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Chapter 1: Exploring the foundations and modern applications of operational and business support systems in retail and manufacturing

1.1. Introduction to Operational and Business Support Systems

This introductory chapter presents an overview of the Foundations and Applications of Operational and Business Support Systems in Retail and Manufacturing. Operational and Business Support Systems, complimentary to Informatics Applications, play a strategic role in the success of Retail and Manufacturing companies. While specialized Retailers and Manufacturers are using increasingly different Development Platforms and Technological Solutions, design processes are converging and share a common – and ever growing – body of knowledge. Operational and Business Support Systems deal mainly with the processing of huge volumes of business data and correspondingly to the optimization of Operational and Business Decision Processes. This optimization is essential for Big Data Analytics, Business Intelligence and Meta-business Models. Business Models define how companies derive their Revenues and Profit. Meta-business Models define how companies derive their Revenues and Profit collaborating with other companies, Suppliers and Clients. Meta-business Models concern Supply Chain or Ecosystem Partnerships and use ICT Systems to support their operational collaboration. The optimization addresses also the meta-processes oriented to the definition of the Business Models and Meta-business Models and concern different decision areas, different levels of complexity and different time horizons (Kache & Seuring, 2017; Boyes et al., 2018; Ghosh, 2020).

Information and Communication Technologies play an essential strategic role supporting the critical decision areas of a Retail Enterprise or a Manufacturing Enterprise, as well as the operational and decision processes oriented to their optimization. The discussion starts with the Information and Communication Technology Systems as Support Systems of the Enterprise Decision and Operation Processes. In the following sections, we will analyze in more detail the Decision and

Operation Systems. Finally, a synthetic overview of the book contents will conclude the first chapter (Xu, 2011; Lasi et al., 2014).

1.1.1. Understanding the Framework of Operational and Business Support Systems

Operational and business support systems are frameworks that support the automation of tier 1 business processes typically not automated by ERP, such as communication expense management and support, operational reporting, business performance monitoring and productivity measurement, promotion execution and media planning, compliance assessment and reporting, and enterprise application portfolio performance assessment. They are capabilities required for effective performance of tier 1 processes, as well as consideration of actor and business service performance monitoring, communication and transaction expense management, and assessment and intervention of operational processes and business, service, and enterprise performance during business execution. Unlike ERP systems, which address focus assembly of enterprise business objects, operational and business support systems prepackaged business process configurations instantiate broader, collaborative capabilities for cross-functional support of service execution. They encompass collaborative coordination between organizational resources during service delivery, assessment of service and service subsystem during portfolio performance, business service and resource productivity during transaction execution, and enterprise business, service, and resource performance during overall business execution. While there have been various tools for accomplishing operational and support services since the advent of computers, the methodology outlined represents a coherent framework that assembles these tools into a capability system for automating the execution of tier 1 enterprise services and processes and subsequent assessment of business and operational support systems performance.

1.2. Historical Evolution of Support Systems

Although it's difficult to even imagine a time when practically every activity had to be carried out manually, long before the beginning of online systems in the 1950s, such tasks were common, and, in particular, they influenced the Manufacturing and Retail Development. Almost at the same time as the appearance of the Production Line created by Ford for Automobile Mass Production and the PERT developed by Dupont for the Production Planning of Rocket Programs, some pioneers foreseen that predictability in Retail would have a huge impact. The fact that IT evolvement followed this expectation progressively, along the years, is something that can count on several supporters. His arguments allow us to divide the path into several important milestones that can help to

structure this chapter and contribute to gain a broader vision of the Systems that Support Manufacturing and Retail Areas.

The first milestone concerns the beginning of the computer usage in commercial applications for process efficiency. The main Rationales of the Systems that appeared in the 1960s, using batch mode and mainframe architectures where punched cards, tapes and prints were the input/output devices, were to adequate the Settlement of Transactional Processes and the Cost Reduction. For Retail, systems were implemented basically for accounting, while for Manufacturing, Control and Inventory Management Systems with MRP and MRP II Integration were the main applications. In turn, the second milestone concerns the introduction of on-line capabilities and database technologies. The fact that databases were developed just after Industry decided to use IT to process high-volume repetitive transactions contributed to make it difficult not to mention the pioneering role that “file-oriented” infrastructural systems played in allowing the concentration of data into efficient and effective data models and retrieval solutions.

