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Implementing ERP Solutions - Enabler for Smart Supply Chains and Agile Manufacturing

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Abstract: ***The paper provides a novel model of Supply Chain Management (SCM) in the wake of ERP complications and the time needed for implementation. There exists number of general software providing different solutions to SCM leading to ERP providing customized solution but with utilization of huge resources. The model provided in this paper does provide a hybrid solution to the same SCM problem considering all the challenges in the industry and importance. The paper considers all the major problems in implementation/migration from existing to new SCM along with possible solutions in the proposed model. Implementation methodology clearly indicates the challenges for a new system of SCM. All these are considered to provide an optimal solution to the SCM in the manufacturing sector. The paper provides a description of the advantages of the new SCM model to conventional existing methods.***
Keywords: ERP, Manufacturing, Supply chain management, hybrid SCM model

I. INTRODUCTION

Globalization and shrinking of the world due to communication and Information Technology, has made competition fierce amongst manufacturing corporations. This has forced organizations not only to manage information in a better way within the enterprise, but also share the information with the other stakeholders like vendors and customers. In the near term, with increasing automation in manufacturing and varying customer expectations are reducing the lot sizes from huge quantities to a quantity of 1.

Reputed software vendors have come out with many new generation applications S/4 HANA, IBP (Integrated business Planning) and has been adopted by many of the Fortune 500 companies. This work was carried out in some manufacturing companies in India and abroad and the effectiveness of implementing large enterprise solutions was studied in detail.

II. LITERATURE SURVEY

Research in the field of agile manufacturing has progressed since the early 1990's and several contributions have occurred since then.

Agile manufacturing systems and defined individual areas for research namely product and manufacturing systems, design, process planning, supply chain management, information systems and human factors[12]. Agile manufacturing as a new strategy is captivating the attention of research. They have used the above classification scheme and commented their usefulness in each major category and their impact on the entire system. Their work further indicates the potential benefits and the future application of agile manufacturing in various industrial domain and their advantages to the end customers.

Considering the main issues related to lean production and agile manufacturing. It provides a comparison between the attributes of lean and mass production as well as between agile manufacturing and mass production. It is emphasized that the need for adopting flexible manufacturing systems defining, an enterprise level manufacturing strategy for introducing new products into a rapid changing market and also emphasizes on the organization ability to thrive in a competitive environment characterized by continuous and sometimes unforeseen changes[13]. This concept in manufacturing is intended to improve the competitiveness of the manufacturing processes based on agile manufacturing are characterized by customer-supplier integrated process for product design, manufacturing, marketing, support services[14]. This needs decision making at functional knowledge level, stable unit costs, flexible manufacturing, and easy access to integrated data and modular production facility.

Agile manufacturing systems will permit fast cost effective responses to unpredictable and ever changing product demand and support rapid product launches, or previously unplanned products tailored to meet changing customer demands. The models are applied to study the hypothetical decision of whether to invest in a dedicated, agile or FMS for engine and transmission parts machining. These decision models are the first step towards developing practical business case tools to help industry to access the value of agile manufacturing systems [15].

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The new paradigm of cloud agile in the information systems area has brought about a number of favorable changes in the implementation of agile methods I the manufacturing industry. The main objective of cloud agile manufacturing is to offer industrial production system as a service [16]. Thus, users can access any functionality available in the cloud of manufacturing such as process design, production, and management, and business integration, factories virtualization without knowledge or at least without having to be experts in managing the required resources[16]. The proposal takes advantage of many of the benefits that can offer technologies and models like business process management, cloud computing, SOA and anthologies.

It is observed that agile manufacturing is hardly profitable and practice within an adversarial supply chain. However, it is a fundamental part of agile [6]. The agile supply chain is targeted at satisfying actual current market place demand using pull procedures. This contrasts within the traditional supply chain where products are pushed towards the market place on the basis of long term forecast. Thus the philosophy in the agile supply chain is to make what is selling not to sell what has been made.

The real paradigm shift required is to create the environment where change is the norm and is a challenge to be overcome.

