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Study of Production Management and Project Complexity: A Review Approach

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Abstract: The main objective of current paper is to study the basics of chracteristics of production management and their related area. The paper focues on nature , scope , functions and objectives of production management also discuss the project compexity and factors affecting project complexicity in details.

Index Terms **– Production Management , Project Complexity, Project.**

I. INTRODUCTION

Production Management is a process which involves managing and controlling production activities of business. It involves the application of management principles to the production function of the business to increase productivity. Production management applies planning, directing, organising and controlling for managing production operations. This process is concerned with the conversion of raw materials into business finished products efficiently without any wastage of resources. The definitions of Production Management is follows:

According to Elwood Spencer Buffa

"Production management deals with decision-making related to production processes so that the resulting goods or service is produced according to specification, in the amount and by the schedule demanded and at minimum cost."

According to E.L. Brech

"Production Management is the process of effective planning and regulating the operations of that section of an enterprise which is responsible for the actual transformation of materials into finished products."

Production management involves framing of various production strategies and ensures the successful implementation of these strategies in business operations. These strategies are formed and implemented by production management for achievement of different pre-set goals in terms of unit costs, quality, production mix and capacity of production. Production management aims at proper integration and utilisation of 6M's: Men, Machine, Money, Methods, Materials and Market to satisfy the customer needs in a better way. Its main objective is to manufacture products and services in the right quantity, of the right quality, at the right time and at a lower cost. Various technological and innovation changes are easily implemented in business using Production management. Production management supervises and controls all persons associated with production operations of the business and ensure the desired output.[48]

II NATURE OF PRODUCTION MANAGEMENT

1. Results in Value Addition

Production management is a key tool available with an organization which assist in value addition. It is a process which enables in producing high-quality products by purchasing raw materials from the right source, in right form, at right price and in right quantity. These quality goods provide better satisfaction to customers thereby improving goodwill of an organization.

2. Inter-Disciplinary Approach

It is an inter-disciplinary approach which is derived from several disciplines and subjects. Different subjects like statistics, mathematics, economics, engineering, sociology and human psychology have contributed toward the development of production management approach.

3. Part of General Management

Production management is an essential component of General management. It is a tool which assist managers in planning, organizing, coordinating and controlling all activities related to the production of products and services.

4. Transformation Process

It is a process of transformation in which raw materials are converted into finished products that are ready for consumption by consumers. Production management focuses on economical production of products avoiding any wastage of raw materials used.

5. Operative Function

Production management monitors day to day operations of business for ensuring long-term continuity. It supervises all production activities on daily basis for checking out whether all resources are efficiently utilized.

6. Both Art and Science

It can be treated both as an art as well as science. Production management is termed as art as it is the one which assign, coordinates and monitors all work activities of an organization. Whereas, it is a science as it manages all machines and technical aspects helping in production activities.

7. Management of Service Sector

Production management not only manages the activities related to production of tangible products. It is a process which monitors the service sector also where intangible products are provided to customers as per their needs.[48]

II. Scope of Production Management

1. Facility location

It involves selecting the right location for setting up production facilities of business that affects its long term growth. This is an important decision to be taken as it involves long term commitment and huge investments in land, building and machinery. Location of facility should be appropriate from where raw materials, labor and other factors of production are easily accessible by business.

2. Plant Layout and Material Handling

Plant layout is concerned with physical arrangement of facilities set up by business. It involves deciding departments, work Centre's, machines and necessary equipment's within the facility for ensuring better productivity. Material handling refers to managing the movement of materials from storeroom to machinery and from machinery to another stage of production like packaging and storing.

3. Product Designing

Product designing means giving shapes to ideas of products for converting them into a reality. Every organization should come up with innovative products in market after conceiving new ideas based on market requirements.

4. Designing of Process

Process design is an overall route followed by business for transforming raw materials into finished products. It is a crucial decision to be taken as it determines the efficiency of business. It involves choosing appropriate technology, deciding sequence of production processes and facilities layout.