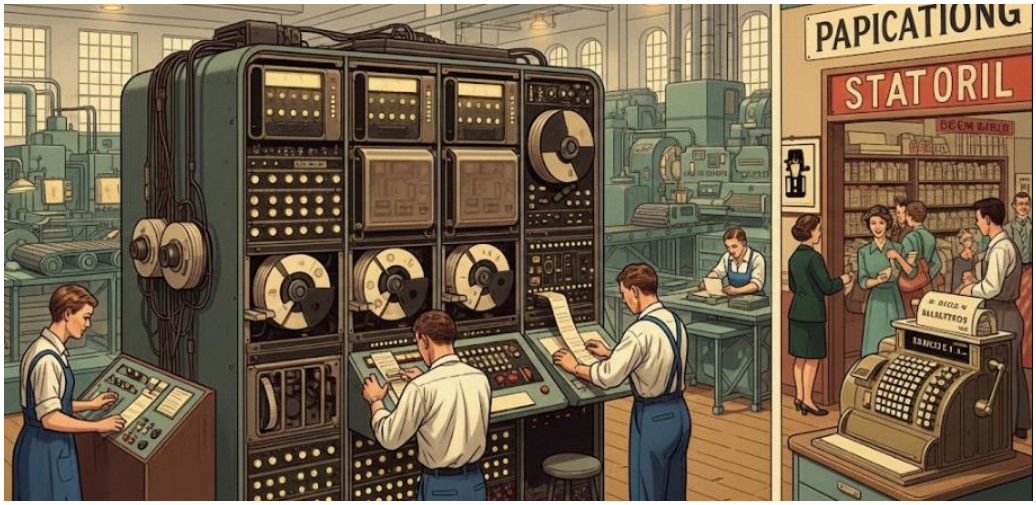

Fig 1 . 1 : Early Computing Systems

1.2.1. Evolutionary Milestones in Support Systems

The Business Support Systems (BSS) and Operations Support Systems (OSS), determined by data on the business processes and the necessary operations to perform them, support, control, and direct organizations' decisions and attitudes. They are responsible for events: real-time operational monitoring and alarming, detection and diagnosis of current special situations, prescriptions and instructions about actions to take, and automatic action taking. They verify hypotheses and predictions considering

system evolution, monitor execution of action plans, guide consecutive actions to fulfill a desired objective, measure results, and feed the knowledge database. It means that they disclose evolutions of key data for the business and operations to serve defined objectives and provide information and procedures to create external and internal conditions for those data evolutions.

The BSS/OSS evolution is determined by the information evolution accelerated by the growing importance of predictive and prescriptive models based on the analysis of resources and knowledge as key business factors. In fact, any organization is able to create and maintain an insertion point in the market only if it can guarantee a continuous and sufficient resource supply to offer and produce goods and services considered, at the same time, convenient by the external world either in price, quality, or both factors that make the product elite value. By the Operating System (OS) point of view, computerized production support has passed along various phases ever since the late 1950s. The first one consisted of designing and developing Basic Programs dedicated to automate single functions to increase efficiency already achieved through the scientific management by means of Time Studies and Work Measurement.

1.3. Key Components of Operational Support Systems

The OSS focuses on operational and managerial process automation enabling tasks that are planned and executed invariably following the same script, uninterrupted by exceptions. The OSS project scope includes but is not limited to automation for processes in these reusable and repetitive functional areas such as Inventory Management, Event and Task Management, Data and File Management, Fulfillment Process Management. Both OSS automations and added value are based on two key enabling components: Data Storage, Management and Distribution including transaction Data and Master Data and Process Automation, Monitoring and Management. This base functionality is used to build dedicated applications specialized in process automation in focused functional areas across various industries. Such OSS applications share the basic functionality but may also possess specific, advanced functions supporting operations in certain niches. The specializations are caused both by historical developments and needs of the major OSS clients.

The OSS must develop a general framework for all applications supporting the OPS function across various carriers, markets, departments, geographies. Such a framework or the base functionality supporting all the OSS applications must satisfy the needs of a broad range of such applications from various industry portfolios. The OSS must therefore include certain base operations common for all applications that concentrate on unique business processes. This base functionality must however not be large because the variety of industry solutions requires investments in the development of tailored

applications. It would be uneconomical to develop generic functionalities that are all present in various modules designed to perform functions for various industries. Another approach is to have the OSS use other means for functioning with certain limitations and industry exceptions. These means include collaboration and fulfillment with Service or Business Support Systems in external domains.

1.3.1. Data Management and Storage

Transactional data generated in retail and manufacturing are often voluminous and require long term archival. On processing transactions, large volume of data is generated. This data is then mined to identify patterns or trends, which is used for strategy formulation like what are the products which are often sold together, what products are regularly purchased by a customer for change of season and so on. These decisions are collectively termed as business strategy in retail business. The traffic of data in a retail business can be divided into two categories: pause mode and flow mode traffic. Examples of pause mode traffic are customer databases, inventory data base, supplier data base and sales history. Examples of flow mode traffic are sales transaction data and credit card data.