III. IMPLEMENTATION METHODOLOGY

Even though application vendors recommend implementing their own methodology and also system integrators (consulting companies) have their own methodology, it is very difficult to adapt going with one or the other's methodology. After so much of deliberations and discussions the following topics were taken in consideration for coming up with a hybrid methodology that suits the needs of our huge corporation.

A. One Business Process

As a corporation we grew organically and also inorganically by acquisitions of many small companies with their own USP. This also led to a situation that we had many lines of business with diverse business processes and work cultures. The biggest challenge was how to do integrate all the lines of business in to one integrated corporation in terms of systems and processes without any disruption to the business, especially important stake holders like our customers, employees and vendors.

We started collecting business process information at a very high level and also at a medium level to come up with all the commonalities and differences between different lines of business and all our entities. There was also another thought to hive off some lines of business that did not match with core/key focus areas such as bio-fuel business which was producing bio-fuel from the meat waste generated by our other plants. The key here is how do we keep this information under tight wraps, so that none of the employees get suspicious of the low focus of such units in the implementation.

We had to come up with a superset of processes that would fit each line of businesses, wherever they are unique in their own way.

B. Global Template

Since we decided to have on set up of processes for the unique lines of business, we decided to create a global template for each one of them. The idea of global template was to create one process for the whole corporation and also leave room to accommodate very unique business requirements for different lines of business.

C. Availability Of Both Internal and External Resources

1) *Internal Resources:* It was decided to form an internal core team, who are subject matter experts from different lines of business for important functions like Finance, Production Planning, Materials Management, Quality Management, Plant Maintenance and IS support team.
2) *External Resources:* There can be no project without consulting help from the software vendor and also from the system integrators. In general, bring external consultants are expected to bring good value from all their past diverse and rich experience advocating process improvements and bringing in industry best practices in the various areas of our business functions.

D. Time from key Decision Makers

At times it is necessary for senior management to involve in the decision making process, for issues that are beyond the authority of the core team. It is very important to avoid delays in decision making, so that time and money is not wasted. We decided to log action items and with responsible and/or accountable persons with a target date. Internal resources in the core team had to write detailed documents with pros and cons to help the top management, by providing all possible information in advance. This would help everyone to be prepared and consume less time in making key decisions.

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E. Managing Funds and Balancing the Cash Flow

ERP/Supply Chain projects are not cheap; it requires a good amount of capital investment. It is absolutely necessary that the project is implemented in phases and budgeted properly, which allows for capital investment in phases and it does not choke the working capital that is required to run the day to day operations.

F. Data Migration/Cleansing

Our legacy systems data was scattered all around in multiple systems, leading to duplicate information with multiple versions of the truth about the same SKU manufactured in multiple locations. Majority of the times the available data was inadequate and/ or incorrect.

G. Deployment Strategy with Minimal Disruption to Business

Deployment strategy is very important as the go-live dates timed during leaner periods of the year, to reduce any potential disruptions caused by the new business processes and systems. Also there could be disruptions because of the design gaps that were not tested properly during integration testing cycles. Phased implementations instead of big bang approach comes with its own set of problems, like additional costs to build interfaces between the ERP and legacy systems for the locations and lines of business that are slated to go live at a later date.

H. Realizing the Benefits of the Implementation Early On

We had to identify the businesses that embark on this journey by going live as early as possible. This is very important to realize the benefits of the investments made to improve systems and processes to become more competitive and ultimate create shareholder value.

I. Keeping Pace with Changing Market And Business Process Needs

Whenever big time ERP projects are implemented in phases spilling over 3-5 years, the market also keeps changing and compelling changes to be implemented by keeping pace with the changing business requirements.

J. Change Management

Proper communication methods are required to communicate the right messages to the entire organization to alleviate any fears that may prevail due to new projects about potential job losses and also communicate the changes in a positive manner. As a part of the implementation strategy, adequate end user training needs to be provided to all the personnel impacted by the new implementation. It is also necessary to build the knowledge within the organization, to reduce the dependency on expensive external consultants for post go-live support and upgrades.

