Deep Science Publishing
https://doi.org/10.70593/978-81-989050-0-0_9

DeepScience
Open Access Books

Chapter 9: Intelligent resource management, productivity optimization, and KPI-driven operations

9.1. Introduction

Resource management is currently a topic of growing importance for both established organizations and startups, and it is also a key research field in Business Science because resources are important assets managed by every organization on a sustainable basis. What distinguishes a successful organization from a mediocre organization is not its technology, market size, or its share price, but the talent, dedication, knowledge, and integrity of its people, and the ability to build the most efficient team of people to fulfill its objectives. Companies have to take into account the intangible aspects of asset management regarding mobilization, value addition, motivation, emotion, loyalty, trust, and atmosphere. The future of business will rely on the wise deployment of both tangible and intangible assets, and the priority will be on the intangible aspects, which will help to differentiate and develop a unique competitive advantage. This explanatory simplex model helps to clarify and visualize a better understanding of human resource management (George et al., 2014; Grover et al., 2018; Jeble et al., 2018).

The future of competitive advantage and profitability will depend on the better investment of both tangible and intangible assets. There are some key questions about how to successfully support business decision-making regarding the right mapping of business objectives to the company's resource allocation and fulfillment capabilities, the right performance measurement systems and indicators, the definition of people's priorities, and the balanced scorecard construction and the fundamental roles of the administrator as well as the employees during the strategy implementation phase. All these important and complex aspects of performance management for intelligent resource management, resource allocation, and productivity optimization are discussed and analyzed in this study (Wang et al., 2016; Wamba et al., 2017).

9.1.1. Overview of Resource Management Dynamics

Resource management dynamics is a rich concept enmeshed in the social, cultural, cognitive, and political factors that shape human interaction with natural and technological systems surrounding them. Various processes at different temporal and spatial scales at which resource flows occur shape the conditions for and constraints on the resource exchanges of individuals and collectives. Global dynamics bring changes in the long-term availability and distribution of resources. Political and economic processes redistribute resources over shorter periods that shape conditions for the availability or distribution of resources, fuel shortages, or excesses with remarkable consequences for an economy and society: injustices, discontent, or conflicts. Technological change alters productivity, replacing labor with capital, and making resource-based production processes incorporate more or less physical energy and/or more or less resource-depleting technologies, with major implications for the sustainability of economic growth. There are cycles of low and high intensity of use of resource and the exogenous factors affecting the duration of the cycles and oscillation relative to the annual growth of product and the annual growth of population are the duration of minimum intensity, the periodicity of cycles, and the trends of the subsystem representing sustainable supply. Resource price transmission across commodity markets with a time lag affects the parameters of resource supply and demand.

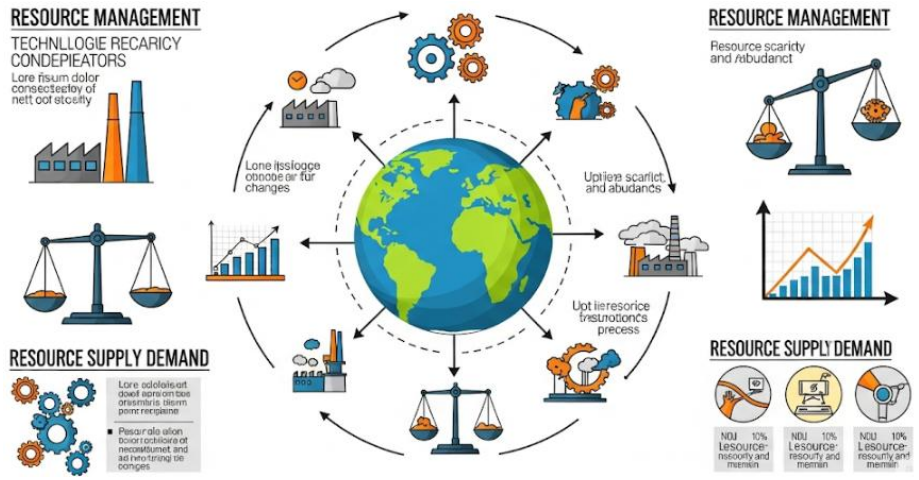

Fig 9 . 1 : Resource Management

Each one of the forces generates signals about the intensity of scarcity or abundance of resources. The response of supply to the intensity of resource scarcity or abundance requires that several factors, including capital accumulation, population growth, and technological change, during the period of minimum scarcity be taken into account. The parameter in the equation of resource demand also depends on capital accumulation and technological change. Resource demand responds to changes in the product-to-resource

ratios that vary in the two regions of resource supply and demand. The product-to-resource ratio increases with the growth of the product but declines with the growth of resource input if the resource input grows faster than a product.

