of Keynes, Harrod, Domar, etc. ; de-spite Walras's earlier and better claim to a general theory, we permit-ted Keynes to take over the term, Schumpeter's objections notwith-standing. Our cant about disaggregation means only that we have guilty consciences.) Yet Schumpeter's concept of recesssion could be exceedingly helpful in interpreting the 1870s, a period which raises a problem ignored by Matthews and Abramovitz in the works cited in the footnote above. Their most telling evidence for the existence of Kuznets cycles consists of two circumstances, swings in the rate of growth of real GNP that average fifteen to twenty years, and the re-currence of deep depressions at similar intervals - there was one in the 1870s, one in the 1890s, there would (or might) have been one in the 1910s but for World War I, and there was one in the 1930s. Including 1873-78 in the category of deep depressions at first sight seems rea-sonable enough, since it is generally considered not only the longest but also one of the worst business contractions on record. But Abramovitz shows a "tentative" peak in the rate of growth of real GNP, after eliminating the effects of business cycles, which he dates 1874.25.**9** This means that the average annual rate of growth between the complete business cycle with peaks in 1869 and 1873 and the complete business cycle with peaks in 1873 and 1882 was higher than for neighboring pairs of cycles - in fact it was the highest on record for any successive pairs of cycles, in spite of the fact that the contrac-tion included in the 1873-82 period is rated a deep depression, whereas the contraction phase of the preceding cycle was very mild. Thus the statistical finding about the rate of growth of real GNP col-lides with the judgment that 1873-78 was a deep depression ; further-more, it plays hob with Abramovitz's analysis of the way Kuznets cy-cles unfold, in which deep depressions and troughs in growth rates go together. How can the paradox of a rapid rate of growth in a period encompassing deep depression be resolved ? Schumpeter's concept of recession could illuminate it : previous innovation must have made possible a great increase in output that imposed hardship - symptoms of depression - on all parts of the economy unable to adapt to the new conditions. Not that one can turn to Schumpeter's own account of the 1870s for a ready-made explanation of the facts Matthews and Abramovitz have wrestled with ; it is rather that today's economists are missing an opportunity to build on Schumpeter's work.

The importance of a book is judged by what it leads to. By this test, it is doubtful if Schumpeter's Business Cycles would merit rescue from the limbo of "out of print." The first reason for the present edi-tion lies in the conviction that it can yet stimulate significant research. Why an abridged edition ? Ordinarily, I deplore abridgements, but in the present case there is every reason to believe that a shorter version will prove more useful, especially since the longer one will always be available in libraries. Eliminating digressions and the less valuable parts of the original two volumes, which ran to more than a thousand pages, will enable the reader, I hope, to spend his time more profita-bly. Having myself spent a great deal of labor trying to master the original edition, I have nothing but sympathy for economists who felt that it was not worth the effort.

Until early in the twentieth century, invention, ingenuity and imagination were discussed as symbols of civilization and as attributes of geniuses, and their contribution to the progress of the race. Then, the growing role of organizations in the twentieth century led to changes in values. If there was to be increasing economic efficiency, there had to be innovation - through organizations and the mobilization of their employees' creative abilities. Such were the discourses of managers as well as policy-makers. Theorists from many disciplines started studying innovation in terms of the effects of technological innovation on the economy and society. To economists, gone was invention without market value.

There are now many people trying to broaden the understanding of innovation as technological innovation.

Innovation project means a collaborative team project that solves authentic problems by innovating a novel, practical and concrete solution.

We will now define innovation more rigorously by means of the production function previously in-troduced. This function describes the way in which quantity of prod-uct varies if quantities of factors vary. If, instead of quantities of fac-tors, we vary the form of the function, we have an innovation. But this not only limits us, at first blush at least, to the case in which the inno-vation consists in producing the same kind of product that had been produced before by the same kind of means of production that had been used before, but also raises more delicate questions. Therefore, we will simply define innovation as the setting up of a new production function. This covers the case of a new commodity, as well as those of a new form of organization such as a merger, of the opening up of new markets, and so on. Recalling that production in the economic sense is nothing but combining productive services, we may express the same thing by saying that innovation combines factors in a new way, or that it consists in carrying out New Combinations, although, taken literally, the latter phrases would also include what we do not now mean to include - -namely, those current adaptations of the coef-ficients of production which are part and parcel of the most ordinary run of economic routine within given production functions.

For cases in which innovation is of the technological kind we could have defined it directly with reference to the so-called laws of physical returns. Barring indivisibility or lumpiness, the physical mar-ginal productivity of every factor must, in the absence of innovation, montonically decrease. Innovation breaks off any such "curve" and replaces it by another which, again except for indivisibility, displays higher increments of product throughout, although, of course, it also decreases monotonically. Or if we take the Ricardian law of de-creasing returns and generalize it to cover industry as well, we can say that innovation interrupts its action, which again means that it replaces the law that had so far described the effects of additional doses of re-sources by another one. In both cases transition is made by a jump from the old to the new curve, which now applies throughout and not only beyond that output which had been produced before by the old method.

We can define innovation also with reference to money cost. Total costs to individual firms must, in the absence of innovation and with constant prices of factors, monotonically increase in function of their output. Whenever a given quantity of output costs less to produce than the same or a smaller quantity did cost or would have cost before, we may be sure, if prices of factors have not fallen, that there has been innovation somewhere. It would be incorrect to say that in this case innovation produces falling long-run marginal cost curves or makes, in certain intervals, marginal cost negative. What should be said is that the old total or marginal cost curve is destroyed and a new one put in its place each time there is an innovation. If there are indivisi-bilities and the innovation becomes possible only beyond a certain quantity of output, while below it the old method remains superior and would promptly be resorted to again, should output fall sufficiently, we may indeed draw one cost curve to combine costs with the old method in one interval and costs with the new method in another in-terval. But this is possible only when the new method has become fa-miliar and the whole system is adapted to it, which means that it en-ters the production functions - i.e., the practical range of choice open to all - and is no longer an innovation.

If prices of factors are not constant but change independently of the action of the firm, the effect on its cost curves - total, average, and marginal - is exactly analogous to the effect of innovation : they break off and new ones emerge instead. It is easy to see that we cannot con-struct a theoretical cost curve that would in one stretch refer to, say, a given wage rate and, in another stretch, to a different one. The anal-ogy may, hence, serve to illustrate still more clearly the impossibility of representing marginal costs in function of output as falling (whether continuously or not) and total costs as falling or rising less than they otherwise would, under the influence of successive innova-tions. If prices of factors change in function of the action of the firm it is no longer so, and cost curves have to take account of such changes. But, in general, prices of factors could then, unless there is lumpiness or innovation in their production or supply, change only in the same direction as the quantity of the product, so that we need not apprehend that any fall along cost curves arises from this source.

Types of innovation:

1. Incremental innovation seeks to improve the systems that already exist, making them better, faster cheaper.

2. Process innovation means the implementation of a new or significantly improved production or delivery method.

3. Service innovation can be defined as “a new or considerably changed service concept, client interaction channel, service delivery system or technological concept that individually, but most likely in combination, leads to one or more (re)new(ed) service functions that are new to the firm.

4. Business model innovation (BMI) refers to the creation, or reinvention, of a business itself. Whereas innovation is more typically seen in the form of a new product or service offering, a business model innovation results in an entirely different type of company that competes not only on the value proposition of its offerings, but aligns its profit formula, resources and processes to enhance that value proposition, capture new market segments and alienate competitors.

5. Radical innovation (sometime referred to as breakthrough, discontinuous or disruptive innovations) provide something new to the world that we live in by uprooting industry conventions and by significantly changing customer expectations in a positive way. Ultimately, they often end up replacing existing methods / technologies. It gives birth to new industries (or swallows existing ones) and involves creating revolutionary technology. The airplane, for example, was not the first mode of transportation, but it is revolutionary as it allowed commercialized air travel to develop and prosper.

6. Disruptive innovation is innovation that helps create a new market and value network, and eventually goes on to disrupt an existing market and value network (over a few years or decades), displacing an earlier technology.

The different types of innovation mentioned here help illustrate the various ways that companies can innovate. There are more ways to innovate. The important thing is to find the type(s) that suit your company and turn those into success.

Innovation determines the degree of knowledge of the product by the buyer and user, shows its advantages and usage patterns. Innovation hides a certain level of market uncertainty and external uncertainty, entered in the project objective. Therefore this information is an indication to what extent the results and the purpose of the project can be defined. Creating new products, three categories describing the company's project portfolio and creating a project plan are used: derivative projects, platforms and breakthrough points

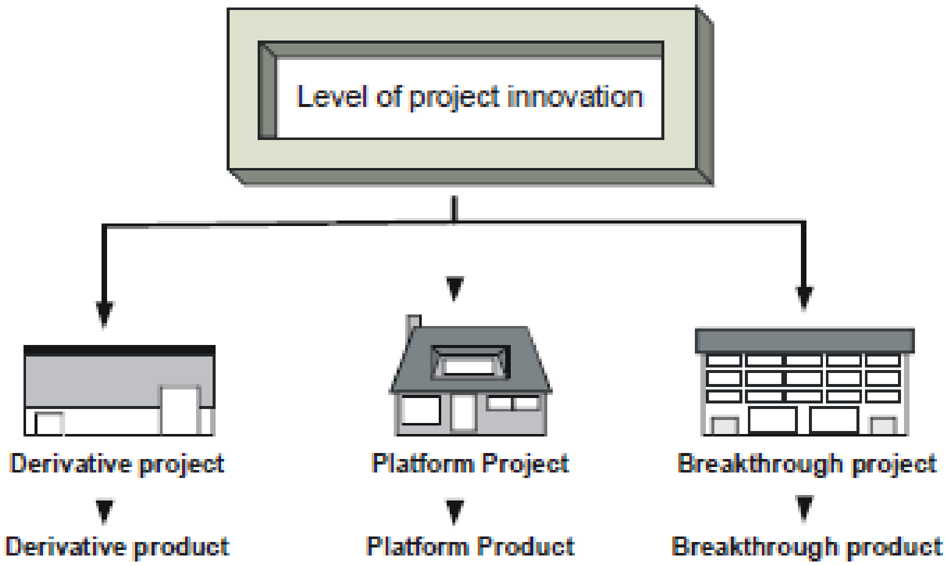


Fig. 1. Division of innovative projects

Each of the three levels of innovation projects (Fig. 1) affects, in varying degrees, the process of defining the requirements of the product and the activities related to the market. In particular, product innovation allows to obtain answers to questions: what to do, what to build and how to advertise your product to buyers. These tasks include the main aspects of project management:

• how we can rely on data related to market research?,

• how well we can define the product requirements and objectives of the project?,

• what time is needed to freeze the requirements for the product?,

• what marketing techniques and market analysis should be applied?.

Each project with different levels of innovation is characterized by a unique elements that strongly differentiate it from other projects. Project managers need to understand these differences and adapt their activities to the level of innovation project.

Derivative projects are modified, expanded and improved existing products. These changes may result in lowering product costs, product improvement, product modification, or additions to existing lines. For this kind of products prediction of costs and other requirements may be relatively accurate. A marketing strategy can be based on the advantages of the product compared to previous models, and should be addressed to both existing customers and potential new customers indicating the new features and product differentiation.

Platform projects require more time than derivative projects because of the need to define the requirements for product. This work should be done on the basis of thorough market research and data from the previous product generation. Products known as platform products are new generations of existing products for new or existing markets and customers

Projects that build new platform products often create new product families, which are the basis for derivative products. Such products are replacing previous ones in well-established market sector. Companies should study the market intensively, analyze the data for previous product generations and carefully plan the price of the product. The final determination of the requirements for the product is made when the project is well advanced.