IV. MODEL, RESULTS AND DISCUSSION

There were numerous benefits that came up with the implementation and brought in newer constraints. Management was clear at the beginning that it would take at least 4-5 years for the size of the implementation to see tangible benefits and also was aware that there would be potential disruptions in every possible area in its own way.

The implementation was also done in a phased manner with roll outs in different plants/locations and lines of business with the following as the criteria for deciding on the order of going live

A. Smaller in size – low volume
B. Simple business process
C. Newer Plant with younger generation that will easily adapt to changes (or)
D. Plants that were chaotic and which needed a serious fix
E. With minimal disruption, that could help expose issues related to the implementation and which could be fixed before it is implemented in other important locations.

Building a Global template that encompasses all the different business processes and across of lines of business helped the management in so many ways that would be detailed down below. Until the start of the implementation project, there was absolutely no clarity as to what was happening in different locations and each location was run like an independent enterprise by individual

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plant managers. There were duplications in capacities in the areas where there was no huge demand. There were many regional warehouses with unbalanced inventories and many non-value added activities like back and forth movement of goods in an unplanned way. Distress sale of products with low shelf life, premium purchases to meet the contractual obligations resulting in lower profits and serious losses eroding the bottom line.

All the core team members were invited to the corporate office to come up with their own version of all the key business processes and was made to present to the project team. This helped the project team and the core team to understand each other's perspective, in terms of what kind of constraints each plant or line of business had. Then the project team comprising of external consultants were give a tour of different manufacturing plants. This was to help them understand the ground realities at the shop floor or at different warehouses. External consultants depending on the business function were asked to come up with their understanding of the as is processes and to be processes (incorporating the industry best practices that was recommended by the software vendor). There were debates and discussions in many areas and finally all the gaps in the new application were quantified and effort estimates in terms of time and money were made. External consulting company doing the system integration came up with their own version of timeline, effort estimates and recommendations.

Collectively as project team, we had to come up with a consensus plan and some of the sensitive issues like changes like org structure and job losses were intentionally left out to get rid unwanted confusion. Finally a project plan was laid out with all inputs considered by the project team. A prototype using real time data from various business units (lines of business) of the to be solution was created for the core team members onboard the project with whatever the standard ERP application was capable of providing. This helped the team to get a flavor of the to be solution at high level.

A global template was created and approved by the top management, to start a phased roll out in different business units.

During the course of building the template, many of the shortcomings within the organization came up to the surface in various functions and lines of business. There were duplications/redundancies in so many areas of Master Data such as

1) Product Masters (close to 35%)
2) Bills of Materials (30%)
3) Resources (machines/ workcenters)
4) Routings /Recipes (28%)
5) Customer Masters (20%)
6) Vendor Master (30%)
7) General Ledger accounts for financial accounting

It was decided to centralize the control of Master Data at a corporate level, rather than being controlled independently at various sites. This led to a huge furor within the organization. The biggest fears with some of the groups were about loss of control and also becoming accountable for the wastages and pilferages. The opposition came under the garb that it will lead to significant delays for launching new products to the market and additional bureaucracy the plants have to deal with the centralized team. The positive side was that it led to phenomenal discussions bringing huge issues to the surface.

Benefits of Centralizing various Master by Function

a) *Product Master:* There was significant amount of reduction of redundant data leading to a single version of the truth with one unit of measure and with alternative units of measure with the right conversion factor. This led to common understanding of number of boxes in a pallet of processed food meant for the plant in the US vs the number of boxes in a pallet in Canada. System maintained automatic conversions from metric to Imperial units. Clear visibility of inventories across plants in different states /provinces, regions and countries with their specific batches and characteristics, best before dates.
b) *Bills of Materials:* Improvements in product masters paved the path to fix the bills of materials for each finished product to semi-finished goods (ingredients) to raw materials. Often the discussions between the plants led improving the data quality (redundancy and incorrect), even though it was all not nice and perfect.
c) *Resources (workcenters):* All the workcenters/resources were accounted for as a part of the organization cleanup. Labor was also accounted as a workcenter/resource. Each activity in an operation was a assigned a rate/hr with appropriate cost centers and GL accounts. Formulas were also assigned for each activity, so that the cost incurred on each operation is accounted in the process order.
d) *Recipes:* In a process industry routing are called as recipes, where details of the product being produced is associated with various operations and bills of materials. Various ingredients that have to undergo operations as defined at various resources (machines) for cooking, packing etc., to finally get a finished product. In the operations run rates are maintained to estimate the costs incurred to produce a product using activity based costing.