A typical retail data base consists of a group of related files accessible in a supervised manner. Typical functionality requirement of a retail data base involves creation of a new data base, retrieval of existing data, updating of existing data, deletion of old data, report generation, back-up/restore operation, provision for audit trail and enhancement tools. With the introduction of web based applications, the retail data bases are getting opened for use to multiple completions for any location. Hence, maintaining the integrity of data base during normal and peak hours of business is extremely difficult. It is also equally difficult to generate the report whenever required due to inherent design complexity of the conventional data base. A necessity therefore arises to consolidate the fundamental requirements of a traditional retail application for designing the data storage and data management platform so as to ensure speed and reliability of data, which becomes more crucial in the scenario of enterprise data base designed for enterprise application.

1.3.2. Process Automation

Whereas chapters 4, 5 and 6 concern the topic of data management and storage in more detail, in this chapter we focus on another important aspect of an OBS, its capability for process automation. The basic idea of this component of an OBS is to specify business processes in the context of a business information model, and to associate with these processes the operations that facilitate the actual execution of them, for example in terms

of the communication facilities of the OBS. Important for the viability and success of an OBS as a system for operational and business support, is that the data collected by the OBS, the data on which the operations act, and the operations are all cleanly related in the sense of using the same business information model.

The goal of creating operational systems, is to make a business organization run, without the necessity to have human agents involved in every action. There are three types of operations that can be specified in the process automation component of a system. The first type covers operations that trigger other operations, possibly at defined occasions, or in reaction to certain events, or in response to certain requests. The second type involves operations that perform part of a process that does not require intensive human interaction, such as collecting data, executing business transactions or issuing invoices. The third type involves operations that are triggered or scheduled by the first operations and that require intensive human interaction using the appropriate communication channels. Monitoring their completion, initiating further operations or notifying participants, is the responsibility of the second operations.

1.4. Key Components of Business Support Systems

In this section, we analyze the two most important components of enterprise business support systems assembled for retail or manufacturing enterprises: the Enterprise Resource Planning System (ERP) and the Customer Relationship Management System (CRM). Because of their importance, we analyze them separately and describe their functions and characteristics.

The ERP system can be viewed as a specialized Evolutionary Business Support System designed for internal processes with a long-term cycle. It is the internal organization and operations of the enterprise as a collection of interrelated processes. Being physically realized within the computer framework of the enterprise internal network, the advertising and promotional activities of the enterprise are performed by the marketing and sales module of the ERP, often called the Commercial module.

The CRM system can be viewed as a specialized Evolutionary Business Support System designed for external customer relations and designed for shorter-term transactions. It keeps available an uncomplicated description of customers and known customer preferences that are relevant to the short-term promotional campaigns run in the ERP. The key characteristic of CRM is its capacity to continuously learn from internal and external events and to continuously communicate updates to ERP so that ERP can respond appropriately to current customer preferences. The actual information flows from the customer to CRM, and then to ERP are designed according to the Information Management's approach developed in Part I. The decisions generated from the

information flows from ERP to CRM, and then to ERP are designed according to the C4CM concept discussed in this book.

1.4.1. Customer Relationship Management (CRM)

CRM refers to the systems required to support and integrate the key business processes of the organization to create maximum customer satisfaction at minimum cost. These processes include sales and promotions, order processing, delivery and installation, service delivery, billing and payment, and support for complaints and inquiries. The software that performs the CRM tasks relies on a database containing key information about all customers, especially their purchasing and service delivery histories. These databases are often geographically expansive and are not restricted to established, current customers. Customers who have left a company and potential future customers also contain vital data. The mix of this information allows for the identification of high-value customers and improved decision making on product and service design. However, these databases are usually transaction-based and customer centric and contain basic contact and demographic information, critical incidents, lifetime value measures, and innovative experiences with products and services.

Because of its specific and numerous information requirements, the construction of the data warehouse for CRM is particularly difficult. Identity resolution is typically more complicated than for internal data warehouse systems because of the open-ended, multi-faceted geographic and behavioral nature of customer databases. There are also extensive privacy and security issues in establishing identity. At the next level of complexity, CRM systems are capable of becoming true cross-channel management systems to provide a seamless transition and experience for the customer and help the company achieve its business goals. The CRM cross-channel systems assist in managing different incoming and outgoing customer channels, such as stores, internet sites, kiosks, call centers, direct mail, email, and consulting services, so that a customer can smoothly move from one to another. CRM is made more powerful by its incorporation of advanced analytics. These algorithms and rule-based logic engines are built to assist companies in improving decision making in the core business processes on an ongoing basis.