For breakthrough projects, market research is usually ineffective and the product definition must be based on projections, intuition and market trials and errors. Therefore, the requirements must remain flexible until the product is placed on the market and customers feedback reviews are received. The breakthrough products represent radical innovation in the market (which means a departure from well-known markets and well-known technology or solutions). Projects forming such products convert new concepts or ideas into products, which are not known to customers. An example of a breakthrough project could be the first package of enterprise resource planning (ERP), the first microwave oven, exploration of space.

Marketing research is inefficient and the product definition must be based on predictions, intuition, trials and errors. That’s why the requirements must remain flexible until the product is placed on the market and customers feedback reviews are received. Therefore, it is important to create prototypes quickly before determining the final requirements. Breakthrough project management organizations are forced to work closely with customers who are testing the first prototypes and help them in determining the final requirements for the product. New product advertising often involves the sale below cost of production, and even their distribution in order to understand the widest group of customers. Often a new product becomes the new standard in the industry – such as the IBM PC. Ability to positioning the technology as the industry standard is a critical element of longterm competitiveness and success.

1.2. Project innovation and traditional project management

Project management is the discipline of initiating, planning, executing, controlling, and closing the work of a team to achieve specific goals and meet specific success criteria at the specified time. A project is a temporary endeavor designed to produce a unique product, service or result with a defined beginning and end (usually time-constrained, and often constrained by funding or staffing) undertaken to meet unique goals and objectives, typically to bring about beneficial change or added value. The temporary nature of projects stands in contrast with business as usual (or operations), which are repetitive, permanent, or semi-permanent functional activities to produce products or services. In practice, the management of such distinct production approaches requires the development of distinct technical skills and management strategies.

The primary challenge of project management is to achieve all of the project goals within the given constraints. This information is usually described in project documentation, created at the beginning of the development process. The primary constraints are scope, time, quality and budget. The secondary - and more ambitious - challenge is to optimize the allocation of necessary inputs and apply them to meet pre-defined objectives. The object of project management is to produce a complete project which complies with the client's objectives. In many cases the object of project management is also to shape or reform the client's brief in order to feasibly be able to address the client's objectives. Once the client's objectives are clearly established they should impact on all decisions made by other people involved in the project-project managers, designers, contractors, sub-contractors, etc. If the project management objectives are ill-defined or too tightly prescribed it will have a detrimental effect on decision making.

Traditional project planning begins with the definition of its range (fig.2), which defines the work that should be done. This range is divided into components called work packages that are embedded in a hierarchical way in so-called Work Breakdown Structure – WBS. Next the Organizational Breakdown Structure – OBS and a network diagram are built and than the required resources are allocated, budget is prepared and many other parts of the plan are determined. Thus, each project contains at least a declaration of the WBS and OBS range, schedule and budget.

In critical studies of project management it has been noted that phased approaches are not well suited for projects which are large-scale and multi-company, with undefined, ambiguous, or fast-changing requirements, or those with high degrees of risk, dependency, and fast-changing technologies. The cone of uncertainty explains some of this as the planning made on the initial phase of the project suffers from a high degree of uncertainty. This becomes especially true as software development is often the realization of a new or novel product.

These complexities are better handled with a more exploratory or iterative and incremental approach. Several models of iterative and incremental project management have evolved, including agile project management, dynamic systems development method, extreme project management, and Innovation Engineering

Some projects may also have a risk management plan and a plan to solve possible problems. The main aim of a conventional project plan is to complete the project on time, within budget and in accordance with the requirements.

Product innovation and knowledge areas PMBoK

Knowledge areas PMBoK	Levels of projects innovation		
	derivative	platform	breakthrough
Integration	Simple integration based on past experiences; focus on values added to the previous products, rapid action and sales	Intensive customer participation and functions interaction; focus on new elements and possibilities in the new generation; intensive testing during the iteration	Integration focused on basic functions to demonstrate the correctness of the concept; The use of feedback reviews from the customer due to the rapid prototyping integration of organizational functions in order to create market awareness
Range	Focus on the work needed to implement the value-added to the product	Redefine the action in a descending; strict control of range to enable the smooth introduction of the product	Flexible range management to allow development based on market reaction and testing
Time	Dealing with rapid time control, to ensure quick entry	Planning for the appropriate time to maximize product opportunities and elimination of error; time to enter the market is important because of the competitiveness	Permission to execute as many versions of the product that the end product was well-defined; flexibility in considering new ideas; contingency plans in case of any difficulties
Costs	Designing with strict control of costs and time, improving cost-effectiveness	Detailed planning and careful control; budget allocation for the detailed testing; attention to possible cross caused unnecessary additives	Flexible cost control until the final definition of the product; allocation of resources for prototypes and testing market
Quality	Focus on continuous incremental improvement of product quality	Intensive planning and quality assurance; removing errors throughout the duration of the project	The quality is less critical because the product is new; in the later stages of the project a little bit of planning quality
Human resources	People aware of the effectiveness; without further action; strict management style	A well-organized team members performing different functions; people who comprehend the whole project, partially limited management style	Creative person wanted with the ability to innovate in various areas; freedom of expression and testing new ideas, a very flexible style of management
Communication	Quick and fast communication channel, the minimum degree of formality	Intense and varied channels of communication in various areas of functioning; formal communication, documentation supplemented by informal contacts	Intensive and frequent informal communication, where possible co-location, formal documentation of the final decision
Risk	Minimal risk, risk management focuses on the changes in production	Rich risk management plan, early identification of potential areas of risk; development of contingency plans and redundancy to protect the project from failure	High risk due to large uncertainties, different approach to the design together with contingency plans;
Orders	If possible, using ready-made elements; using multiple sources to reduce costs and avoid delays	Delivery must be taken into account in the definition and design of basic components and subsystems; the use of multiple sources for other components	The use of all available sources, including trial versions to guarantee the essential features of the product in the first prototypes, providing sources of supply to thefinal version

Each of the three types of levels of project innovation, in varying degrees, affects the classical process of project management based on nine different areas of knowledge PMBoK. The higher the innovativeness of the product, the more confusion at the beginning of the project and therefore estimates are less accurate and the risk is higher. In this case, greater flexibility and creativity are needed to complete the project successfully. Table 1 shows how different levels of product innovation affect the areas of knowledge: integration, range, time, cost, quality, human resources, communications, risk and orders.

Project management is the engine for implementing new ideas and there are a host of tools and techniques that make this process more effective. In most organizations, there is a relatively high level of competence in project management … however, the understanding of how to manage an innovation project is not always as clear. It is important to understand the distinction between a regular project and an innovation project:

- Innovation projects tend to start with loosely defined, sometimes even ambiguous objectives that become clearer as the project proceeds. The processes used are more experimental and exploratory and seldom follow strict linear guidelines.
- Teams need to be more diverse and have a higher level of trust as they explore new territory where failure is a possibility.
- With failure as a built-in possibility, innovation teams are more actively involved with risk management and need to learn to fail fast and fail smart in order to move on to more attractive options.
- Also, innovation projects generally need to be sold to project sponsors and funding committees, a responsibility usually not required from normal project teams. Since projects are implemented by people, the ability to collaborate and work effectively on a team is critical.

Excellent project managers honor and manage requests, offers and promises. They focus on the most important issues and juggle priorities. They have what seems like an innate sense of timing, which comes from their continual scanning of the business climate and understanding of priorities and concerns of others.

Projects often involve making hundreds of decisions, a process that can be fraught with hazard and conflict unless a well-developed set of criteria for the project has been developed in advance.

TOPIC 2. BASIS OF INNOVATION PROJECT MANAGEMENT

2.1. The history of project management.

2.2. The Project Life Cycle (Phases).

2.1. The history of project management.

Until 1900, civil engineering projects were generally managed by creative architects, engineers, and master builders themselves, for example Vitruvius (first century BC), Christopher Wren (1632–1723), Thomas Telford (1757–1834) and Isambard Kingdom Brunel (1806–1859).It was in the 1950s that organizations started to systematically apply project management tools and techniques to complex engineering projects.

In the late 19th century, the need for more structure in construction, manufacturing, and transportation sectors gave rise to the modern project management tactics we use today.

For example, the creation of the Transcontinental Railroad, corduroy roads, and the rebuilding of the South after the Civil War were all major feats in the history of project management.

As the 19th century progressed, business leaders began to face the challenges of labor laws and regulations from the federal government.

Henry Gantt (1861–1919), who played a crucial role in the history of project management, is considered the founding father of modern project management. He developed planning and control techniques to help business leaders succeed and comply with these new regulations.

One example is the creation of the famous **Gantt Chart** to ensure monitoring and control of the project schedule. This basic bar chart shows the phases of a project from inception to completion.

The rise of the computer played a major role in the history of project management. Computers brought connectivity and communication to the forefront of project management in the 1980s.

As technology grew into the 1990s, the Internet became widely available through dial-up means. Some project management entities created systems for project management purposes, but it was not until the late 19^{th} century when the newfound era of computers and project management truly began.

As a discipline, project management developed from several fields of application including civil construction, engineering, and heavy defense activity. Two forefathers of project management are Henry Gantt, called the father of planning and control techniques, who is famous for his use of the Gantt chart as a project management tool (alternatively Harmonogram first proposed by Karol Adamiecki); and Henri Fayol for his creation of the five management functions that form the foundation of the body of knowledge associated with project and program management. Both Gantt and Fayol were students of Frederick Winslow Taylor's theories of scientific management. His work is the forerunner to modern project management tools including work breakdown structure (WBS) and resource allocation.

The form in use today across many fields and industries in the business world emerged in the 20th century specifically in around the Second World War through the mega projects that were required.

The 1950s marked the beginning of the modern project management era where core engineering fields come together to work as one. Project management became recognized as a distinct discipline arising from the management discipline with engineering model.

PERT and CPM are very similar in their approach but still present some differences. CPM is used for projects that assume deterministic activity times; the times at which each activity will be carried out are known. PERT, on the other hand, allows for stochastic activity times; the times at which each activity will be carried out are uncertain or varied and because of this core difference, CPM and PERT are used in different contexts. These mathematical techniques quickly spread into many private enterprises.

At the same time, as project-scheduling models were being developed, technology for project cost estimating, cost management, and engineering economics was evolving, with pioneering work by Hans Lang and others. In 1956, the American Association of Cost Engineers (now AACE International; the Association for the Advancement of Cost Engineering) was formed by early practitioners of project management and the associated specialties of planning and scheduling, cost estimating, and cost/schedule control (project control). AACE continued its pioneering work and in 2006 released the first integrated process for portfolio, program and project management (Total Cost Management Framework).

The International Project Management Association (IPMA) was founded in Europe in 1967, as a federation of several national project management associations. IPMA maintains its federal structure today and now includes member associations on every continent except Antarctica. IPMA offers a Four Level Certification program based on the IPMA Competence Baseline (ICB).The ICB covers technical, contextual, and behavioral competencies.

In 1969, the Project Management Institute (PMI) was formed in the USA. PMI publishes A Guide to the Project Management Body of Knowledge (PMBOK Guide), which describes project management practices that are common to "most projects, most of the time." PMI also offers multiple certifications.

In 1979, the UK Government's Central Computing and Telecommunications Agency (CCTA) adopted the method for all information systems projects. Little did they know that 10 years later this will evolve into one of the most acclaimed project management methodology known as **PRINCE (projects in controlled environments).**

An upgrade to PRINCE was considered to be in order and the development was contracted out but assured by a virtual committee spread among 150 European organizations. Most companies who adopt a PRINCE approach to project management adapt the method to their commercial environment and use those parts of PRINCE that work for them. This is acceptable as the puritanical days of sticking rigidly to a method are seen now as undesirable and unnecessary. Originally developed for IS and IT projects to cut cost and time overruns; the second revision was made more generic an applicable to any project type.

In 2002 and 2005 PRINCE2 was updated in consultation with the international user community.