5. Production Planning and Control (PPC)

It involves planning and controlling various aspects of production activities. PPC is a process of deciding production in advance, setting up the exact route for each item, deciding the start and finish deadline of each product for directing production orders to shops and following product progress in accordance with the order.

6. Quality Control

Quality control is a process of checking and maintaining the required quality standards of production activities within the organization. It ensures that goods produced are of high quality by setting up check points and measuring performance from time to time.

7. Maintaince Management

It refers to evaluation of all business activities for identifying any deviations if there. Maintaince management involves taking all corrective steps for removing these deviations. It focuses on keeping all the processes on track in line with decided quality, pre-determined cost schedule and time range. Taking care of all machinery repairs, replacement and servicing are included in this.[48]

III. Objectives of Production Management

1. Production in Right Quantity

Production management formulate and implement various production strategies to ensure production in right quantity. Production in the right quantity is important for every organisation to ensure profitability. Excess or shortage in production will have adverse effects. Excess production of products will leads to blockage of funds in inventory. Whereas the shortage in production will create a shortage of its products and will not be able to fulfil demand.

2. Minimisation of Production Time

Completion of production activities timely is essential for the achievement of the goal. Production management designs schedules for various production activities of business. It monitors all production activities and ensures that all operations are going as per planned schedules. In case of any deviation in production activities, production manager takes all necessary corrective measures to remove these deviations. It helps in minimising the overall time involved in production activities.

3. Production of Right Quality

Production management ensures that quality products are manufactured by the organisation. It aims that customers' expectations are fulfilled by the product. Attempts are made to convert the needs of customers into production specification while designing a product. Certain standards are set through production management process and attempts are made to fulfil these standards.

4. Minimisation of Cost

Cost reduction is the primary focus of every business. Production management aims at minimising the cost of product activities of business. It involves usage of sound supply chain management in production planning minimising the overall production and supply cost. Production management estimates the true cost of a product before its production and tries to keep its production cost within the parameter of pre-estimated cost.

5. Planning and Control of Materials

Production management helps in maintaining the optimum stock of inventory within the organisation. It keeps complete record of all materials required for various production activities. By maintaining records, shortage of any raw materials can be easily detected. It helps in ensuring that all raw materials are always available in the right quantity so that production activities are not affected.

6. Analyse the Market

Production management completely analyse market situations before framing production strategies. It recognises and takes into account various technological and innovation changes at early as possible. All these changes are implemented in production activities of the organisation to face the market competition. Production activities go in line with market demand.

7. Optimum Utilisation of Resources

Proper utilisation of all resources is must to earn the desired profit and achieve desired goals. Production management issues rules and guidelines for all persons associated with production operations. It monitors their activities and helps them in improving their efficiency. Production managers check the overall activities and productivity of all departments of organisations. It is ensured that there is no wastage of resources and all resources are efficiently utilised.[48]

IV Functions of Production Management

1. Selection of Products and Its Design

Production management helps the firm in selection of proper products and design. Selection of the right product and its proper design is important for the survival of every business in the market. It performs several research programs to understand the wants of customers. Proper knowledge of customer requirements helps the firm in deciding the right product. After choosing a product, its proper design is selected to ensure that customer needs are fully satisfied at a lower cost.

2. Production Planning and Control

Planning and monitor production activities are quite important for every business. Production management keeps an eye on each and every activities and element associated with production operations. It decides in advance what to produce and in how much quantity, then decides process for production, sets the starting and completion dates for production activities. It designs an exact plan route in advance and implements that in operations to ensure timely delivery of orders. Production managers monitor all production activities and take all necessary activities as and when required.

3. Location of Facilities

Selection of proper location for setting production facilities is a must for ensuring smooth functioning. It is a long term capital decision which affects the business organisation in the long run. Production management properly analyse the area before setting up production plants and other facilities of business. It takes into account various geographical and other factors to ensure the availability of raw materials, enough employees and various infrastructural facilities.