1.4.2. Enterprise Resource Planning (ERP)

The Enterprise Resource Planning (ERP) software is large systems to support all processes inside the organization. An ERP integrates all the main functional business processes in a uniform, enterprise-wide information system consisting of a central database and a limited number of modules. The ERP helps all areas of an organization to plan and control their resources. The core modules are for finance and accounting,

production and materials management, sales and marketing, and human resources. Typically they are complemented with modules for project management, maintenance management, quality assurance, or other specialty areas. The ERP modules share a common database, allowing schedule and resource plans to flow from one area to another. For example, daily production schedules generated in the manufacturing module can be used in human resources planning, financial analysis of labor costs, and purchasing of production materials.

The goal of ERP is a coherent organization of many sub-processes that exhibit a great deal of interaction. Coordination is especially important during periods of change, for example, when there is a new product, or in the case of individual customer orders in made-to-order industry segments. The ERP solution focuses those activities that generate costs with limited additional revenue. In summary, the main differences between general-purpose business support systems and ERP are: An ERP integrates several support areas. It contains an extensive knowledge base for financial decision making. It analyzes data based on financial principles. It uses and maintains a single integrated database for all business support activities. It provides frequent updates, verifiable against the financial principles that control monetary flows. It integrates problem-solving activities in support areas that are typically not run and analyzed together. This volume addresses key issues in the development of foundations and applications of the specific areas dealt with in ERP solutions.

1.5. The Role of Technology in Support Systems

The research of support systems is based on the structure and functioning principles of real social systems, especially on business organizations, but refers also to a wider kind of systems including these business systems with their market and technical environment and their social and political surroundings. But the support systems of a business organization are not identical to the functioning principles, that are hardly identified considering the long and paradoxical way of information technology, which may also be hindered by social and cultural problems that more and more characterize the societies in transition. Support systems are the organizational structures that are able to guarantee that the enterprise organization works according to its functioning principles. Likely, the best support systems are these that guarantee the operation of business organizations with the lowest investment, covering a relatively limited number of functions. But organization and governance of these support systems are a crucial factor for the efficiency of both support and business systems. For a long time, these support systems relied on in-house solutions, that is, owned, software systems, run on on-premise physical servers but their operative and technological models started changing with the growth of the cloud computing paradigm. The widespread availability of cloud services

has allowed small and medium enterprises to opt for external solutions relying on external, cloud-hosted, systems that allow them to cover several organization and governance requirements with relatively lower risks and costs.

1.5.1. Cloud Computing

Cloud computing is a computing paradigm effectively and efficiently providing a variety of configurable computing resources via internet, such as storage, servers, networks, databases, applications and services. Characteristics of cloud computing are that the service is offered to multiple clients with different demands and the resource is administratively shared among multiple clients by dynamic scaling according to real time demand. Virtualization technology, providing a platform to make multiple virtual replicas of computing resources on a single physical computing resource, enables these characteristics of cloud computing.