Since the progression of mankind and need of undertaking more complex projects project management has evolved in too much advanced and well documented methodologies. Apart from the numerous variants evolved on need based customizations, the two major parent methodologies in practice these days are **PMI-PMP® & PRINCE2®.**

Along with the wide applications of well evolved methodologies in most of the industries and sectors like construction, manufacturing, Space & Weapons development, Hospitality , Pharmaceutical Industry etc. Project management has now been a buzz word across corporate world as well. Most of the projects across corporate world involve Banking, Services, back office operations etc.

It has been observed by experience and experimentation across different fortune 50 companies, that application of specific methodology for each type of project can vastly influence the outcomes and hence the project success rate within pre-set boundaries.

Timeline Facts to Remember

- Project management has been around since ancient times.
- The Transcontinental Railroad was the first true project management undertaking in modern times.
- The Industrial Revolution and associated labor changes drove the need for better project management tactics.
- Henry Gantt used charts to monitor and manage projects.
- Frederic Taylor authored a publication on better project management tactics to improve the efficiency of skilled laborers. Many successful organizations still use these tactics today.
- PERT and CPM were two of the first mathematical formulas for discerning project risk.
- Computers gave project managers new ways to compute risks and manage projects.

- The Internet gave birth to mass communication and efficiency across all projects and in greater detail to the devices of today

2.2. The Project Life Cycle (Phases)

The project manager and project team have one shared goal: to carry out the work of the project for the purpose of meeting the project's objectives. Every project has a beginning, a middle period during which activities move the project toward completion, and an ending (either successful or unsuccessful). A standard project typically has the following four major phases (each with its own agenda of tasks and issues): initiation, planning, implementation, and closure. Taken together, these phases represent the path a project takes from the beginning to its end and are generally referred to as the project "life cycle." Dividing a project into phases makes it possible to lead it in the best possible direction. Through this organisation into phases, the total work load of a project is divided into smaller components, thus making it easier to monitor. The following paragraphs describe a phasing model that has been useful in practice. It includes six phases:

1. Initiation phase
2. Definition phase
3. Development phase
4. Planning phase
5. Implementation phase
6. Closing phase

Initiation Phase

During the first of these phases, the initiation phase, the project objective or need is identified; this can be a business problem or opportunity. An appropriate response to the need is documented in a business case with recommended solution options. A feasibility study is conducted to investigate whether each option addresses the project objective and a final recommended solution is determined. Issues of feasibility ("can we do the project?") and justification ("should we do the project?") are addressed.

Definition phase

After the project plan (which was developed in the initiation phase) has been approved, the project enters the second phase: the definition phase. In this phase, the requirements that are associated with a project result are specified as clearly as possible. This involves identifying the expectations that all of the involved parties have with regard to the project result. How many files are to be archived? Should the metadata conform to the Data Documentation Initiative format, or will the Dublin Core (DC) format suffice? May files be deposited in their original format, or will only those that conform to the Preferred Standards be accepted? Must the depositor of a dataset ensure that it has been processed adequately in the archive, or is this the responsibility of the archivist? Which guarantees will be made on the results of the project? The list of questions goes on and on.

Planning Phase

The next phase, the planning phase, is where the project solution is further developed in as much detail as possible and the steps necessary to meet the project's objective are planned. In this step, the team identifies all of the work to be done. The project’s tasks and resource requirements are identified, along with the strategy for producing them. This is also referred to as “scope management.” A project plan is created outlining the activities, tasks, dependencies, and timeframes. The project manager coordinates the preparation of a project budget by providing cost estimates for the labor, equipment, and materials costs. The budget is used to monitor and control cost expenditures during project implementation.

Implementation (Execution) Phase

During the third phase, the implementation phase, the project plan is put into motion and the work of the project is performed. It is important to maintain control and communicate as needed during implementation. Progress is continuously monitored and appropriate adjustments are made and recorded as variances from the original plan. In any project, a project manager spends most of the time in this step.

Closing Phase

During the final closure, or completion phase, the emphasis is on releasing the final deliverables to the customer, handing over project documentation to the business, terminating supplier contracts, releasing project resources, and communicating the closure of the project to all stakeholders. The last remaining step is to conduct lessons-learned studies to examine what went well and what didn’t. Through this type of analysis, the wisdom of experience is transferred back to the project organization, which will help future project teams.

TOPIC 3. EVALUATION OF INNOVATION PROJECTS

3.1. The need of innovation project evaluation

3.2. Indicators for evaluating effectiveness of a project.

3.1. The need of innovation project evaluation

Evaluation continues to be highly significant in the innovation policy arena. In part this reflects the increased prominence of evaluation across practically all areas of policy. This has something to do with the rise of the "knowledgebased society" – decisions are supposed to be based upon knowledge rather than prejudice or chance. "Evidence-based policy" has become a rallying call for modernising politicians. Governments are under pressure to justify their expenditure decisions to an informed media and populace. Their performance is benchmarked by a variety of public and private bodies, informing the investment decisions of global corporations, for example.

Evaluation is also significant because different parts of government are in effect competing for a limited share of public funds. They have to justify their planned expenditures to political authorities – not just to a prime minister or president, but also to the ministry of finance, and whatever "watchdog" organisations scrutinise public finance and accounts.

Perhaps the major issue is that innovation projects are often working in largely uncharted and poorly understood territory. While the importance of innovation is generally conceded, the nature of the innovation process is undergoing near-continual change. (For instance: sectors that were previously regarded as non-innovative – such as many services – are seen to be highly active (and new countries are joining in the process, too); the location of critical knowledge, and the sorts of networks that are formed to apply this in innovations, is evolving in new directions; new tools for managing innovation are becoming available.) Innovation policies span a huge range of actions and targets, and there is much learning needed about how to act effectively in diverse and changing conditions. Evaluations of those interventions that have been made is thus a vital tool.

Evaluation is, at heart, a matter of seeing how well a policy or project achives or has achieved the objectives set for it. There is, however, a little more to it than this. Some authors differentiate between three aspects of evaluation – evaluation of effectiveness, of efficiency, and of efficacy. The features of evaluation, then, are:

- Evaluation can examine how **efficiently** the project operated, exploring the management of the activities to see whether there is good communication of objectives and progress, avoidance of redundancy and ability to detect and address problems as they arise.

- Evaluation can examine the **effectiveness** of the project, how **far** the objectives will be met. This is easier if the objectives have been set in quantitative or verifiable terms, and/or if there are related projects against which it can be benchmarked. In assessing project effectiveness, it is common to use **performance indicators**. Here the concern is, as has been well spelled out by the United Way of America (2002) with outcomes: *"not how many worms the bird feeds its young, but how well the fledgling flies".*

- Evaluation can go further and consider the **efficacy** of the project: how relevant it is to the broad policy goals to which it was designed to contribute.

- Beyond these very pragmatic goals, evaluation can also involve **explanation**. It can cast light on how and why the project achieved the degree of effect that was realised. It can illuminate issues of project management, and, more profoundly, raise the understanding of the broader innovation system within which the project operates.

- Evaluation may be used in what may seem to be a simplistic manner, but can prove to be technically very demanding to operationalise, to attempt to examine the precise value for money that has been achieved (in terms of an estimate of the rate of return of the public expenditure).
- Evaluation can also be used to examine unintended consequences of the project intervention: benefits and costs of the activities that were not expected by the project designers, or not explicitly spelled out as being among the project objectives.

Many areas of policy have become subject to evaluation and to more routine monitoring of performance by a range of relevant indicators – school achievement, prisoner recidivism, hospital bed occupancy, levels of poverty and unemployment, and so on. Innovation policy is subject to the same pressures. But innovation is rather challenging in terms of performance indicators. How can we tell if we have increased the innovativeness of the economy?

Specific Innovation projects usually have more modest goals that are intended to contribute to this grand objective. For instance, projects might set out to raise awareness of particular technological opportunities or of the potential benefits for firms and Universities to collaborate in developing new applications of emerging knowledge in a particular area. They might provide support for small firms active in an area to protect their intellectual property, for spin-offs to be generated from government laboratories, for consultancies to help industrial clusters use new approaches in their supply chains and other relationships. The projects might be viewed as technology transfer policies, intellectual property policies, training policies, cluster policies and so on. But if – as in the examples mentioned – innovation is among the main goals, then they can also be seen to be Innovation projects. And as such, they can be evaluated in terms of the more modest goals they have – is the desired change effected, and does it appear to have the desired consequences?

3.2. Indicators for evaluating effectiveness of a project.

An indicator is a variable that is normally used as a benchmark for measuring program or project outputs. It is "that thing" that shows that an undertaking has had the desired impact. It is on the basis of indicators that evidence can be built on the impact of any undertaking. Most often, indicators are quantitative in nature, however, in some few cases, they are qualitative.

Importance of Indicators

Indicators are an important for any project, particularly for monitoring and evaluation purposes. Some of the benefits of indicators are highlighted below.

1. At the initial phase of a project, indicators are important for the purposes of defining how the intervention will be measured. Through the indicators, managers are able to pre-determine how effectiveness will be evaluated in a precise and clear manner.

2. During project implementation, indicators serve the purpose of aiding program managers assess project progress and highlight areas for possible improvement. In this case, when the indicators are measured against project goals, managers can be able to measure progress towards goals and inform the need for corrective measures against potential catastrophes.

3. At the evaluation phase, indicators provide the basis for which the evaluators will assess the project impact. Without the indicators, evaluation becomes an audacious responsibility.

Types of indicators

The three widely acknowledged types of indicators are process indicators, outcome indicators and impact indicators.

1. *Process indicators:* are those indicators that are used to measure project processes or activities. For example, in a Safe Water project, this could be "the number of chlorine dispensers installed at water points" or "the number of households that have received training on chlorination of water."

2. *Outcome Indicators:* Are indicators that measure project outcomes. Outcomes are medium impacts of a project. For example, in the case of a Safe Water project, outcome indicators could be "the proportion of households using chlorinated drinking water" or "the percentage of children suffering from diarrhea."

3. *Impact Indicators:* Are indicators that measure the long term impacts of a project, also known as the project impact.

Factors to consider when selecting project indicators

Any appropriate M&E indicator must meet particular thresholds. They must be:

1. ***Precise/Well defined***: Probably the most important characteristic of indicators is that they should be precise or well defined. I other words, indicators must not be ambiguous. Otherwise, different interpretations of indicators by different people implies different results for each

2. ***Reliable:*** Reliability here implies that the indicator yields the same results on repeated trials/ attempts when used to measure outcomes. If an indicator doesn't yield consistent results, then it is not a good indicator.

3. ***Valid:*** Validity here implies that the indicator actually measures what it intends to measure. For example, if you intend to measure impact of a project on access to safe drinking water, it must measure exactly that and nothing else.

4. ***Measurable:*** Needless to say that an indicator must be measurable. If an indicator cannot be measured, then it should and must not be used as an indicator.

5. ***Practicable:*** In other cases, although an indicator can be measured, it is impracticable to do so due to the cost or process constraints. An indicator must be able to utilize locally available resources while at the same time being cost effective.

In world practice, the most commonly used methods for assessing the effectiveness of a project are the methods of assessing the effectiveness of the project based on discounted estimations, since they are much more accurate, they take into account different types of inflation, interest rate changes, profitability rates, etc. These indicators include:

- Income Profit (Resent Values) - PV;
- Net Returns (Net Residual Values) - NPV;
- Profitability Index - PI;
- Internal Rate of Retum - IRR;
- payback period - PP;
- discounted payback period - DPP.

Estimating changes in the value of money considering time factor. In project analysis it is accepted to compare the value of money at different times using two methods - discounting and compounding.

In general, the increase in the value of money (compounding) in the future is determined by the formula:

$$F_t = P(1+r)^t$$

where P - present value of money;

r - annual bank interest rate (discount rate - acceptable to the investor rate of return on capital);

t is the serial number of the year to which Ft corresponds.