9.2. Understanding Intelligent Resource Management

Resource management is a broad concept, related to the supervision and management of anything from human resources, infrastructures, financial, technologies, raw materials, and all assets required to complete any task, operation, or develop a product. Resource management is completed at first by categorizing, by dividing resources into asset classes based on any classification factor. This sort of classification enables the resource managers to define specific policies and procedures for each group class, considering existing and future requirements and corporate goals. The second step is the allocation of resources to the classes. The allocation must be performed by the product development or operation requirements; for example, in the case of operation resources, the selection must change each business cycle, since production will dictate the types and quantities of the required assets. There are two types of allocation: hard allocation to support the product's secure requirements and soft allocation which consists of resources placed at the units of the classes, assuring the units can request resources when there are specific requirements for the requested products or services. The third step is to manage the capability of the product development or daily operations. If a product cycle can be defined, the capability management must be concentrated at the beginning of the product cycle. If disclosure cannot be defined the capabilities should be managed daily; otherwise constant mismatch will happen between the product requirements and the operations capabilities. The fourth step is measuring the results and impact on the company system and developing corrective actions. The allowed corrective actions must improve future performance but must not be costly, nor should affect the continuity of operations. Results are measured in terms of costs, revenues, return times, and required investments. But above all the global performance of the system must be taken into account; that is, the impact on future operations must not be detrimental.

9.2.1. Definition and Importance

The Mixed-Integer Resource Management Problem (MIRMP), which is the mathematical optimization of the right combination of decisions of certain types for hierarchically organized resources with limited counting and/or identified by distinct characteristics, plays an important role in business productivity improvement. The MIRMP serves as a transparent tool for the managers to simulate the results of the given combination of decisions and for optimization of business productivity to find the best

combination of decisions. The MIRMP can be systematically solved by the Business Productivity Model (BPM) based on the empirical productivity law. The BPM can be used to investigate key parameters of the MIRMP, namely the functional dependencies of productivity on fixed decision variables, and Internal vs. External Scan Rate Ratios (ISRR and ESRR) of the examined flow assembly line. The ISRR represents the internal indicators of the product production process, the examined flow assembly line and the ESRR describes external conditions of demand on which the product demand can depend. The composition of flow assembly line functions and the rules for bottleneck identification are used to perform all calculations needed for the BPM application.

The processes of identifying bottleneck resources and solving the MIRMP are very important for proper management of the company because bottleneck resources predetermine the level of productivity and remaining resources should implement support functions that do not prevent bottleneck resources from implementing limiting functions. The process of concluding that this is the only function that characterizes the resource role may require a considerable tracking effort by the resource processing function.

9.2.2. Key Principles

Intelligent Resource Management (IRM) leverages the capabilities of Artificial Intelligence, such as machine learning, natural language processing, and data analysis, to optimize the productivity of a business and its employees and partners through effective planning, allocation, utilization, and control of its resources. The resources that need to be carefully managed include people, facilities, equipment, inventory, tools, operations, energy, and time, as well as those that are utilized by processes that are logical and conceptual, such as knowledge, project procedures, and communication. For any business with productivity or profitability concerns, the solution is not simply technology-driven or people-driven, but a careful blending of both elements across all business processes. Hence, the speed of technological advancement, the need for adaptability and enhanced creativity with increased workplace diversity, and globalization, as well as the intensifying demands of customers, advisors, and investors, compel business owners to continually explore new and improved ways to get results.

The IRM approach builds on several performance principles from related philosophies and disciplines, including Lean Production, Theory of Constraints, Six Sigma, Agile and Flexible Manufacturing, Chaos Theory, Fractal Theory, Process Reengineering, Business Process Modeling, Supply Chain Management, and Corporate Financial Management. IRM integrates the practices, systems, and tools from these fields into a cohesive, unified whole, and applies Artificial Intelligence and related technologies to drive implementation, coordination, and integration of IRM insights. By emphasizing

stakeholder collaboration, IRM is a continuous, cross-enterprise activity that works to optimize stakeholder, individual, firm, and society performance across multiple time frames, from the short to the long term.

9.3. Productivity Optimization Strategies

The strategies for optimizing productivity within an organization, while a small part of intelligent resource management, help different organizations devise plans to make the most of their management resources in order to achieve their business goals. These strategies have been derived from over 50 years of learning through practice. These strategies encompass a wide variety of activities. The early efforts expanded activity definitions. They provided ways to educate the staff on the need to be aware of and to recognize unproductive activity and points of productivity stoppage. These procedures created increased awareness of opportunities for productivity improvements. Some examples of work management systems include MODAPTS, SSM, and MTM.