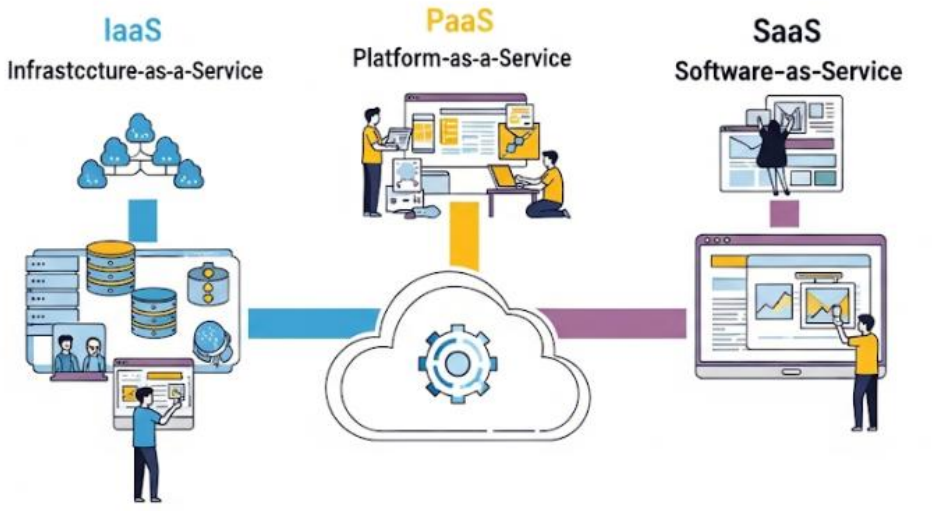

Fig 1 . 2 : Cloud Computing: Three Models, One Powerful Platform

Cloud computing is typically categorized into three service models: Infrastructure-as-a-Service (IaaS) based on resource pooling in which physical/virtual physical computing resources such as computing power, storage and network are provided, Platform-as-a-Service (PaaS) on which application software and services are created/deployed and Software-as-a-Service (SaaS) based on data sharing in which complete software applications are delivered as a service to users from a cloud infrastructure. IaaS provides the most basic computing resources and allows its customers to deploy their own operating systems and application programs in the cloud, on which virtualization technology has a large impact. PaaS runs application programs developed by users on a

cloud platform and/or cloud infrastructure provided by the PaaS vendor, thus hiding the complexity of managing the underlying cloud infrastructure from its customers. SaaS runs on-demand software applications and is provided to the end users from a cloud infrastructure without users' concerns to programming the application software itself.

1.5.2. Artificial Intelligence and Machine Learning

Artificial Intelligence (AI) is concerned with creating computer programs or systems capable of intelligent behavior. Such programs create a new class of services that assist with a number of different tasks. Some of these tasks may involve automating processes. Other tasks may rely on modifications or controls of processes. It is not possible to define AI in an all-encompassing way. The term has frequently been redefined over the years. New advances in techniques and hardware mean that what is not possible today, or done manually today, can perhaps be defined as AI. Just 10 years ago, a number of tasks we now take for granted, including data analytics via language, virtual assistants, image recognition, were considered AI. AI is being used in the areas of applications such as business analytics, supply chain, customer experience, marketing. Let us consider a few areas that utilize AI.

Machine learning (ML) is a subset of AI. An ML model improves its predictions based on input data. It does not require a predefined functional form for the underlying mapping. The earliest examples were created using decision trees. There are a number of different models for machine learning: decision trees, neural networks, visual network, support vector machine, Markov model, hidden layer Markov model, and others. ML has also been applied in areas such as optimization, anomaly detection, clustering, imputation, evaluation of large databases, detection of text and translation of text, and ranking. More recently, in the last 5 years, there has been lot of excitement about deep learning, which consists of stacked and more complex neural networks. Large companies are developing proprietary products that have various applications: image recognition, generating photographs and videos, automatic coding, visual dialogue, text and natural language coding, conversational agent, earnings call summary, medical diagnosis, etc.

1.6. Operational Support in Retail

In a retail environment, operational decision-making is concerned with both the management of the physical and IT system that support front-office business functions and the processes through which these systems are utilized. The latter, which is usually the main concern, considers decision to be made ranging from the short-term (for example, determining the quantities of products to be allocated to specific stores to

satisfy anticipated customer demand which is highly stochastic, based on past observations, during the next week), the medium-term (for example, determining the planned sales and inventory levels for a chain of stores, in relation to estimated future sales for the next year, in order to maximize the chains' profits and return on investment), to the long-term (for example, determining the planned structure of the chain, in terms of the number, location, and sizes of the stores, in relation to projected retail revenues in various geographical areas, and the chain's market share, in order to optimize the revenues and costs of the chain over a multi-year period).

As the above examples illustrate, a number of decision areas exist, namely inventory management, demand forecasting, store sales planning, distribution network planning and optimization, product sourcing, merchandise planning, and store planning and control. Ranging from the most concrete and specific in terms of their operational nature, with a need for system support to facilitate timely and effective decision-making, to the most abstract and strategic in nature, with a focus on considerations about the store chain as a whole and its long-term evolution, this group of decision areas has also been referred to as operational support and strategic design. One key aspect of retail and of the relevant IS research is the relationship between the retail IS, on the one hand, which enables the collection, transmission, and storage of relevant and timely data, and decision-making, on the other hand, that is based on these data.

1.6.1. Inventory Management

In retail and manufacturing – as well as other types of organization – it is critical to maintain an effective balance of stock in order to be able to meet customer demand without holding excessive amounts of money in inventories. This requires timely and accurate visibility of actual inventory and corresponding stock evaluations at various locations across a wide range of stored products. Accuracy of delivered products – including quantities, attributes, and user-defined priorities – is also important. And stock units must be centrally controlled and managed.

Inventory Management Systems track product availability, status, and movement through change-tracking and auditing of stored object item numbers, quantities, locations, logistics center, supplier, inbound/outbound change history, and delivery date. The system distributes notification messages to notify users of events that affect the availability and status of product items, enabling corrective actions to be implemented when required, and delivering alerts and status reports on-demand per user-defined priorities and preferences.