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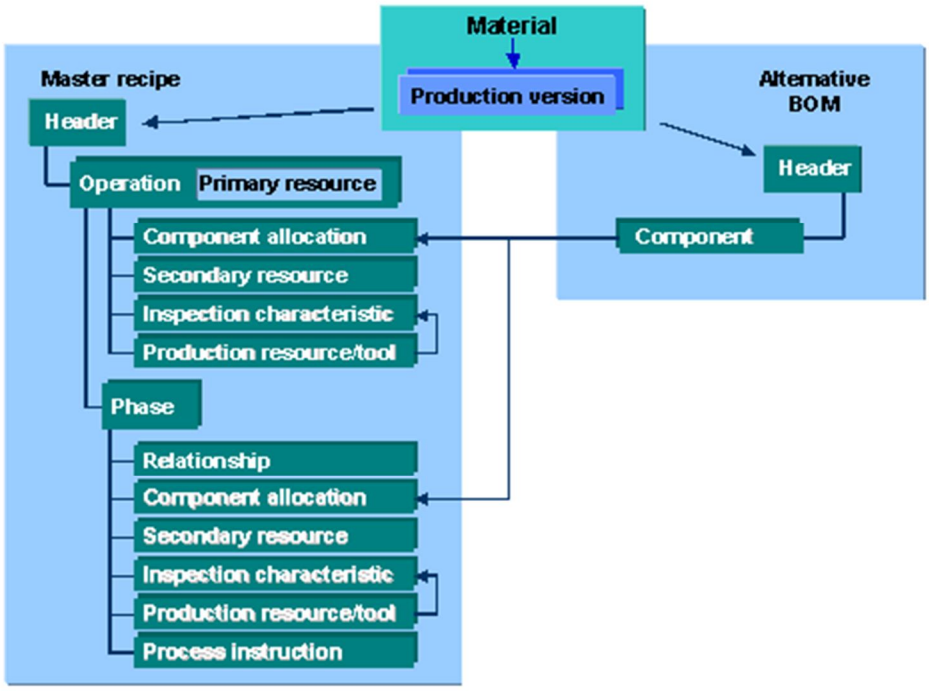


Fig. 1: Proposed Model of SCM

e) *Product Costing:* Was done scientifically as much as possible based on the principles of activity based costing. Product costs were assigned to each product including the procured out items, to have a standard price for each product. ABC has been challenged by productivity gurus like Eliyahu Goldratt in his book throughput accounting. Unfortunately, even though his ideas are closer to commonsense, it is very difficult to get traditional cost accountants onboard. Rationalizing product masters lead to quantitative improvements of eliminating duplicates and better inventory control and also better track and trace. This also brought significant visibility within the organization. It also led to transfers of stocks from a duplicate/redundant product master to the rationalized product. This resulted in better visibility of stock not just in terms of quantity but also in terms of dollar value. Wherever products were ordered based on re-order points, their values were scientifically established based on days of demand to take care of seasonality and fluctuations. Products were also classified as make to order stock and make to stock items. This also led to better planning by consumption of forecasts by incoming sales orders.

f) *Materials Requirement Planning:* At one point it was thought that it would be a dream to have some basic stuff like MRP in our Plants. But after all the clean up it started to appear as a possibility, each MRP run exposed variety of problems and we had to fix each one of the problems.