In addition to the specific technologies, there is a need for strategies that will enhance the chance of success of implementations. These strategies include communications, setting realistic goals, user involvement, and long-term commitment. It is difficult to ensure a successful implementation. It does take time to install the work management system. A variety of factors facilitate or inhibit the implementation once the decision is made to adopt a specific work management process. These factors relate to the organizational infrastructure. They also include factors related to individual transactions actually completed when the implementation is occurring.

Implementing work standardization helps reduce non-value workloads and enhance the process of productivity growth. While it is possible to hire additional people to help improve a balance if the workload is too great, the usual solution is to improve the use of combined market expertise competencies for client undertakings. The two main types of standards are general work methods that describe the best way for average people well-trained in their craft to work and lower maximum levels of work intensity. These strategies are important in that they help firms improve their productivity thus enhancing their ability to compete.

9.3.1. Techniques for Enhancing Efficiency

The efficiency of resource utilization is the critical factor of productivity. Reducing input while maintaining the desired output vector can augment the productivity index. However, enhancing efficiency may be laborious, and often involves complicated processes. It requires evaluating and acquiring clear insights into the input-output

relationship, followed by decisively determining the input or output variable to focus on for optimization. Generally, there are three groups of techniques to address this important task: expert systems, benchmarking, and mathematical programming techniques. Expert systems utilize heuristics based on human knowledge to address decision-making issues to enhance efficiency. This approach tends to be the least accurate since it represents the opinions of a few selected experts and might be designed to account for only certain factors affecting the efficiency contribution. Benchmarking compares current observations regarding performance with similar activities carried out in the same organization at some previous time or as a best practice by a different organization at the current time. The power of benchmarking comes from utilizing a recent reference point, accounting for all the factors that might influence the efficiency level.

Expert systems rely on the fact that experts are knowledgeable regarding the activity of interest, and have or can provide rules that link the values of influencing factors to efficiency, and to their contribution to the efficiency index. Expert system output provides insight into the elements that require action in order to ameliorate efficiency and the actions that are required to effect improvements. Education, increased supervision, application of better working practices, better tools, and better-utilized resources, are all useful actions that may be indicated. However, such systems also have limitations, most notably the absence of exactness, and potential inexact ordering of recommended changes. Furthermore, it is usually impractical to use too many different knowledge-based rules, making it necessary to disregard or ignore some important factors possibly influencing efficiency.

9.3.2. Role of Technology in Productivity

The use of technology, generally via computing and communication, is the predominant strategy adopted by corporate management to push back the Limits to Productivity, arising from the unending quest for requirements satisfaction by their customer-users. Technology provides a two-prong thrust in this pushback: it enables more of the efforts required to transform the deliverables from resources into desirable user-serviceable entities to be made more productive, through support for the resource agents transforming the deliverables, and it augments the trigger mechanism by which this transformation occurs by automating users' requirements trigger; in the manufacturing sector, information technology and relationship management technology are used to implement the burgeoning options for direct-user involvement in the triggering of the deliverables transformation process embodied in the configured-to-order model and its various implications, from drop-shipping to micro-manufacturing. The intelligent dissatisfaction with being passive consumers of user-oriented products and services has

enabled new life into the century-old pushback efforts popularly known — albeit inaccurately — as mass customization.

The movement toward more direct-user involvement in product design, responsibility and accountability for the delivery of service-oriented products and services, management by the user or some surrogate of the design agencies responsible for the deliverables that pass the user's favorable net satisfaction level becomes increasingly characterized by the penetration of information and knowledge working into traditional mass-market commercial relationships as novel forms of corporate-user partnerships. The increasing availability of user-oriented technologies lies at the heart of these developments: these technologies enable corporate partners to finance, provide, and service large-scale capital equipment via a long-term development and utilization contract that enables both partners to share in leveraging the total capitalization of the like of commercial aircraft.

9.3.3. Case Studies of Successful Implementation

ABSTRACT Productivity has become a prime discussion element in the socio-political business economies. It is common knowledge that productivity increases will lead to increases in standards of living and should be a priority for all economies whether developed or developing. This paper will highlight informative definitions of productivity and productivity strategies that organizations could use to enhance their productivity. The information should be beneficial for managers and executives looking to enhance their organizations' bottom line. 3.3. CASE STUDIES OF SUCCESSFUL IMPLEMENTATION This session will take a look at various organizations and countries that have successfully enhanced their productivity and the strategies that they have used. These organizations and economies range from the Michelin organization to the Nike organization. Both of these organizations will be reviewed carefully to see how they achieved their exceptional productivity ratings. Also, some countries and economies will be reviewed such as the Japanese and Chinese economies. The session will also talk about various products from the automobile industry to the service industries, and how all of these industries achieved or maintained their economic success. The Michelin company, for example, is the worldwide leader in the manufacture and supply of tires for all vehicles. The company’s special strategy was to implement a series of productivity optimization projects in Europe in the nineties to radically modernize its industrial tool. Many specific improvements were undertaken within the Group in order to implement a leaner industrial tool, primarily using the information technology systems. The analyses presented in this paper demonstrate the necessity of studying in detail the productivity improvements in their local context to enhance their transferability within the Group. During these projects, the group moved ahead with

detailed studies and created several serious business cases, featuring several tire plants covering various conditions and reasons.