To support these requirements and functions, an Inventory Management System must: define stored objects explicitly enough to permit users to be confident that they selected

the correct item to examine; support user-defined item groupings to provide visibility and report on important categories of stored items – items of interest because they may have particular characteristics, location, status, or significance; control permissions to enforce necessary access, modification, and warning notifications filtering rules and track associated events. Report and delivery notification messages, warning notification type, and associated delivery preferences. Incorporate audit and change-tracking functions. Provide alerts for valid state transitions. And provide configuration function so users can tailor item monitoring and reporting options for both specific attributes and boundary values that trigger the default actions.

1.6.2. Supply Chain Optimization

Supply chains connect the operations of different companies and are generally distributed over large geographical areas. Thus, the optimization of their operation and coordination often involves considerations regarding transport methods and costs, financial flows, and revenues, plus issues such as distribution network design and customer service level. Therefore they are much larger in scope than the typical inventory replenishment models. However, key decisions in supply chain management involve product replenishment decisions at particular times, e.g., daily or seasonally. Thus, they reside in the area of operational support, since the exact timing and values of some critical replenishment decisions must be specified relatively far in advance. Ignoring specific shipment timing decisions, many supply chain decisions actually simplify the management problem, since they can be delegated to the participants of smaller supply chain segments.

Costs and revenues of the entire supply chain can be viewed from a cross-sectional perspective. Supply chain management makes the corporate logistics decisions on the internal operations that form the supply chain, bridging the gap between the tactical marketing and operational inventory control. It is through the management of the inter-company transactions of costs, revenues and potential profit sharing that more efficient decision making is likely to be reached. These inter-company transactions lead to a wide variety of different intercompany integrated company systems. Using bar codes or other identification methods to capture the transactional data generated during the transaction process is the starting point of developing the required inter-company business systems.

1.7. Operational Support in Manufacturing

Manufacturing has processes in the realization of their product in similar but more complex operations, however the implementation of such an operation involves more tasks, such as who is going to do, where is going to do it, how the assembly line should

look like, design fuse to see how the parts are combined, and propose what are the times it should take for the different operations, these activities take support of an Operational System, remiss to time variables such as time due when, time that goes to take the task, time embedded when different task embarks, and times in normally what is expected to dedicate to a task. One of these time variables is also concern of the proposal of Operations Management. That is why it is our corresponding treat the Operation Management, and the Task Timing proposal and Task Scheduling.

Operations Management will be aware of how will be used the organization resources. Organizational Resources are Scarce; it is why it is an important Functional Affair. That is why to carry our Operation must assume Time and Cost Constraints. Task Time Budgeting will be on Task Observe, and propose Times Embedded in Normal Conditions; Task Schedule will break down where, and who will put each marked Task in a Calendar, establishing also Temporal Restrictions Special Conditions on Product, and Resources. Again, Organization Resources are Scarce; this characteristic must be taken into account in the Schedule Proposal. The complex resource make the research proposal will take into account constraints relation, and how they will influence the Turn Round of a Batch. A schedule can be done on different time levels; for example all the constraints description of the task, and Part Task may fix a metrical proposal, or a more specialized proposition on Staff Assignment, and Working Shift with a Calendar Level Proposal.

1.7.1. Production Scheduling

At the executive and strategic level of the company, decision makers apply competitive models such as product-market growth, product portfolio allocation, and resource allocation models to optimize revenues and margins on a quarterly/annual basis. The tactical level of the company is responsible for working on optimized profit plans over the midterm (months/weeks). This function is accomplished through implementing enterprise-wide information systems such as Marketing Planning & Execution systems, Business Intelligence systems, and Business Performance Management systems. Whereas these systems provide insights on what products should be manufactured, and in what shops, during the tactical time frame, operations management is responsible for implementing detailed schedules that specify, for every product, the time frame when it will be produced – down to respective shop and work areas. Because many resources are shared among several products, their time scheduling is crucial to ensure that production runs smoothly over the short term (hours/days/weeks). The most known set of tools to accomplish this task are the Manufacturing Execution Systems. These real-time systems allow erasing production disturbances as they arise to allow manufacturing companies to reach settled objective of On-Time Delivery.

At an even more granular level, also down to each order, is located the Production Scheduling function, whose objective is to anticipate as much as possible production solutions that will allow the company to minimize setups and changeovers which consume both machine time and production labor and thus create a bottleneck for manufacturing. The Production Scheduling function has therefore become strategic for assembly manufacturers and flow manufacturers that pursue efficiency as a competitive advantage. The tools used by these manufacturers to achieve efficiency are Advanced Planning & Scheduling systems, which pursue the objective of leveling the load on all machines and, when that is not possible or is too costly,..