4. Machines Maintenance and Replacement

Production management plays a significant role in the maintenance of machinery and plant. Proper functioning of machinery is important for uninterrupted production. Production management process focuses on continuous routine inspection of machines, performs regular cleaning and oiling, removal and replacement of any obsolete and damaged equipment's. All these steps taken by production management prevent any machinery breakdown and avoid any production halts.

5. Enhances Goodwill and Reputation of Business

Goodwill and image of a business is a key element in attracting and retaining customers. Production management helps the business in improving its goodwill by properly satisfying customer needs. Production management ensures that the right quality products at the right cost are delivered to customers at the right cost. This increase the overall confidence and satisfaction level of customers.

6. Helps in Facing Competition

Production management helps the business is facing stiff competition in the market. It properly analyzes the market requirements and competitors activities before planning for production activities. All strategies are framed and implemented in accordance with the situations of the market. It ensures that a firm produces the right product in the right quantity, at the right time and provides it to the customer at the right cost. Customers' needs are given prime importance by production management. This will helps in facing the competition easily.

7. Helps in Expansion and Growth

Expansion and growth are the ultimate aims of every business. Production management supports the business in its expansion and growth. It aims at increasing the profitability of the business by decreasing the overall operating cost. This process ensures optimum utilisation of all resources. Production monitors operations of every department of business and takes all corrective measures as and when required. High-profit earnings by business help in expanding its operations and growing its size.[48]

V. COMPLEXITY IN PROJECT MANAGEMENT

The origins of complexity theory applied to project management can be traced back to the works by Morris [1, 2], Bennet and Fine [3], Bubshait and Selen [4], Bennet and Cropper [5], Gidado [6], Wozniak [7], and Baccarini [8]. All these works highlight the importance of complexity in project contexts in general and in particular its effects on project goals and objectives, project organization form and arrangement, and in the experience requirements for the management personnel. The importance of complexity to the project management process is widely acknowledged for several reasons [1–8]: (i) it influences project planning, coordination, and control; (ii) it hinders the clear identification of goals and objectives of major projects; (iii) it can affect the selection of an appropriate project organization form and experience requirements of management personnel; (iv) it can be used as criteria in the selection of a suitable project management arrangement; and (v) it can affect different project outcomes (time, cost, quality, safety, etc.). An understanding of project complexity and how it might be managed is of significant importance for project managers because of the differences associated with decision-making and goal attainment that appear to be related to complexity [8, 9]. As projects have become more and more complex, there has been an increasing concern about the concept of project complexity and the application of traditional tools and techniques developed for simple projects has been found to be inappropriate for complex projects [1, 8]. According to Parsons-Hann and Liu [10], it is evident that complexity contributes to project failure in organizations; what is not clear is to what degree this statement holds true. Identifying and characterizing different aspects of project complexity in order to understand more efficiently the stakes of project management complexity can be of great support in assisting the global project management community. Complexity can have both a negative and a positive influence on projects. The negative influence, in terms of difficulty to be understood and controlled, is because of the emergence of new properties that none of the elements of the system owns. The positive influence is due to the apparition of phenomena that could not be predicted due to the sole knowing, even complete, of the behaviour and interactions of the elements of the system. In order to properly manage complexity, project managers must know how to seize the opportunities emerging from complexity and to know how to avoid or at least diminish the negative effects of complexity [11].