The reverse process - the definition of the current equivalent of the value of money that will be received in the future - is called discounting. The general formula for bringing the value of money in the future to its present value is as follows:

$$P = F_t /(1+r)^t$$

The discount rate is the rate of profitability (in%) that investor needs to get on the invested capital.

The discount rate reflects the cost of money, taking into account the time factor and risks, since the funds received now are more advantageous than the funds to be received in the future.

The total accumulated amount of discounted income (PV) is calculated by the formula:

$$PV = \sum_t P_{\text{t}} /(1+r)^t$$

Net Present Value (NPV) is defined as the amount of streaming effects (that is, exceeding the results over costs) for the entire estimated project lifetime up to the initial period:

$$NPV = \sum_t \left(\frac{P_t}{(1+r)^t} \right) - IS$$

where IC - investments (expenses) made during the period t.

Pt - profit for period t.

If the project involves a one-time investment, and a consistent investment of financial resources for several years, then the use of the NPV is based on the comparison of discounted investment of IPs with gross discounted cash inflows. Then to calculate NPV the formula is used:

$$NPV = \sum_t \frac{P_t - IS_t}{(1+r)^t}$$

For a more accurate determination of the net present value of cash flows, the indicator "modified net present value (MNPV)" is used. Modified value of NPV:

$$NPV = \sum_t \frac{P_t}{(1+r)^t} - \sum_t \frac{IS_t}{(1+r)^t}$$

Net present value is measured in monetary terms and shows the absolute effectiveness of the project at a given discount rate. An investment project is accepted or rejected depending on its NPV. The following criteria for determining the effectiveness of investment projects based on NPV can be identified:

• where NPV > 0 – the investment project is considered effective at the discount rate d, i. e. the value of a business will increase upon implementing the project;

• where NPV < 0 – the investment project is not effective and the investor will suffer losses the amount of which will be equal to the NPV;

• where NPV = 0 – the project will not generate profit but will not be loss-making, either.

The profitability index (PI) is the revenue per unit of invested money. If the investments are singular and do not foresee further inflows of funds with the simultaneous projected profit, then it is defined as the ratio of the present value of cash flow of income to the amount of investment costs:

$$PI = \sum_t \frac{P_t}{(1+r)^t} / IS$$

In this case, if the project involves simultaneous investment for a certain period of time and receipt of investment income, the following formula is used to calculate PI:

$$PI = \sum_t \frac{P_t}{(1+r)^t} / \sum_t \frac{IC_t}{(1+r)^t}$$

The return on investment index (profitability) is closely related to the NPV: if the NPV value is positive, then RI> 1, and vice versa. Thus, if RI> 1, then the project is considered to be effective, and if RI 1 - ineffective.

Internal rate of return (IRR) is a discount rate that makes the net present value (NPV) of all cash flows from a particular project equal to zero. IRR calculations rely on the same formula as NPV does.

The following is the formula for calculating NPV:

$$NPV = \sum_t \left(\frac{P_t}{(1+r)^t} \right) - IS = 0$$

Payback period (PP) in capital budgeting refers to the period of time required to recoup the funds expended in an investment, or to reach the break-even point. Payback period is usually expressed in years.

$$PP = \sum_{t} \frac{IS_t}{Pt^t}$$

The methods of net present value (NPV) and of internal rate of return (IRR) are among the ones most frequently employed in the evaluation of investment projects based on discounted cash flows.

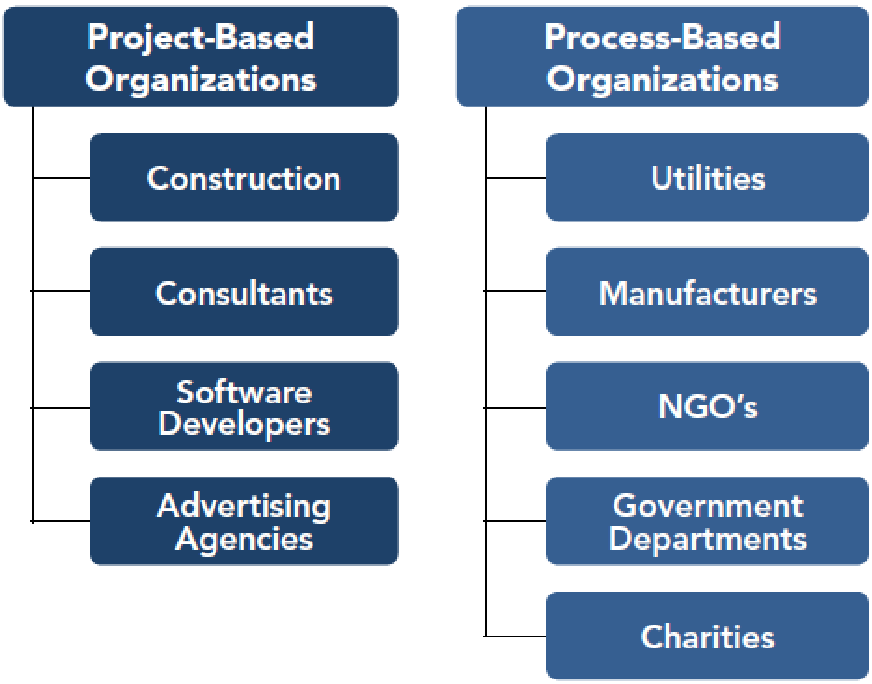
TOPIC 4. STRUCTURE OF ORGANIZATION AND PROJECT`S PARTICIPANTS

4.1. Project organization and structure

4.2. Stakeholder and participants of innovation project

4.1. Project organization and structure

The way in which an organization is structured is largely a result of whether its day-today work is process driven or project driven.



Project Focused

These organizations' day-to-day work involves delivering unique innovation projects for external customers for a set time period. Their management structure is designed to support projects and everyone working in the organization is assigned to one or more projects. Examples include: Construction companies, Consulting organizations, Software developers, and Advertising agencies.

Process Focused

The day-to-day work of these organizations predominantly involves continually delivering products or services for external customers. Their management structure is designed to support the process required to deliver the product or service to the end customer. Examples include: Utility companies, Manufacturing companies, Government departments, Charities, and NGOs.

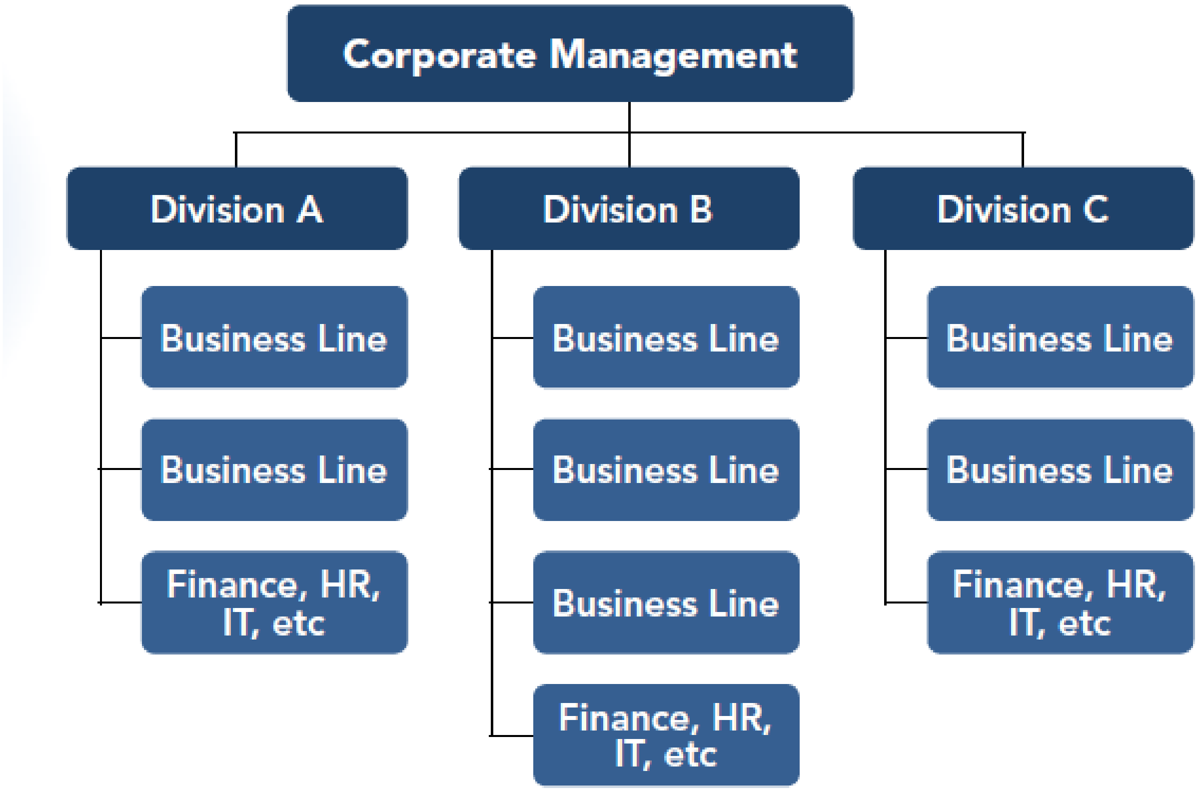
In reality, even the most process-focused organizations will run occasional projects and some may have parts of the organization that are dedicated to project-based working. The vast majority of the staff in public utilities (electricity, gas, and water) will be employed to provide an ongoing service to their customer base. But there will be some areas of the business concerned with physical or management infrastructure that are wholly project driven.

The extent to which your organization has the necessary assets and processes to conduct successful projects will play a significant role in your project costs and level of risk. The less experience it has, the higher your project costs will be and the greater degree of risk compared to a project-driven organization.

Every organization is unique and these classifications are only useful in that they illustrate the fact that innovation project management is likely to present more of a challenge in processfocused organizations than in those that are project focused.

It is better to think of organizational structures existing on a continuum as described below. This is not only more realistic but it allows us to begin thinking about how exactly the organizational structure will impact a project in practical terms.

At one extreme are organizations in which employees are isolated within their department or division as shown.