1.7.2. Quality Control Systems

Quality has become a very important competitive advantage in manufacturing, with companies implementing processes that others are imitating today. They follow the principle of Zero Defects in the manufacture of their products. A company following this principle will incur costs only to assure the continuing quality of its products. The costs for making and shipping faulty products, and the costs for correcting any defects, should be zero. This means that the company would not incur costs for inspection or in rectifying faulty products during and after manufacture. In order to assure that companies do achieve Zero Defects, they should establish preventive quality control standards.

In order to achieve Zero Defects, companies must establish preventive quality control standards. The establishment of inspection, detection of defects, and corrective action at the source would be strongly approached by the transferred quality responsibility, where inspection and quality assurance will be no longer the responsibility of the quality control department but by the relevant workgroups themselves. Thus, the quality control system would emphasize the planning of all the relevant manufacturing and non-manufacturing processes, including the provisioning of resources, to assure the quality of the output and not rely simply on final inspection.

The objective of quality monitoring and assurance systems should be to define the procedures for allocating the available resources in order that all of the processes occur at the expected process and output performance levels. These procedures should, therefore, ensure that the key process characteristics have acceptable limits on variability. To support this goal, the quality monitoring and assurance are achieved through technology and systems. Statistical Quality Control techniques are often used to define the key characteristics associated with the cost-effective performance of the organizations, including the resources needed to enable processes to operate within expected levels of performance. Statistical process control is then used to monitor and maintain processes within the acceptable limits.

1.8. Business Support in Retail

Retail is the activity of selling goods to consumers. Usually selling happens in smaller units than producing. Finding consumers who buy goods for their own consumption is a challenge for retailers. Marketing tries to stimulate consumers to buy from some specific retailer. Marketing involves decisions concerning the four Ps: product, price, promotion, and place. High-quality and favorable-price products should be presented in a sufficient number. There should be enough, but not excessive, amount of different products at each place. Promotion stimulates desire to buy and visit either place or website. Promotion stimulates sales in the chosen short period of time, while retention maintains and strengthens customer relationships for continuing future sales. Modern technology and communication create many new possibilities in every aspect of retail marketing. Data mining analyzes historical and up-to-date data concerning retail performance, in order to set correct marketing strategies and policies. High-quality products become popular through local or worldwide negative or positive feedback. Profile-driven dynamic pricing makes it important to track data about each customer, collect complete purchasing history, create profile and segment for each customer, continuously maintain the segment status, and initiate retention at risk reminders. Customer Relationship Management (CRM) as a business information practice normally engages sales business processes among sales executives in different locations, inside and outside the acquired company and origination.

Marketing automation utilizes IT-supported systems to automate marketing activities. Retail is about selling goods that were previously produced by businesses. Nevertheless, support systems direct activities in both business processes and decision exploration. Daily sales benchmarking systems present in retailing the quantification of sales volumes of products into sales per day for each product for the selected period choose to analyze, especially when problems of sales decrease occur. It probably reduces comparison errors. Data-driven marketing by using big data lies at the basis of these systems. They analyze sales performance dynamic of each product for each geographical place.

1.8.1. Sales Analytics

Successful retailing today requires timely support in making decisions regarding the assortment and stock of products, prices and special offers, advertising, placing products on shelves, and logistics. These and several other retail problems require extensive and sophisticated information support. Specialization and flexibility, a small number of store types distinctive for a retailer, along with their many individual locations, high store sales variability, mostly temperature-related seasonal character of sales, large product assortments, a small number of sales transactions for many stockkeeping units require

utilization of business analytics and decision support for problem areas where human work is usually not enough to find and implement the best solution. Business intelligence and analytics utilized in the areas of retail and consumer behavior is a major application of mathematical methods. Basic methods include regression of sales data, archetypal and predictive modeling of various processes involved in buying and selling, time-series forecasting. Other methods include econometric modeling as a special case of regression modeling, factor and cluster analysis, and multivariate statistical analysis.

Notably, the majority of methods discussed here are methods of sales forecasting. Product sales forecasting is the process of estimating future demand for a part of a retailer's product assortment — for specific products, specific periods of time, and specific locations. Sales forecasting is the main task of point-of-sale business analytics. Accurate sales forecasting is central to the efficiency of many retailer operations. It is essential for timely and accurate ordering of products sold by retailers, for effective inventory management, for optimizing food product pricing decisions, for successful new product launches, for preparing supermarket shelf-space allocation adjustments as well as seasonal temporary price reductions and special promotions.