9.4. Key Performance Indicators (KPIs)

KPIs are a means of identifying gaps in performance and acting to address them. Defining KPIs for resource management and for productivity measurement is central to resource management optimization and productivity enhancement. KPIs for productivity must support the goals of an organization as expressed in KPIs for organizational productivity measurement. However, KPIs for productivity must go beyond simply reflecting the productive mission of the organization. The concept of KPIs for productivity has been further developed so that they properly characterize the different levels of productive performance, as well as the functional areas of management control, and other areas of the organization's functional performance: marketing, sales, finance, production, organizational development, and human resource development. Furthermore, specialized forms of Goal KPIs, Top-Down KPIs, Middle-Out KPIs, and Bottom-Up KPIs describe each of these levels in detail. It is then important to link functional area goals through functional area Goal KPIs or resources (material, capital, and people) to the company’s sales performance Goal.

Measuring organizational productivity is a means of recording productive performance. The purpose of this system is to identify problems in areas of the business model where low productivity, poor product/service business model performance, and poor functional area strategy execution together affect overall organizational productivity and poor throughput profitability and shareholder value. The purpose of the entire KPI system is to provide information that allows a predictive early warning of negative trends, corrective action programs, and recognition of achievement at different levels and across functional areas of the organization.

9.4.1. Defining KPIs for Resource Management

Many factors affect a company's standard decision-making process and subsequently the production process itself. Internal decisions, such as those taken by management and executives, either in strategic or operational terms, as well as the decisions made by the different departments and at different levels of a company, lead to the establishment of rules for managing resources economically. The basis for such decisions comes from the quantitative and qualitative analysis of economic data in the design, planning, development, and control of business activities. Verifying whether the analysis tools have correctly defined the objectives of production or subordinate departments is a question of strategic importance.

This need to define organizational objectives may be met by defining Key Performance Indicators (KPIs) that, if correctly constructed, monitor, with a score or a numeric measure, the performance of a function, a process, a department, or a service temporal behavior. Each KPI can have a target value that could be realistic to expect, and a goal value that must be realistic but can be more ambitious than the target value accentuating the motivation of the resource. The achievement of the main objectives of an organization can help to monitor a KPI with a value equal to 1 (objective achieved); if the value is less than or greater than 1, then the objective would not be achieved or would be more than doubled. Monitoring the KPI with a value less than 1 but sufficiently close warns that greater attention is focused on the activity behind the KPI. Each KPI is associated with a monitoring frequency that may be daily, weekly, monthly, quarterly, semester, annually, etc., and when this is exceeded, it requires corrective action because it has entered a risk area.

9.4.2. Measuring Productivity Through KPIs

KPIs designed to measure productivity should always consider the volume of work per time unit as well as the amount of time taken to do it. Ways of measuring cost-effectiveness include output or production capacity, average labor cost, labor contingency, general indexes and total cost, productivity criteria using the labor coefficient and coefficient data; methods that rely on progress; heat engines; internal construction of complete structural equations; the utilization of prospective indicators; and future indicators based on customer satisfaction. To these descriptive methods, we can add procedures for study, analysis, and generalization of judgment and decision-making using MCDM techniques as well as outliers.

Productivity is an index of economic performance. Within the company, it serves as a yardstick for costs, timing, and returns with first playing a fundamental role. Improving does not necessarily mean the organization is not in a satisfactory position and does not have adequate performance; rather it means when the time comes to alter the way work is performed by evaluating time, difficulty, and technical quality to meet customer deadlines and expectations. Productivity is also a significant element in payment policy. It is through understanding indicators such as work volume and resources used that we can calculate the awarded assessment from which payment will depend. It is logical to apologize for the famous thought on this subject: What gets measured gets done! Indeed, knowing managers and employees that what is assessed will in the end be ‘held against them’ serves to stimulate.