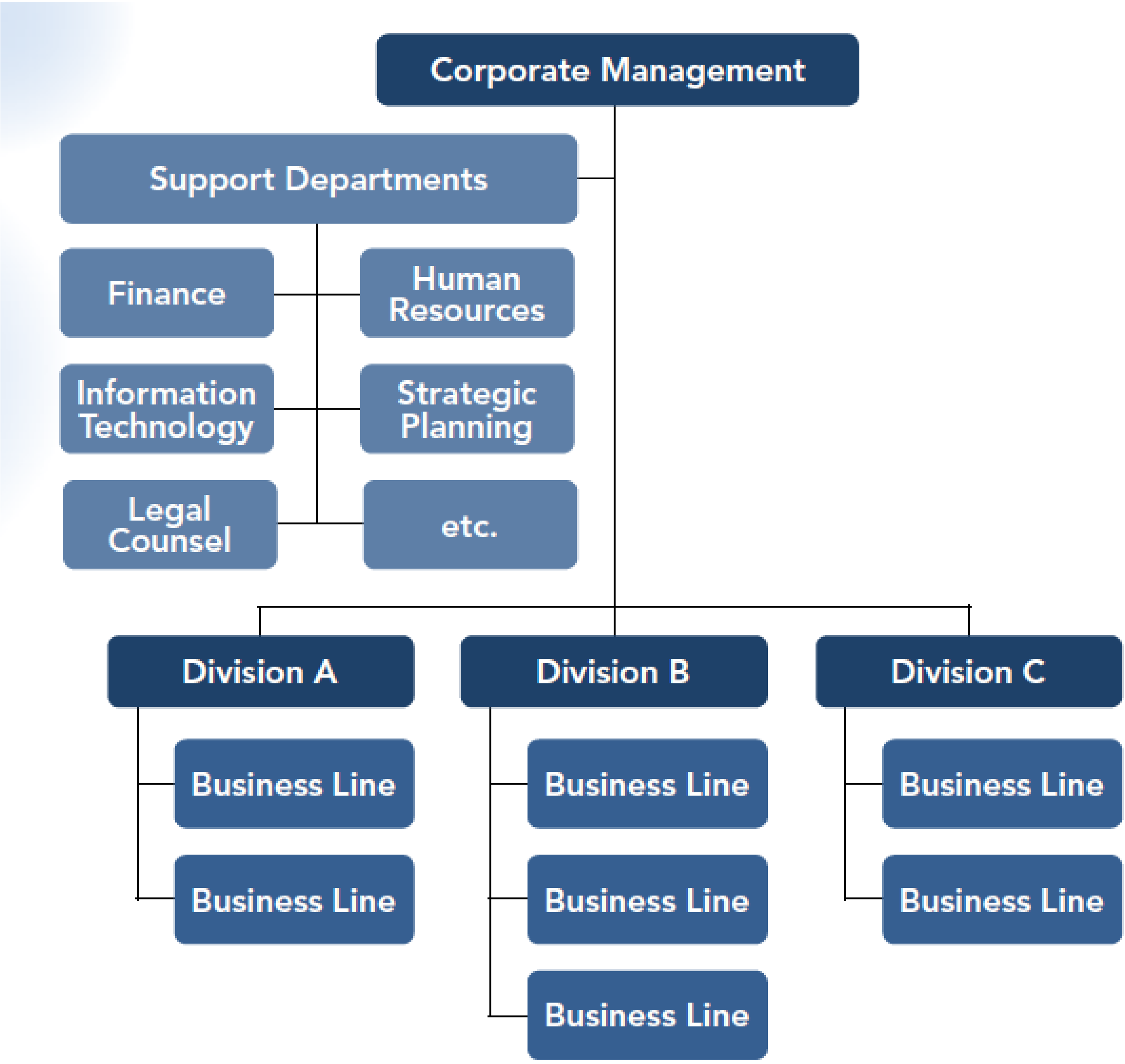


In this scenario, senior management allocate capital to each division, which then operate autonomously to return as much profit as possible. Each division is completely independent of the others and there is no mechanism to allow communication across divisions other than by going up the hierarchy to senior management who would then have to pass the decision down to the other divisions.

This type of structure makes producing a limited amount of products or services efficient and predictable, but would make it almost impossible to run a project that cut across divisional boundaries.

A refinement of this structure is shown below and is referred to as a weak matrix. This is because although each division operates independently, they no longer have direct control over support functions like IT, finance, and human resources.

This type of structure makes sense because these support functions do not need to be duplicated and can be shared between the divisions. This saves money and enables the support departments to be bigger and employ more specialist staff.



The implication for project management is that there will be mechanisms for communicating across divisions and that people will be more accepting of working with others outside of their own division.

Key Points

✓ Organizations may be either process driven or project driven.

✓ Even the most process-focused organizations will run occasional projects and some organizations may have parts that are dedicated to project-based working.

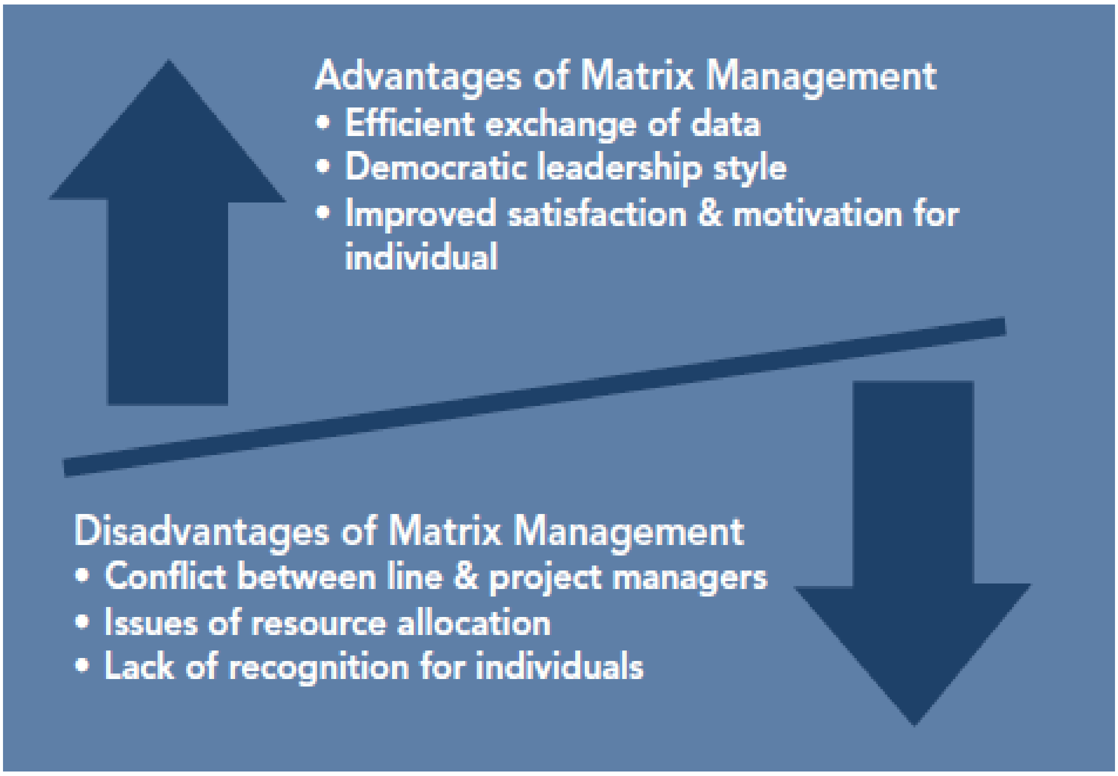
✓ There are various ways of structuring the project environment depending on the type of organization.

Projects in a Matrix-Management Environment

This type of structure can be taken further to give what is known as a pure matrixmanagement environment.

This is a type of structure in which even though an individual may 'belong to' a particular department, they will be assigned to different projects and report to a project manager while working on that project. Therefore, each individual may have to work under several managers whilst performing their role.

Matrix management is now fairly common and exists at some level in most large organizations, particularly those that have multiple business units and international operations.



The matrix structure also encourages a democratic leadership style that incorporates the input of team members before managers make decisions. The ability to contribute valuable information before decisions are made leads to employee satisfaction and increased motivation.

A disadvantage of the matrix structure is that it is a recipe for disagreement between the line manager and the project managers. This is because the latter will often try to minimize each department's billing to the project, whereas the departmental managers will usually try to secure as much of the project's budget as possible.

There can also be disagreements about resource allocation and prioritization. This occurs because project managers tend to view their own project as the most important activity and forget that the line manager may have other commitments that his department is expected to meet

Firstly, line managers have finite resources at their disposal and often have to juggle these in such a way as to 'satisfy most of the demand for most of the time.’ In addition, they often have numerous deadlines, relating to both departmental work-in-progress as well as to each project that they are supplying resources to.

Secondly, projects in progress may be subject to changes, following the agreement and commitment of the line resources required. This may result from a failure to achieve the expected progress in any area of work and is likely to have a knock-on effect on the ability of the line manager to supply the resources they are committed to. As a line manager, you may also have to accommodate unexpected resource shortages due to absenteeism and staff turnover.

All of these factors mean that conflict is unavoidable in organizations that are structured in this way and many of these issues described may be complicated further if staff are working on more than one project at a time.

Another feature of the matrix structure is that it can lead to staff members becoming concerned about the extent to which the efforts they expend on project-related work will be recognized and rewarded financially. This problem may be compounded if they feel their project-related work will not be recognized within their own department and no matter how hard they work on the project it will not affect their chances of advancement. This concern is primarily an issue with staff seconded to projects on a full-time basis as they may feel increasingly isolated and left behind in relation to their long-time colleagues and the departmental practices with which they are familiar. Also, individuals involved with long-term projects may have worries about what happens to them at the end of the project. Their fear could be that their department has learnt to cope without them, or developed new procedures whilst they were assigned to the project.

Projects are all about utilizing existing resources and expertise in an efficient and effective way to get things done. The downside of this, from a staff perspective, may be that projects are not seen as training-oriented environments in which to develop personal skills. The questions raised by the problem of establishing a sound project management structure revolve around the creation of effective reporting lines. There are two organizational extremes that can be adopted:

- All of the personnel working on the project remain in their normal situation, reporting to their line managers. In this case, the project management staff will need to coordinate the required project work through the line managers.
- A project team is created and all personnel working on the project are drawn into a project team and report exclusively to the project manager. In practice a combination of these approaches is often found to be the best solution, and is by far the most common method. However, this organizational framework risks breaking one of the tenets of good management - that of matching responsibility with authority. The project manager will be responsible for performance on the project but may lack sufficient authority where contributors report to their own line managers. All of these factors mean that unless your organization is completely project focused then you can expect conflict, disagreement, and compromise to be an integral part of organizing a project.

Key Points

✓In a matrix environment, an individual may ‘belong to’ a particular department but they will be assigned to different projects and report to a project manager while working on that project.

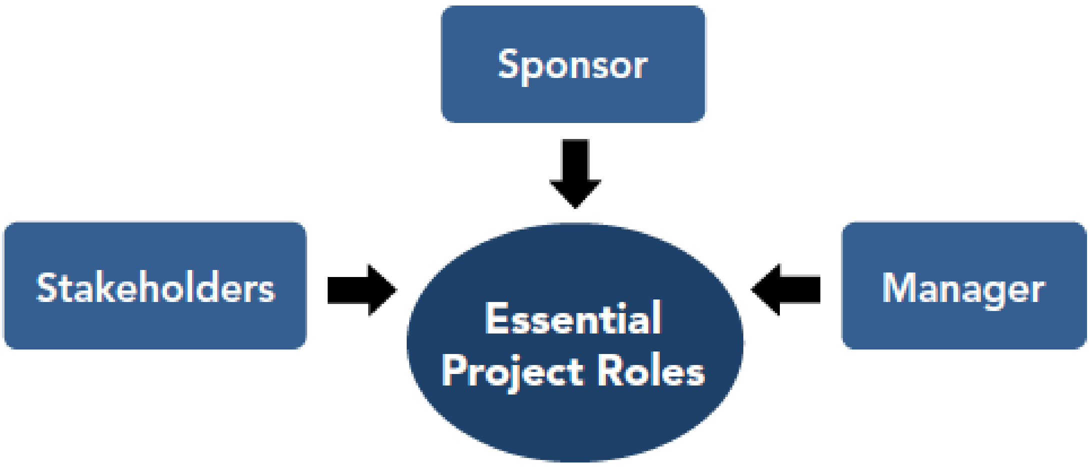
✓An advantage of the matrix structure is that it can lead to a more efficient exchange of information as people from different areas work closely together.

✓A disadvantage of the matrix structure is that it is a recipe for disagreement between the line manager and the project managers.

✓Unless your organization is completely project focused then you can expect conflict, disagreement, and compromise to be an integral part of organizing a project.

4.2. Stakeholder and participants of innovation project

Irrespective of how the organization is structured, there are certain roles and responsibilities that are required in all projects. Different organizations may use different names for these roles but the responsibilities of each one will be the same.



The project management team must identify the stakeholders, determine their requirements and expectations, and, to the extent possible, manage their influence in relation to the requirements to ensure a successful project.

There are narrower views of the term stakeholder, focusing on the influencers and decision-makers of a business or technological change. In this context, stakeholders are managers who have the organizational authority to allocate resources (people, money, services) and set priorities for their own organizations in support of a change. One of the keys to a successful project is successfully managing the relationships between everyone involved - the stakeholders.

There are three processes involved:

1) Identify the Project Stakeholders

This involves identifying the people, groups, or organizations that could impact or be impacted by a decision, activity, or outcome of the project. It analyzes and documents their interests in and influence on the project. A stakeholder is defined as anyone with an interest in the project, irrespective of whether that interest is positive or negative. They may be individuals or organizations that are actively involved in the project, or whose interests may be affected by the execution or completion of the project.