Many issues that affected MRP run are listed below

i) Posting transactions like Goods Issues and Goods Receipt on time pertaining to a process order
ii) Posting goods receipts to a Purchase order
iii) Goods Issues of stocks for transfers to other plants and warehouses
iv) Goods Issues of Stocks from Warehouses to customers for delivery against the sales orders
v) Short Closing / Cleaning Purchase orders for the residual quantities left out
vi) Closing Production order for the residual quantities that are not going to be produced at a later point in time

The other tangible benefits that came with the implementation was to negotiate better contracts with the suppliers and reducing spot/emergency purchasing activities. Initially there was surge in inventories, but over time teams had learnt to manage and fix the numbers as the business needed. Commodities such as meat could never follow the procurement arising out of MRP, as the yields varied in the kitchen/plant and dynamics of the commodity markets.

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It was also very difficult for the operations management team to go the root cause of MRP related issues directly, as they had to go through various transactions and reports before being able to pin point the exact issue. Project team had to write custom reports that reveal many of the underlying deep rooted in processing transactions. This consumed significant amount of time and money in an exercise to police people, as to what was happening in the plant. Even if the benefit that came was only in the short run i.e., only until it become a part of the culture to post transactions on time (may be 6 months from the date of implementation). System Integrators, who wrote this code made more again by selling to other customers as an Intellectual Property.

ERP Implementation also led to rationalization of the workforce, by moving people around and improving productivity across the organization.

There is better visibility than in the past in terms of managing supply and demand to the changing needs of the market and smaller lot sizes. Sales and Operations planning is not perfect, but it is better than what it was before. Other industries are picking of lessons from our implementations, through our consulting partners and also some of our ex-employees who have moved on to other companies.

There is still a long way to go, as food processing companies are protected by local laws of the land as competition is somewhat protected has been one of our impediments to aggressively compete with our own benchmarks. Our reaction times are still slow, especially cutting down losses on account of shorter shelf life items. Implementation of mobile technologies for faster reaction seems to be solution for some of the problems and only time will tell us on how we leverage on the implementation efforts.

Even though our consulting partners were insisting on the on-site offshore models to reduce development costs, there was a loss of time and money due to lack of understanding from the other side of the world and also lesser motivation amongst offshore employees of our consulting partners.

V. CONCLUSION

Implementation of ERP like SAP is a very important step forward for organizations, that would like to transform in to digital age and have the desire to do business at the speed of light. This important step provides an opportunity for the organizations to re-engineer the business processes, reduce or eliminate non-value added processes, provide better value for their customers and shareholders.

There is a humongous effort that is required to clean up activity like master data that plays a very important role in every aspect of running the business. It might seem like the amount of time and money going in to data clean up is not providing any tangible results immediately, but all the investments in to new ERP implementation would yield the desired results with the high quality of input data.

Many of the application software companies have learnt and acquired many of the best practices from and across the industry and pass it on their customers as Industry Best Practices. In addition to the above cost of memory and the cost of computing has plummeted steeply and this also making ERP or Supply Chain Management software applications very attractive. These applications help the organizations/businesses and support next-generation transactional and analytical processing with a broad set of advanced analytics, run securely across hybrid and multi-cloud environments. All the businesses that are striving to become cost-effective need to leverage the technology to make proactive and intelligent business decisions based on real time insights from big data and internet of things.

With the current technological trends provide real time insight from complex datasets and ongoing transaction with compromising on data security and privacy. Implementing the next generation ERP application leads to business agility and streamline IT management across the organization globally. In order to achieve, efficient and agile implementation C level executives should be aligned in their vision for their enterprise not just meeting the tactical needs, but also need to have the vision with a strategic outlook of at least 10 year horizon period.

They need to stay put without cutting corners take all the stakeholders in to confidence and have to be in perfect synch, like a symphony orchestra. Implementing ERP/Supply Chain software applications on in-memory platforms will definitely give the organizations a quantum jump in achieving the tactical and long term strategical objectives to thrive in an extremely competitive business environments.