9.4.3. Aligning KPIs with Organizational Goals

The challenge of defining KPIs is that they should relate directly to the goals of the company. Some examples of goals are entering a new market, capturing a market share, increasing efficiencies, lowering risks, etc. Some KPIs by definition will not be present in the metrics of the companies. For example, if one of the goals is to enter a new market that requires funding, the company will not have indicators about having enough resources, like a favorable operating profit, for example. In that case, the company must rely on other sources of financing these activities, and, in any way, they are investing money in an activity that does not bring any returns in the short run, so that cannot be measured with KPIs. These situations are more common in start-ups or semi-stable phase companies than in stable companies.

Some achievements relate directly to the level of resource utilization. We can think that having enough resources to support the organization is an automatic part of monitoring the current KPI of participating resources in the principal activities. However, there are repercussions of using ratios to measure activities of different nature. For example, comparing a product's development with the activities related to consolidating the product is an ambiguous comparison. The same happens for sales, marketing, and operational programs. If companies are in a hurry to develop the product to launch it to the market, the ratio iteration time is a sensitive comparison to indicate how much to concentrate on selling once the product is launched, under penalty of incurring larger expenses with these programs when compared with the revenues from the product sales.

If the goal is to ensure a balance of investments and a certain structure of activities that can support the levels of sales and profit, then the monitoring of KPIs in different activities is not adequate. The desired action to have enough funds to support a relatively stable number of activities is not to monitor a ratio but to commission unusually significant sales with external resources. It is more frequent to use ratios as targets by comparing what someone is doing with what the organization expects them to do than command using the target of external funding and this certainly is the KPI of highest interest in short-term dedicated activities.

9.5. Data-Driven Decision Making

A health institution is an organization that delivers health care, treatment, and rehabilitation. Maintaining a quality service while achieving business objectives is an essential challenge for health institutions in a competitive environment. There are many combinations of the main resources of a health institution, the staff responsible for the health service, spending rates associated with the patients, admission and discharge

times and policies, and patient satisfaction levels. Choosing the right combination can bring competitive advantages.

In the world we live in, we are inundated by great volumes of diverse and disparate data. This data is generated every day from multiple sources. These sources are contained in many databases stored by different business or technical functions of health institutions and are becoming increasingly available. Using these data for the decision-making process is not only a useful strategy in this economy but also an essential one. One of the most important steps of the business strategy is the making of decisions. Data is one of the bases of the decision-making process. Normally, the type of information presented to the decision-maker is not direct, because it is presented in a consolidated way, containing analysis influences that conceal data and biases not analyzed carefully.

The sheer volume of data generated requires some artificial intelligence programs to analyze and learn these data and influence the decision-making process. The level of consolidation of the data associated with computers' capabilities has changed decision-making from an intuitive, subjective process to a rational, objective, knowledge-based one. It is no longer possible to make the decisions that determine the success of organizations based on intuition and personal experience alone.

9.5.1. Importance of Data Analytics

Traditional project management processes manually record and index relevant information and resources during the project execution stage. Consequently, these historical data are not stored and presented in a way that permits in-depth data analysis after the project is concluded. Tools such as scheduling networks mostly focus on time and cost without a direct connection to the many types of resources that need to be optimally balanced. New technologies such as construction computer vision and activity recognition enable the collection of images from the construction site that are processed by data-driven algorithms for semi-automated detection as well as shorter- and longer-term predictions for the many types of resource utilization. These processes can be dramatic improvements on the more traditional methods where snapshot photos were taken at infrequent times and then manually analyzed by specialists. Such on-site, real-time data collection and analysis processes present managers with accurate windows on current construction productivity and provide the opportunity to enable project productivity optimization while the project is being executed.

Data analytics plays an important role in construction project management. For example, analytics methods are implemented to provide near-term estimates of construction project productivity based on real-time data collected from the construction site. More generally, predictive algorithms use historical project data to identify systematically

recurring productive and non-productive activities as a function of project and site characteristics, including project location, engineering design features, internal and external organization and human resource components, and construction method/technology. Such predictive analytics functions can support front-end strategic decisions on projected project productivity and the development of project tasks for productivity optimization over the many phases throughout the full project lifecycle. On the operational side, resource and supplier scoping and scheduling and vendor contract implementation can also be enhanced through analytics and support timely and accurate decisions on short-term resource allocation at the project site which affects project productivity performance.

Fig 9 . 2 : Construction Management

9.5.2. Tools for Data Analysis

There are two important criteria for selecting a data analysis tool: technical features and user patterns. Some of the most common data analysis tools are demonstrated in this context. Price-wise, the data visualization tools are usually on the expensive side. They do, however, provide a lot of features, and they do provide a lot of good graphical displays. On the opposite side of the spectrum are the programming-based statistical packages or programming libraries. Although the price is 0, they are mostly code-based and require a fair amount of programming experience to deploy.