In project contexts, there is a lack of consensus on what complexity really is [12–20]. There does not even seem to be a single definition of project complexity that can capture the whole concept [11, 20–24]. Within the Luhmannian system theory, complexity is the sum of the following components [25]: differentiation of functions between project participants, dependencies between systems and subsystems, and the consequential impact of a decision field. Project complexity can also be interpreted and operationalized in terms of differentiation (number of elements in a project) and interdependencies and connectivity (degree of interrelatedness between these elements), which are managed by integration, that is, by coordination, communication, and control [1, 8, 26–29]. Custovic [30] defines complexity as that property of a system which makes it difficult to formulate its overall behaviour in a given language, even when given reasonable complete information about its atomic components and their interrelations. In a similar context, Vidal and Marle [11] define project complexity as that property of a project which makes it difficult to understand, foresee, and keep under control its overall behaviour. Tatikonda and Rosenthal [31] view complexity as consisting of interdependencies among the product and process technologies and novelty and difficulty of goals. Pich et al. [32] define complexity as information inadequacy when too many variables interact. Ward and Chapman [33] view the number of influencing factors and their interdependencies as constituents of complexity. Some authors associate complex or complicated projects with the number of elements and with the concept of linearity. Girmscheid and Brockmann [34] argue that any difference between a complicated project and a complex project has to do with the number of elements as opposed to the relationships between the elements (complex). Richardson [35] associates linearity with complicated projects and nonlinearity with complex projects, which implies that nonlinearity makes the relationship between inputs and outputs unpredictable. Remington et al. [9] defines a complex project as one that demonstrates a number of characteristics to a degree or level of severity that makes it extremely difficult to predict project outcomes, to control or manage the project. Girmscheid and Brockmann [34] define project complexity as a set of problems that consists of many parts with a multitude of possible interrelations, most of them being of high consequence in the decisionmaking process that brings about the final result.

Experience suggests that the interrelationships between the project's components are more complex than is suggested by the traditional work breakdown structure of project network. Identifying the sources and factors that contribute or increase project complexity is paramount for project managers. Gidado [36] determines four different sources of complexity: employed resources, environment, level of scientific and technological knowledge required, and number of different parts in the workflow. Thus, a large amount of required resources, a turbulent environment, working on the edge of technology, and innumerable possible interactions are certainly identifiable factors for complex projects. Since there has been a lack of consensus and difficulty in defining complexity, some authors have focused on identifying the factors that contribute or increase project complexity. Remington et al. [9] suggest to differentiate between dimensions, characteristics, or sources of complexity, and severity factors, those factors that increase or decrease the severity of complexity. Vidal and Marle [11] consider the following factors as necessary but nonsufficient conditions for project complexity: size, variety, interdependences and interrelations within the project system, and context dependence. Remington et al. [9] group a number of factors that seem to contribute to the perception of project complexity under the following headings: goals, stakeholders, interfaces and interdependencies, technology, management process, work practices, and time. Table 1 shows the main factors that are considered in the literature as drivers of project complexity

Table 1 Main Factors Affecting Project Complexity [49]

Factor	
Size	To consider it an indication of complexity, the organizational structure of the project should be over a minimum critical size and their elements need to be interrelated.
Interdependence and interrelations	An event in an interconnected structure can cause totally unknown effects on another entity inside the structure.
Goals and objectives	They must be adequately and properly defined both at a strategic and at an operational level.
Stakeholders	The number of project participants and how the information flows between them are a key factor affecting project complexity.
Management practices	Relationships between project participants, suppliers, overlapping of activities, methods, and techniques are factors that affect project complexity.
Division of labor	Adding project organizational structure by dividing labor, the way for personnel selection, and the level of pressure on this personnel to achieve project objectives are factors that increase project complexity.
Technology	Task scope or the variety of tasks that need to be accomplished is the most critical dimension of technology. It explains why there is a need for a variety of technologies and a given level specialization in each of them.
Concurrent engineering	It breaks down functional and departmental barriers by integrating team members with different discipline backgrounds often known as cross-functional teams.
Globalization and context dependence	Globalization boots complexity by the erosion of boundaries, higher mobility, heterarchy, and higher dynamics. It can be an essential feature of complexity.
Diversity	A higher number of elements and a higher variety across elements increase complexity.
Ambiguity	It expresses uncertainty of meaning in which multiple interpretations are plausible.
Flux	Flux is affected by external and internal influences. It also implies constant change and adaptation to changing conditions.

IV. CONCLUSION

The review study shows the importance of project management and also describles the project compexity in detail. In future study we can focus on a particular region to study the characteristics of project management for working projects in that region.

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