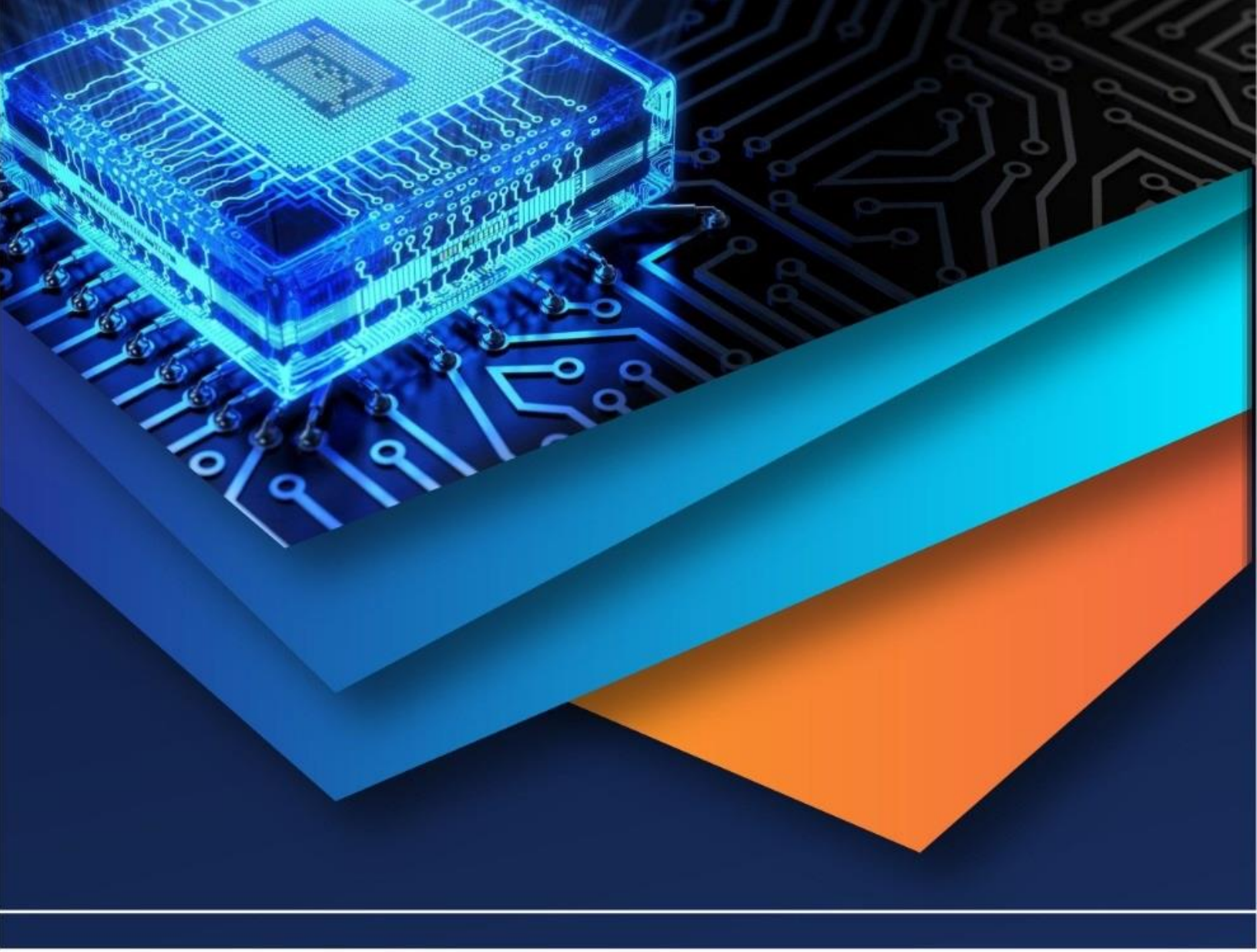
The aim of this study is to bring out the need for effective implementation of ERP /Supply Chain software applications to remain competitive and improve shareholder value and provide opportunities for the communities they serve.

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