Technical features aside, user patterns also require specific attention because of the demand for quick and fast data-driven business decisions within companies. This decision-making speed impacts both business competitiveness and revenue growth,

especially with increased levels of uncertainty. Various user groups may only need certain basic features of a data analysis tool and may not frequently use it. Both of the above reasons point towards the increased advantages of a drag-and-drop type of data analysis tool. However, business users may also require more complex data operations on a day-to-day basis which, at some point, require technical training for a better product utilization experience.

Given the dual requirements for data analysis tools as outlined above, some companies are opting for two-pronged approaches which usually include both programming-based tools and cheap and easy-to-use graphical dashboards or user-defined reporting tools. The former is used for ad hoc analyses. The latter tools are targeted user groups and the responsibility of producing insights and recommendations using data analysis would be delegated to these targeted users. These semi-technical user group members are usually business analysts from different departments within the organization.

9.6. Challenges in Resource Management

Resource management is embedded in a palette of day-to-day or even minute-to-minute activities, it occurs in the actions of managers, leaders, and employees in every function and at every level in a company. While these decentralized efforts contribute to a more efficient and effective workplace, they are also prone to pitfalls. Many times and for different reasons, managers may resist making the right level of resources available. A common concern is when an employee becomes specialized in some business domain. Decisions at lower levels of the hierarchy carry a risk of resource day-to-day.

For efficient and effective completion of work, resource management has two key aspects. The first aspect concerns the way an organization identifies its critical resources. This requires establishing metrics to assess the criticality and performance of a resource whether it is over-provisioned or under-provisioned and the cost of restoring it to optimized provisioning. The second aspect concerns the decision to apply any slack resource at the disposal of an organization and the decision to retire any resource that may become obsolete. Template policies for resource performance are quantitative, such as expected contribution to bottom-line revenues or costs and metrics that implement policy guidelines in a specific context.

The second aspect is critical in innovation using creative energy or strategic plans that fail to translate into a coherent course of action for the firm. Selective programs are necessary and urgent, especially in large organizations susceptible to strategic drift or which are new to strategy deployment as instructions. Because of their unusually long period, reducing slack is well-nigh impossible during downturns in business cycles or

worse, severe depressions. These are the objectives of resource management and its policies.

9.6.1. Common Pitfalls

While the opportunities to improve resource management are both exciting and plentiful, there are some common pitfalls that organizations can encounter when attempting resource management initiatives. Addressing these issues before the fact can significantly increase the success rate of these initiatives. A common first pitfall is to tie resource management directly to project portfolio selection. It is vital, at least in the early stages, not to imply that resource management is there to tell upper management what projects can proceed based on current resource constraints. Enforcing this risk is that resource management will be perceived primarily as a project gating mechanism, rather than a means to optimize overall productivity. Executives might then be encouraged to continue to fund additional projects without devoting enough resources to the existing projects. Furthermore, unless the organization is mature in its use of analysis packages to look across projects, a statement of resource constraints could become overly simplistic and even misleading. Resource management also should not try to centralize all resources and force all project managers to go to the resource manager for resource assignments. The resource manager should only attempt to centrally coordinate those resources whose nature requires this. Trying to coordinate all activities and resources can create a bureaucratic nightmare that counters the initial impetus to implement resource management. Resource management also should initially avoid a detailed analysis of those resources that are primarily used permanently. Attempting to include these resources will make the task more complicated than it needs to be in the beginning, as well as add little to the subsequent analysis.

9.6.2. Addressing Resistance to Change

Resistance identified in sub-section 5.1 is often seen merely as a negative; a roadblock that must be overcome. However, resistance usually comes from a good place: a desire for a desirable outcome or an awareness of potential problems. In their desire to create changes, managers often forget how they have developed their beliefs and opinions over many years, and that the experiences that brought about their philosophies may have also affected the personal philosophies of other team members. In making their place in the decision process for the changes they make for the team, managers lose valuable information that could assist them in creating better decisions. Listening to the concerns of the team members can help identify ways to avoid negative results because of the changes.

In addressing resistance, the goal is initially to build an environment of trust and openness and to build communication channels between management and team members. Recommendations for creating a climate of mutual respect and openness and for addressing resistance to change include: Allowing as many team members as possible to help create the criteria for the evaluation of possible changes to team workflow, process, structure, etc. Schedule team meetings to discuss, develop, and prioritize changes that may be able to assist in team operations. Let team members take the lead in creating and proposing potential solutions, with guidance from their managers. So that the team understands how the solutions are related to their ideas, and follows the guiding principle of communication when implementing changes. Consider incremental changes in a process improvement philosophy. Phase in some changes in a group before phasing in other changes so that the team can get comfortable with the change. Seek buy-in by allowing team members to test changes first before implementing an official change process.