A project manager must be sure to identify and list all potential stakeholders for a project. In addition to those on the project team potential stakeholders include those shown in the diagram.

Stakeholders can be internal to the organization or external. In many projects the public at large will become a stakeholder to be considered during the project. The challenge for the project manager when the public is a stakeholder will be to act while considering public needs. Often there is no direct representative of the public to be consulted during project planning and execution.

2) Analyze their potential involvement with the project

This is the process that develops appropriate management strategies to effectively engage stakeholders throughout the project. Stakeholder analysis is so important that a wide variety of experts are consulted to help analyze the actual level and the desired level of engagement level of the various stakeholders. These experts are the same ones that were consulted in the previous process to identify the stakeholders and analyze their interest and/or influence on the project in order to determine the general strategy for engaging them.

3) Manage their engagement with the project

This is the process that communicates and works with stakeholders to meet their needs and expectations, address issues as they occur, and support stakeholder engagement. It details how you communicate with stakeholders and ensures appropriate engagement levels. If you intend to manage a project then you will need a detailed knowledge of these roles and their responsibilities. However, in order to understand the basic principles of project management there are only two roles that you need to know about in any detail, the project sponsor and the project manager.

Key Points

✓ Irrespective of how the organization is structured, there are certain roles and responsibilities that are required in all projects.

✓ Project stakeholders are individuals and organizations that are actively involved in the project, or whose interests may be positively or negatively affected by execution of the project or project completion.

Some of the key players are:

- **Project sponsor**, who owns and funds the entire project. Sponsors need to review and approve all aspects of the plan.
- **Designated business experts**, who will define their requirements for the end product. They need to help develop the scope baseline and approve the documents relating to scope. They will be quite interested in the timeline as well.
- **Project manager**, who creates, executes, and controls the project plan. Since project managers build the plan, they do not need to approve it.
- **Project team**, who build the end product. The team needs to participate in the development of many aspects of the plan, such as identifying risks, quality, and design issues, but the team does not usually approve it.
- **End users**, who use the end product. They too, need to participate in the development of the plan, and review the plan, but rarely do they actually need to sign off.
- **Others**, such as auditors, quality and risk analysts, procurement specialists, and so on may also participate on the project. They may need to approve the parts that pertain to them, such as the Quality or Procurement plan.

Research and innovation projects can be very different and yet have clear characteristics in common, when it comes to the organisation of project management. Below follows a suggestion of what the main pillars of the project management model are.

The overall objective, the type of collaboration and the number of collaborative partners in research and innovation projects may be basically different.

It is the project manager’s responsibility to analyze and collate the progress reports and to summarize this information in regular highlight reports, which should be presented to the project owner. Highlight reports should be produced at regular intervals, for example monthly, and may also be produced in response to exceptional circumstances.

The project manager will need to maintain clear communications with other management bodies, appropriate to the size of the project. They should submit the project plans and sub-project plans to the project owner for approval and then advise the owner if there are any significant deviations from them. If tolerances are being exceeded then remedial plans may also need to be submitted for the approval of the project owner.

In addition to preparing the project plan, the project manager should specify or create a configuration management method for the project. Configuration management covers the tracking, documentation and issue of all project documents and products, throughout the project life cycle.

The project manager should agree the technical and quality strategy for the project, with the section that is responsible for organizational policy. It is important that the project manager also maintains clear communication with any related projects to ensure that work is neither overlooked nor duplicated.

Key Points

✓ The sponsor is responsible for securing the financing and overall resource budget approval and owns the opportunities and risks related to the financial outcome of the project.

✓ The project manager is appointed to deliver the project as it is defined in the project charter or project plan.

✓ Duties include: submitting the project plans to the project owner for approval, appointing team leaders and defining their responsibilities.

✓ The project manager will also need to liaise with project office staff to maintain project integrity and make recommendations and put into effect the decisions made.

✓ Be aware that disagreements have the potential to arise at all levels.

✓ Personality conflicts often manifest themselves as a dispute over a project issue.

TOPIC 5. PLANNING THE PROJECT REALIZATION

5.1. The essence of project planning, objectives, purpose and types of plans.

5.2. Network planning.

5.1. The essence of project planning, objectives, purpose and types of plans

Often project planning is ignored in favour of getting on with the work. However, many people fail to realise the value of a project plan for saving time, money and many problems. The planning phase is considered the most important phase in project management. Project planning defines project activities that will be performed; the products that will be produced, and describes how these activities will be accomplished and managed. Project planning defines each major task, estimates the time, resources and cost required, and provides a framework for management review and control. Planning involves identifying and documenting scope, tasks, schedules, cost, risk, quality, and staffing needs.

The result of the project planning, the project plan, will be an approved, comprehensive document that allows a project team to begin and complete the work necessary to achieve the project goals and objectives. The project plan will address how the project team will manage the project elements. It will provide a high level of confidence in the organization's ability to meet the scope, timing, cost, and quality requirements by addressing all aspects of the project

A **project plan**, according to the Project Management Body of Knowledge (PMBOK), is: "...a formal, approved document used to guide both *project execution* and *project control*. The primary uses of the project plan are to document planning assumptions and decisions, facilitate communication among *project stakeholders*, and document approved scope, cost, and schedule *baselines*. A project plan may be summarized or detailed."

The latest edition of the PMBOK (v5) uses the term *project charter* to refer to the contract that the project sponsor and project manager use to agree on the initial vision of the project (scope, baseline, resources, objectives, etc.) at a high level. In the PMI methodology described in the PMBOK v5, the project charter and the project management plan are the two most important documents for describing a project during the initiation and planning phases.

Project planning is a procedural step in project management, where required documentation is created to ensure successful project completion.

Documentation includes all actions required to define, prepare, integrate and coordinate additional plans. The project plan clearly defines how the project is executed, monitored, controlled and closed.

Project planning requires an in-depth analysis and structuring of the following activities:

- Setting project goals
- Identifying project deliverables
- Creating project schedules
- Creating supporting plans

The Plan is a contract between the Project Manager, Executive Sponsor, Project Team and other management of the enterprise associated with and/or affected by the project. Each Project Plan component is essentially a work product resulting from subtasks in the *Make Plan* Project Management task, but can be revised during other project management activities. It is important to document all parameters that will have an impact on the project, its planning and execution. The finished product can be 30 pages long describes the following about the project:

- Purpose/background/approach
- Goals/objectives
- Scope
- Deliverables
- Constraints/assumptions
- Related projects/critical dependencies
- Schedule and milestones
- Budget/cost-benefit assessment
- Risk assessment
- WBS

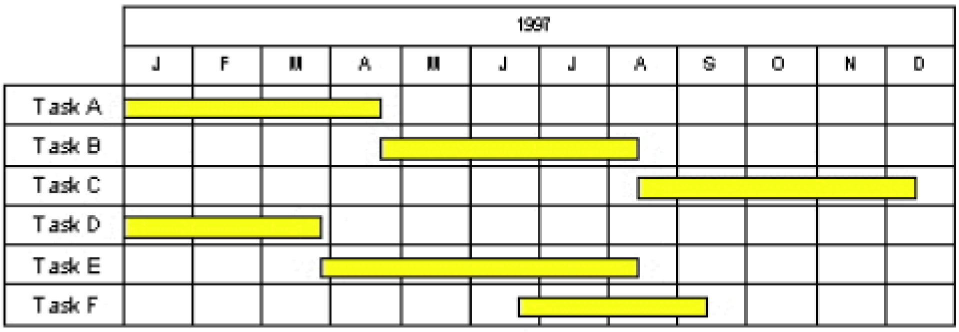
- Quality management approach
- Tools and techniques to be used
- Resource estimates
- Standards
- Change and control procedures
- Roles/responsibilities
- Work plan
- Team contact directory
- Approval sign-off form

5.2. Network planning

Project Planning Techniques The three basic project planning techniques are Gantt chart, CPM and PERT. All monitor progress and costs against resource budgets.

Gantt Chart Gantt charts are also called Bar charts. The use of Gantt charts started during the industrial revolution of the late 1800's. An early industrial engineer named Henry Gantt developed these charts to improve factory efficiency. Gantt chart is now commonly used for scheduling the tasks and tracking the progress of energy management projects.

Gantt charts are developed using bars to represent each task. The length of the bar shows how long the task is expected to take to complete. Duration is easily shown on Gantt charts. Sequence is not well shown on Gantt Charts (Refer Figure below).



CPM - Critical Path Method

Program evaluation and review technique (PERT) and **critical path method (CPM)** date back to the 1950s. PERT was originally developed to plan and monitor the Polaris missile, an extremely large project using over 3000 contractors and involving thousands of activities. PERT is credited with reducing the project duration by two years. Because of its success, most government contracts still require the use of PERT or a similar technique. CPM was initially developed to plan and coordinate maintenance projects in chemical plants. DuPont developed a **Critical Path Method** (CPM) designed to address the challenge of shutting down chemical plants for maintenance and then restarting the plants once the maintenance had been completed.

Complex project, like the above example, require a series of activities, some of which must be performed sequentially and others that can be performed in parallel with other activities. This collection of series and parallel tasks can be modeled as a network.

CPM models the activities and events of a project as a network. Activities are shown as nodes on the network and events that signify the beginning or ending of activities are shown as arcs or lines between the nodes. The Figure 2 shows an example of a CPM network diagram:

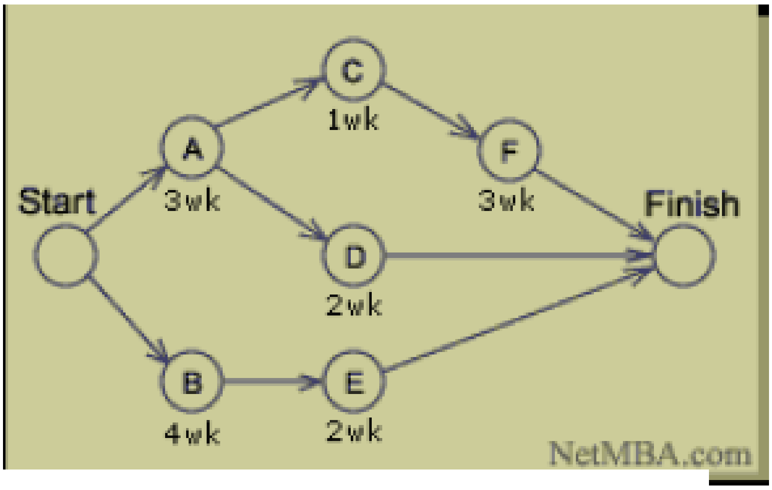


Figure 2. CPM Diagram

Steps in CPM Project Planning

1. Specify the individual activities.
2. Determine the sequence of those activities.
3. Draw a network diagram.
4. Estimate the completion time for each activity.
5. Identify the critical path (longest path through the network)
6. Update the CPM diagram as the project progresses.

1. Specify the individual activities. All the activities in the project are listed. This list can be used as the basis for adding sequence and duration information in later steps.

2. Determine the sequence of the activities. Some activities are dependent on the completion of other activities. A list of the immediate predecessors of each activity is useful for constructing the CPM network diagram.

3. Draw the Network Diagram. Once the activities and their sequences have been defined, the CPM diagram can be drawn. CPM originally was developed as an *activity on node* network.

4. Estimate activity completion time. The time required to complete each activity can be estimated using past experience. CPM does not take into account variation in the completion time.

5. Identify the Critical Path. The critical path is the longest-duration path through the network. The significance of the critical path is that the activities that lie on it cannot be delayed without delaying the project. Because of its impact on the entire project, critical path analysis is an important aspect of project planning.

The critical path can be identified by determining the following four parameters for each activity:

• ES - earliest start time: the earliest time at which the activity can start given that its precedent activities must be completed first.