9.7. Future Trends in Resource Management

Managing resources effectively is key to the long-term success of organizations. To be competitive in their respective lucrative markets and reach their goals, they have to strive for high productivity levels while simultaneously adopting more sustainable and people-centered approaches. This section discusses some future trends that are likely to have a significant impact on heuristics and resource management regardless of whether they are formulated as GRH or PRH. The first part highlights the influence and potential of artificial intelligence in resource management. The second part discusses the growing interest in sustainability issues for organizations which inevitably affects the way resources are managed and productivity levels are reached. These trends have a significant influence on productivity levels as organizations will be urged to shift their focus from profit maximization per se to profit optimization in a triple-bottom-line manner.

Impact of Artificial Intelligence

AI provides resources and resource managers with new instruments and previously unavailable opportunities. New tools assist in creating examples, designs, or drafts. As the tools continue to improve these processes, managers save time and engage in more cognitive tasks that require a higher level of expertise. Furthermore, we expect business process management as a subdomain of operations management to be heavily influenced by AI. By systematically analyzing all business processes and looking for managerial decision points that could be potentially enhanced by AI, organizations will be able to fully reap the benefits of AI.

It would allow for example robotized process automation to take over time-consuming process steps in the business process, reduce error rates, and achieve a higher quality in operations. Additionally, the introduction of AI will continue to have an effect on tangible and intangible resource allocation decisions as organizations will become aware of the need for AI specialists either in conjunction with a talent pool approach or with hiring AI specialists directly into the organization.

9.7.1. Impact of Artificial Intelligence

Advancements in artificial intelligence (AI) will exponentially accelerate the magnitude and pace of the effects of technologies on resource management theory and practice. AI is a set of increasingly mature technologies that can increasingly automate complex processes and tasks, which were previously thought to be within the exclusive domain of human intelligence or requiring, at least, significant human oversight and involvement. AI is the technology increasingly enabling what people often call smart or intelligent products, systems, and solutions, like healthcare diagnostics, voice recognition, strategically defeating chess grandmasters, target-market-focused advertising, self-driving navigation, and several AI-powered robots and autonomous vehicles. Consequently, AI is expected to enable unprecedented improvements in productivity and resource performance while also fundamentally automating many existing jobs and functions, including roles in resource management, like those related to demand forecasting, ordering, and supply scheduling.

A hallmark of intelligent systems is their potential to integrate an array of resources, such as equipment, communications, software, and people using the Internet of Things and Cyber-Physical Systems. This allows for the ability to facilitate increasingly efficient control, coordination, and collaboration of resources that extend beyond any single endowed intelligent system or individual. Businesses, that successfully leverage AI for enhanced resource management and productivity, will utilize the wide-ranging and synergistic capabilities of advanced AI algorithms and systems, which become ever more powerful, including their ability to learn and evolve.

9.7.2. Sustainability Considerations

Sustainable resource management consists of producing goods and services while minimizing the use of natural resources, reducing pollution, and guaranteeing that future generations may meet their needs. Sustainable decisions shall take into account not only economic, but also social, and environmental factors for their evaluation in an appropriate time horizon. Traditionally, resource decisions, i.e., levels of product and factor inputs should follow profit maximization criteria without sustainable

considerations. However, it is because of its importance that we also present in detail sustainability considerations, focusing on service level and energy use.

With regards to service/resource level decisions, when demand response associated with service levels in the core of related parties is weak, e.g., lead times for delivery in the supply chain, sustainability considerations may lead to minimizing total input use. For example, the service level with regard to product availability and customer demand satisfaction in the case of shortages associated with product inventories and customer waiting lines is invariant to sustainability factors. Sustainable resource management may therefore limit total input (labor, capital, and materials including over-time or layoff policies) use within a feasible range for given demand levels, by allowing greater variability of product lead times compared to demand levels, and variability of customer lead times compared to their demand levels during shortages by delays. Sustainability demands are therefore translated into managing heterogeneity of demand levels for product lead times and customer service delays while making such a decision is an acceptable wealth transfer decision on the part of resource owners. This enables product availability and customer demand fulfillment to be managed without loss or wealth costs, thereby allowing loss.