• EF - earliest finish time, equal to the earliest start time for the activity plus the time required to complete the activity.

• LF - latest finish time: the latest time at which the activity can be completed without delaying the project.

• LS - latest start time, equal to the latest finish time minus the time required to complete the activity.

The *slack time* for an activity is the time between its earliest and latest start time, or between its earliest and latest finish time. Slack is the amount of time that an activity can be delayed past its earliest start or earliest finish without delaying the project.

The critical path is the path through the project network in which none of the activities have slack, that is, the path for which ES=LS and EF=LF for all activities in the path. A delay in the critical path delays the project. Similarly, to accelerate the project it is necessary to reduce the total time required for the activities in the critical path.

As the project progresses, the actual task completion times will be known and the network diagram can be updated to include this information. A new critical path may emerge, and structural changes may be made in the network if project requirements change.

CPM Benefits:

• Provides a graphical view of the project.

• Predicts the time required to complete the project.

• Shows which activities are critical to maintaining the schedule and which are not.

CPM Limitations

While CPM is easy to understand and use, it does not consider the time variations that can have a great impact on the completion time of a complex project. CPM was developed for complex but fairly routine projects with minimum uncertainty in the project completion times. For less routine projects there is more uncertainty in the completion times, and this uncertainty limits its usefulness.

PERT

The *Program Evaluation and Review Technique* (PERT) is a network model that allows for randomness in activity completion times. PERT was developed in the late 1950's for the U.S. Navy's Polaris project having thousands of contractors. It has the potential to reduce both the time and cost required to complete a project.

In a project, an activity is a task that must be performed and an event is a milestone marking the completion of one or more activities. Before an activity can begin, all of its predecessor activities must be completed. Project network models represent activities and milestones by arcs and nodes.

PERT is typically represented as an *activity on arc* network, in which the activities are represented on the lines and milestones on the nodes. The Figure 3 shows a simple example of a PERT diagram.

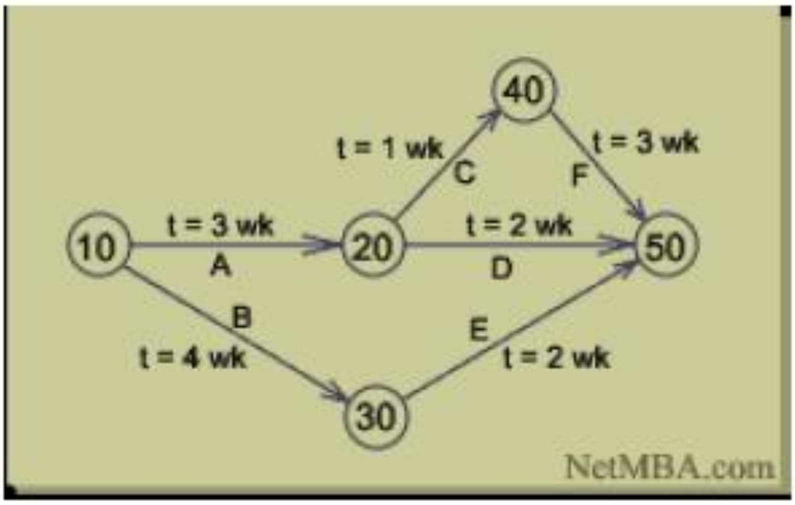


Figure 3. PERT Chart

The milestones generally are numbered so that the ending node of an activity has a higher number than the beginning node. Incrementing the numbers by 10 allows for new ones to be inserted without modifying the numbering of the entire diagram. The activities in the above diagram are labeled with letters along with the expected time required to complete the activity.

PERT planning involves the following steps:

1. Identify the specific activities and milestones.
2. Determine the proper sequence of the activities.
3. Construct a network diagram.
4. Estimate the time required for each activity.
5. Determine the *critical path*.
6. Update the PERT chart as the project progresses.

1. Identify activities and milestones. The activities are the tasks required to complete the project. The milestones are the events marking the beginning and end of one or more activities.

2. Determine activity sequence. This step may be combined with the activity identification step since the activity sequence is known for some tasks. Other tasks may require more analysis to determine the exact order in which they must be performed.

3. Construct the Network Diagram. Using the activity sequence information, a network diagram can be drawn showing the sequence of the serial and parallel activities.

4. Estimate activity times. Weeks are a commonly used unit of time for activity completion, but any consistent unit of time can be used.

A distinguishing feature of PERT is its ability to deal with uncertainty in activity completion times. For each activity, the model usually includes three time estimates:

• *Optimistic time (OT)* - generally the shortest time in which the activity can be completed. (This is what an inexperienced manager believes!)

• *Most likely time (MT)* - the completion time having the highest probability. This is different from expected time. Seasoned managers have an amazing way of estimating very close to actual data from prior estimation errors.

• *Pessimistic time* (PT) - the longest time that an activity might require.

The expected time for each activity can be approximated using the following weighted average:

Expected time = (OT + 4 x MT+ PT) / 6

This expected time might be displayed on the network diagram.

Variance for each activity is given by:

$[(PT - OT) / 6]^2$

5. Determine the Critical Path. The critical path is determined by adding the times for the activities in each sequence and determining the longest path in the project. The critical path determines the total time required for the project.

If activities outside the critical path speed up or slow down (within limits), the total project time does not change. The amount of time that a non-critical path activity can be delayed without delaying the project is referred to as *slack time*.

If the critical path is not immediately obvious, it may be helpful to determine the following four quantities for each activity:

• ES - Earliest Start time

• EF - Earliest Finish time

• LS - Latest Start time

• LF - Latest Finish time

These times are calculated using the expected time for the relevant activities. The ES and EF of each activity are determined by working forward through the network and determining the earliest time at which an activity can start and finish considering its predecessor activities.

The latest start and finish times are the latest times that an activity can start and finish without delaying the project. LS and LF are found by working backward through the network. The difference in the latest and earliest finish of each activity is that activity's slack. The critical path then is the path through the network in which none of the activities have slack.

The variance in the project completion time can be calculated by summing the variances in the completion times of the activities in the critical path. Given this variance, one can calculate the probability that the project will be completed by a certain date.

Since the critical path determines the completion date of the project, the project can be accelerated by adding the resources required to decrease the time for the activities in the critical path. Such a shortening of the project sometimes is referred to as *project crashing*.

Benefits of PERT. PERT is useful because it provides the following information:

• Expected project completion time.

• Probability of completion before a specified date.

• The critical path activities that directly impact the completion time.

• The activities that have slack time and that can lend resources to critical path activities.

• Activities start and end dates.

The following are some of PERT's limitations:

• The activity time estimates are somewhat subjective and depend on judgment. In cases where there is little experience in performing an activity, the numbers may be only a guess. In other cases, if the person or group performing the activity estimates the time there may be bias in the estimate.

• The underestimation of the project completion time due to alternate paths becoming critical is perhaps the most serious.

Other forms of network planning network-planning techniques have been developed since then they are..

1. Precedence diagramming method (PDM)

2. Graphical evaluation review technique (GERT)

Network techniques, on the other hand, separate planning and scheduling functions. A network diagram is the result, or the output, of the planning function and is not drawn to a tome scale. The network diagram is also referred as project graph, which shows activities and events of the project and their logical relationship.

TOPIC 6. MANAGEMENT OF INNOVATION PROJECTS RISKS

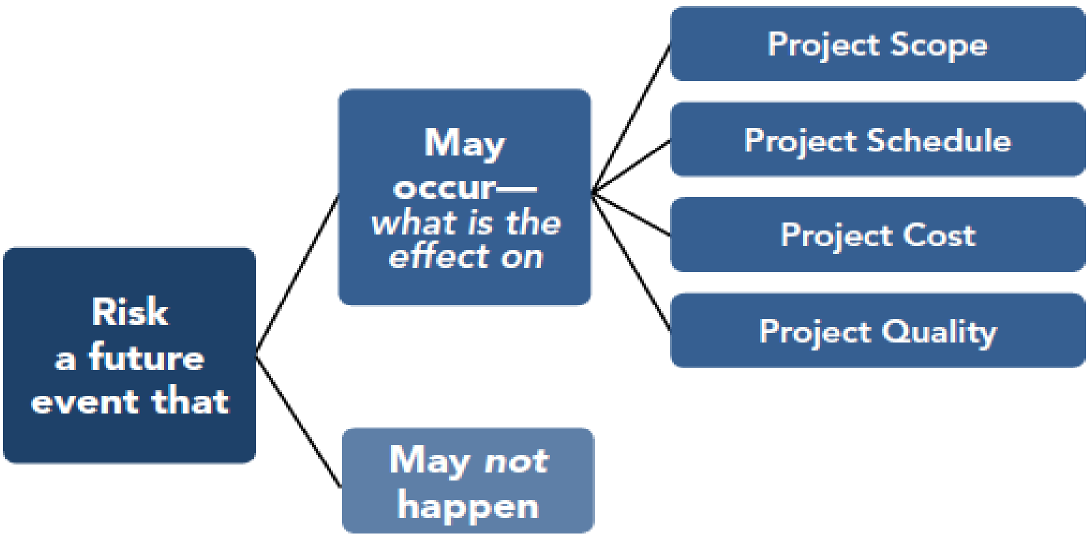
6.1. Risk Management Steps

6.2. Internal and hidden risks of innovation projects

6.1. Risk Management Steps

Everything that is done in business contains some measure of risk. No matter what the activity, there is an element of risk that must be analyzed and weighed against the potential rewards. The best organizations are those who can choose the right risks to take on, and the ones to avoid.

Dealing with too little risk often means that the organization is being too conservative and is limiting their potential for growth - too much risk, however, and the company is likely to crash and burn at some point along the way.



The purpose of a risk diagnosis is to detect those factors which may jeopardize the successful realization of the project objectives. In product-innovation projects, these factors can be differentiated in terms of their technological, organizational and commercial factors.

The meaning of the term "risk" must be understood clearly for effective project risk management. In the context of a project, we are concerned about potential impacts on project objectives such as cost and time. A general definition of "risk" in this context is:

Risk is an uncertainty that matters; it can affect project objectives negatively or positively.

The uncertainty may be about a future event that may or may not happen and the unknown magnitude of the impact on project objectives if it does happen. Thus, a "risk" is characterized by its probability of occurrence and its uncertain impact on project objectives.

The kinds of risks appearing in a risk register are shown below based on when they might occur during the life cycle of a project.

- Throughout the project life cycle, a future event that may occur at any time in a project's lifecycle is a risk. It has a probability of occurrence and an uncertain impact if it does occur.
- During Planning and Design, uncertainty in the total cost estimate, due to uncertain quantities and unit prices is a risk. In this case the probability is 100% (the estimate and its uncertainties exist), and the uncertainties impact the project cost.
- During construction, a Notice of Potential Claim (NOPC) has a probability of becoming a Contract Change Order (CCO) and an uncertain cost/time impact if this happens. This risk is retired from the register if the claim is dismissed or if it is replaced by a CCO.

• During construction, a CCO which has occurred (100% probability) is a risk, but its cost/time impact may be uncertain. If there is an estimate in the CCO Log of the project, the uncertainty is expressed as a range around the estimate. This risk is retired from the register when the CCO is executed with the contractor.

Categorization of the possible sources of risks:

– *Environment* (government policy, exchange rates, availability of

– skilled labour, weather, culture)

– *Technical* (new methods, technologies, materials)

– *Resources* (staff, materials, finance)

– *Integration* (software modules, new & old systems)

– *Management* (multiple parties' experience, use of project management techniques, HRM, set the tight goals, product transition management, organization structure, organization behaviour)

– *Marketing* (customer, competitors)

– *Strategy*

All approaches to project risk management strive to maximize both efficiency and effectiveness. Although the details of risk processes may differ depending on the project, risk management has three important parts: identification, analysis, and action. Before risk can be properly managed, it must first be identified, described, understood, and assessed. Analysis is a necessary step, but it is not sufficient; it must be followed by action. A risk process which does not lead to implementation of actions to deal with identified risks is incomplete and useless. The ultimate aim is to manage risk, not simply to analyze it.

Risk Management Steps

1.	**Risk Management Planning**	Risk management planning is the systematic process of deciding how to approach, plan, and execute risk management activities throughout the life of a project. It is intended to maximize the beneficial outcome of the opportunities and minimize or eliminate the consequences of adverse risk events.
2.	**Identify Risk Events**	Risk identification involves determining which risks might affect the project and documenting their characteristics. It may be a simple risk assessment organized by the project team, or an outcome of the CRA/CEVP® workshop process.
3.	**Qualitative Risk Analysis**	Qualitative risk analysis assesses the impact and likelihood of the identified risks, and develops prioritized lists of these risks for further analysis or direct mitigation. Project teams assess each identified risk for its probability of occurrence and its impact on project objectives. Teams may elicit assistance from subject matter experts or functional units to assess the risks in their respective fields.
4.	**Quantitative Risk Analysis**	Quantitative risk analysis is a way of numerically estimating the probability that a project will meet its cost and time objectives. Quantitative analysis is based on a simultaneous evaluation of the impacts of all identified and quantified risks.
5.	**Risk Response**	Risk response is the process of developing options and determining actions to enhance opportunities and reduce threats to the project's objectives. It identifies and assigns parties to take responsibility for each risk response. This process ensures each risk requiring a response has an "owner." The Project Manager and the project team identify which strategy is best for each risk, and then select specific actions to implement that strategy.
6.	**Risk Monitoring & Control**	Risk monitoring and control tracks identified risks, monitors residual risks, and identifies new risks—ensuring the execution of risk plans and evaluating their effectiveness in reducing risk. Risk monitoring and control is an ongoing process for the life of the project.

Identifying the Risks

Before a project even gets started, it is essential that any potential risks are identified and a strategy for managing such risks developed. One of the best ways to do this is by learning from past experience - either your own experiences, or those of the organization as a whole.

Evaluating the Risks

With a list in place that highlights which risks you will be taking on during the project, you can start looking closely at each of them and deciding what kind of threat they actually are. Is the risk something that would do long-term damage to the organization if it came to pass? Usually, risks that fall into this category are of the legal variety.

Both qualitative and quantitative analysis must be performed for each risk. Firstly, each risk is assessed and rated according to its likely probability and then secondly on the impact it would have on the project if it happened. There are a variety of tools that are used to assist in these processes:

Techniques used in Risk Analysis	
Qualitative	**Quantitative**
Risk Probability & Impact Assessment Probability & Impact Matrix Risk Data Quality Assessment Risk Categorization Risk Urgency Assessment Expert Judgment	Data Gathering & Representation Techniques Quantitative Risk Analysis & Modeling Techniques: ▪ *Sensitivity Analysis* ▪ *Expected Monetary Value (EVM) Analysis* ▪ *Decision Tree Analysis* ▪ *Tornado Diagrams* ▪ *Monte Carlo Analysis* Expert Judgment

Qualitative Risk Analysis

– Risk Probability & Impact Assessment

– Probability & Impact Matrix

– Risk Data Quality Assessment

– Risk Categorization

– Risk Urgency Assessment

– Expert Judgment

Quantitative Risk Analysis

– Sensitivity Analysis

– Expected Monetary Value (EMV) Analysis

– Decision Tree Analysis

– Tornado Diagrams

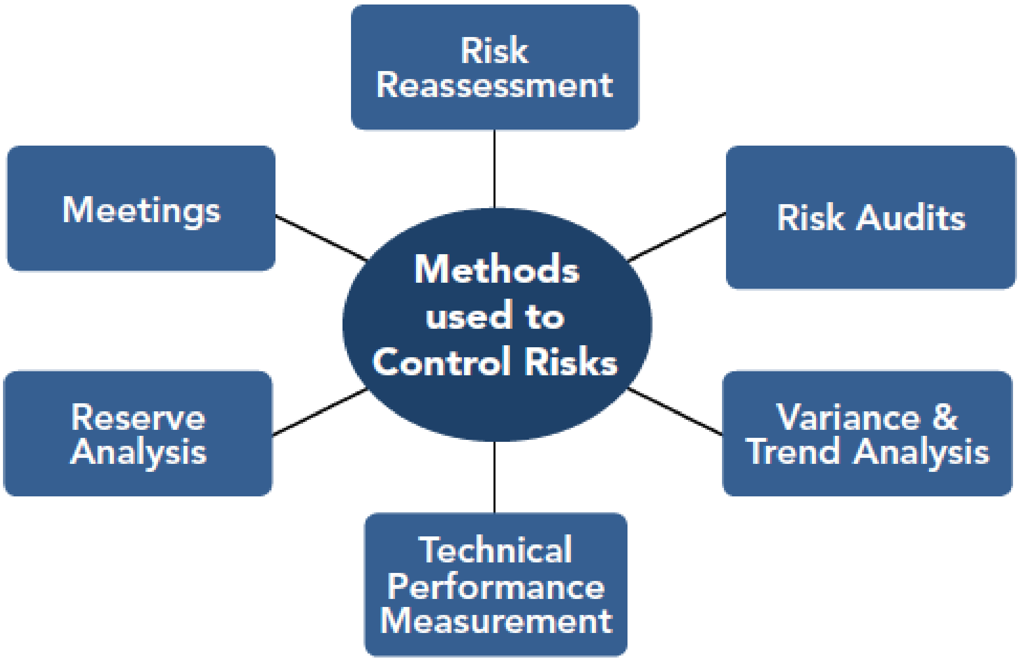
– Monte Carlo Analysis

Beyond what kind of damage a certain risk could do is the consideration of how likely that risk is to occur. For example, a risk that is very likely to occur and would also be highly damaging to the company is one to take very seriously. On the other hand, a risk that is unlikely to be realized and also wouldn't do much harm is one that you can mostly ignore.

Mitigating the Risks

This was touched on briefly above as far as taking steps to limit the damage that any of your potential risks would do. The easiest example to understand is the one regarding members of the team.

Doing what you can to limit your exposure to risk throughout the project, while still giving the project a chance to succeed is the task that a project manager takes on. No one likes to have to deal with risk, but it is an unavoidable part of doing business. The best that can be done is to evaluate each risk that you might face, and weigh it against the potential rewards that are waiting at the end of the project. Project managers also plan how they will control risks using a variety of tools and techniques shown in the diagram below.



The goal is to make the level of risk acceptable to the organization and to take steps that minimize the element of risk as much as possible.

Managing Project Risk

A risk is a future event that may or may not happen, but if it does occur it will have an effect on project scope, schedule, budget, or quality. It may have one or more causes and, if it occurs, it may have one or more impacts.

All project activities carry some element of risk, which are uncertainties about them that could affect the project for better or worse. It is important to understand the difference between business risks and project risks. What a project manager needs to know is what is the likelihood a risk will occur and if it does what will it impact as this affects the project plan.

What is certain is that if the risk happens in the future it will have an effect on project project scope, schedule, cost, or quality. It may have one or more causes and, if it occurs, it may have one or more impacts. All project activities carry some element of risk, which are uncertainties about them that could affect the project for better or worse. The important distinction that must be understood is the difference between business risks and project risks. Business risks are more general and relate to the organization, whereas project risks relate specifically to the project objectives.

This could be because of lower than expected ticket sales or higher than expected maintenance costs. These risks exist outside of the scope of the project. Risks are caused by a requirement, assumption, constraint, or condition that creates the possibility of negative or positive outcomes.

Risks include both threats and opportunities that project managers must assess. Opportunities do have uncertainty associated with them, but they should be grasped, and action taken to ensure that they are realized.

Threats have potentially negative impacts that the project management team should strive to mitigate. Organizations and stakeholders are willing to accept varying degrees of risk. This is called risk tolerance. Risks that are threats to the project may be accepted if they are in balance with the rewards that may be gained from taking them.

All organizations have a 'risk tolerance' that is affected by their legal status and their culture. For instance, a pension fund is likely to be more risk averse than a small start up company. In all cases, attitudes to risk are driven by perception, tolerances, and other biases, which should be made explicit wherever possible.

To be successful, the organization should be committed to address risk management proactively and consistently throughout the project. A conscious choice must be made at all levels to actively identify and pursue effective risk management during the life of the project. Communication about risk and it's handling should be open and honest. Risk exists the moment a project is conceived. Moving forward on a project without a proactive focus on risk management increases the impact that a realized risk can have on the project and can potentially lead to project failure.

Key Points

- ✓ A risk is a future event that may or may not happen but if it does occur it will have an effect on project scope, schedule, cost, or quality.
- ✓ Risks include both threats and opportunities because both have uncertainty associated with them.
- ✓ A project manager needs to know the likelihood that a risk will occur and its potential impact to the project if it does.
- ✓ All organizations have a 'risk tolerance' that is affected by their legal status and their culture.
- ✓ Attitudes to risk are driven by perception, tolerances, and other biases, which should be made explicit wherever possible.

6.2. Internal and hidden risks of innovation projects

From incremental to breakthrough innovation projects, managers need to handle different activities and with them dissimilar venues of risks. The standard approach to risk is based on the occurrence of events. Specifically, risk management is concerned with identifying potential adverse events and taking steps to reduce either their probability of occurrence or their impact. Managing risk requires thinking about risk, and thinking about risk requires thinking about and being comfortable with uncertainty and randomness.

Managing risk must be a core competence for any financial firm. The ability to effectively manage risk is the single most important characteristic separating financial firms that are successful and survive over the long run from firms that are not successful. At successful firms, managing risk always has been and continues to be the responsibility of line managers - from the board through the CEO and down to individual trading units or portfolio managers. Managers have always known that this is their role, and good managers take their responsibilities seriously. The only thing that has changed in the past 10–20 years is the development of more sophisticated analytical tools to measure and quantify risk. One result has been that the technical skills and knowledge required of line managers have gone up. Risk management is about managing people, processes, data, and projects. Of these, people are the most important. All the problems, and all the successes, come down to people. Compensation, incentives, and principal–agent problems are critical. What are principal–agent problems? A classic is when managers of a firm do not have the same goals as the owners.

Referring to the risks of successful innovation projects, “Time risk” and “Risk-averse culture” appear to be the two most internal significant risks. Whereas, the least barriers for the successful innovation projects have been “Leadership support” and “Personnel risk”.

On the other side, for the non-successful innovation project’s internal risks, the two most significant risks have switched places. “Risk-averse culture” becomes more relevant and influential on the success rate of innovation projects than “Time risk”. Interestingly, the two second most important risks on those innovation projects which have been non-successful, have been “Leadership support” and “Customer Insight Risk”.

“Leadership support”, “Customer insight risk” and “Marketing risks” appear to be the most significant hidden innovation project’s risks. Indeed, if the innovation project lacks the leadership support or customer insight, it has high chances of failing. On the other side, time risk is the least hidden. It has scored the same weighted mean in both analysis, successful and non-successful, that is, time risk remains the biggest internal “certain” risk of innovation projects.

In conclusion, an innovation project could be considered successful if the project is finished within the pre-established time limits (time), has delivered the outcomes and benefits required by the organization, its partners and other stakeholders (performance), and stayed within financial budgets (costs). Such projects, will probably face the following most dominant internal risks:

“Risk – averse culture”;

“Lengthy development times”;

“Not enough customer insight”;

“Insufficient support from leadership and management”.

Particular attention should be directed towards “Leadership support” and “Customer insight risk” as the two biggest hidden risks influencing a project to become non-successful. Therefore, more efforts should be directed toward the mitigation activities of such risks before the project starts. Managers should ensure the full leadership support and complete understanding of customers on the innovation project that they are launching.

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