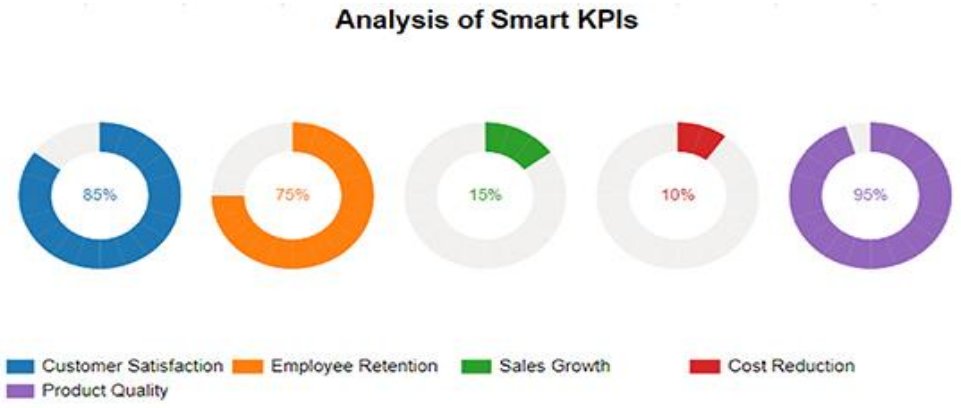

Fig 9 . 3 : Smart KPIs

9.8. Conclusion

The objective of this chapter was to analyze Artificial Intelligence solutions that can be used for intelligent resource management in a business context. In the knowledge-based economy, intelligence allows the most innovative and most rapidly adaptable companies to be the most profitable and the most competitive. The rapid evolution of Artificial Intelligence techniques opens new development perspectives to many companies, enabling them to increase intelligence by applying existing state-of-the-art artificial

intelligence technologies, solutions, and systems. The companies can simultaneously develop techniques to raise the knowledge economy and Artificial Intelligence techniques to promote recursive development. Intelligent resource management creates smart companies that make the knowledge economy become a knowledge-based economy, which then in turn allows more companies to develop smart systems for intelligent resource management.

Intelligent resource management generates a virtuous recursive process whose consequences can be very important, generating substantial business performance. Companies invest in intelligent resource management solutions that allow them to raise their efficiency and effectiveness. In a time frame that can vary between a few months and a few years, this investment is compensated through better performance and reduced costs. As the costs of intelligent resource management solutions drop, more companies implement these solutions and generate better performance and reduced costs. This encourages other companies to invest in better performance to respond to competition, favoring the recursive process. Today, many resource management aspects can be handled intelligently through Artificial Intelligence, either through solutions integrated into the ERP Information Systems or through Cloud solutions that can be developed as services, given the current level of maturity of the Internet of Things and Cloud Computing.

9.8.1. Final Thoughts and Future Directions

What we witness today is unprecedented technological development at all levels and in all areas. The current rate of technological changes, led by information and communication means, is compared to the shift from the first to the second generation of engines that propelled the economy of the first industrial revolution. While its initial phase was marked by the development of industry, especially with the transformation of products and services with increasing productivity and quality, the second phase emphasizes new ways to work jointly, i.e., on new ways of organizing the markets and inter-organizational relations where important economies based on the inherent characteristics of the technological changes are obtained. This chapter deals with aspects of this kind of management with the aim of generating proposals that contribute to increasing the organizational performance of companies and to contribute to benefiting society with the results obtained. After finishing this work and pondering its contents and the general framework of the previous paragraphs, we can conclude that for a better understanding of the process of managing the resources of a business or a group of businesses, we must analyze the micro and macroeconomic contexts, as well as the management ability of the company in different stages of its evolution related to the business sector in which it operates. In addition, we consider consolidating the thesis

that there are no universal rules. There are no best practices to be adopted indiscriminately in all companies. Each company must seek its way of reaching optimization situations through its management style and its cultural and contextual environments.

References

Jeble S., Dubey R., Childe S.J., Papadopoulos T., Roubaud D., Prakash A. (2018). Impact of Big Data and Predictive Analytics Capability on Supply Chain Sustainability. International Journal of Logistics Management, 29(2), 513–538. https://doi.org/10.1108/IJLM-05-2017-0134

George G., Haas M.R., Pentland A. (2014). Big Data and Management. Academy of Management Journal, 57(2), 321–326. https://doi.org/10.5465/amj.2014.4002

Wamba S.F., Gunasekaran A., Akter S., Ren S.J.-F., Dubey R., Childe S.J. (2017). Big Data Analytics and Firm Performance: Effects of Dynamic Capabilities. Journal of Business Research, 70, 356–365. https://doi.org/10.1016/j.jbusres.2016.08.009

Wang G., Gunasekaran A., Ngai E.W.T., Papadopoulos T. (2016). Big Data Analytics in Logistics and Supply Chain Management: Certain Investigations for Research and Applications. International Journal of Production Economics, 176, 98–110. https://doi.org/10.1016/j.ijpe.2016.03.014

Grover V., Chiang R.H.L., Liang T.-P., Zhang D. (2018). Creating Strategic Business Value from Big Data Analytics: A Research Framework. Journal of Management Information Systems, 35(2), 388–423. https://doi.org/10.1080/07421222.2018.1451951