1.8.2. Marketing Automation

Industrial marketing management systems are designed to optimize all marketing elements in the industrial environment. They are analogous to the marketing management systems for consumer products used by national producers and worldwide marketers, except that they operate within the business marketplace regulatory constraints of the presented difference. They collect information about industrial market properties in order to define market segments and provide guidelines for decision making about the product supply element. The basic marketing policies needed for industrial products are also collected. The choice of the distributors of industrial products can be optimized, as well as promotional campaigns.

Marketing automation refers to software platforms and technologies that assist business owners and marketers in marketing activities and tasks. Marketing automation helps streamline, automate, and measure marketing tasks and workflows, so they can increase operational efficiency and grow revenue faster. Common features of marketing automation software include lead generation, lead management, lead scoring, CRM integration, campaign management, marketing analytics and reporting, account-based marketing, social marketing, search engine optimization, customer journey mapping, email marketing, inbound marketing and telemarketing.

Marketing automation is usually associated with the email channel. This discussion focuses on email marketing, since it is mostly the core of automation. Most of the

functionality is around automating contact with customers, both potential through outbound emails and existing. Emails with customer multi-choice questionnaires, feedback requests, re-engagement communications, and customer loyalty and relationship building, discount and promotional campaigns for important dates are campaigns built by marketing automation systems. These campaigns usually need a tight connection to analytics data feeds to inform who, what, and when of campaign execution.

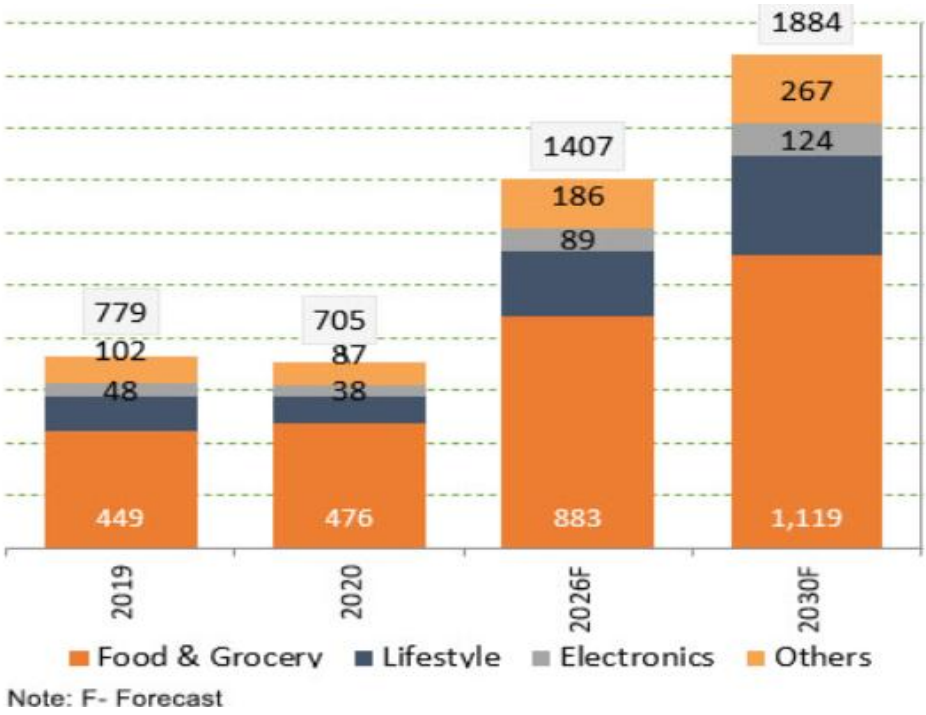

Fig 1 . 3 : Retail Industry

1.9. Conclusion

This book is an attempt to provide a more comprehensive understanding of information technology (IT) and knowledge-based decision support systems (DSS) in a variety of international retail and manufacturing environments. It provides a history of how current operational and business support systems (OSS and BSS, respectively) emerged, how and why they differ in research and implementation scope and focus from generic enterprise-wide systems, highlights some of the current use of these systems together with their benefits to management and consumers in these environments, and provides a more detailed exploration of these areas across the IT and DSS literatures. This book has attempted to go beyond the usual industry magazines and offers a broad research and

implementation analysis into what drives support system exploration and investment, particularly in an international context. Some of the chapters in this book have presented a research-oriented and others a more practical-oriented look at the DSS area in retail and manufacturing. However, we hope that this blend of approaches across a multitude of sub-environments in these traditional business areas has led to a more coherent understanding of how current operational and business systems have emerged and are currently evolving. There are many unanswered questions regarding next generation OSS and DSS. Research and implementation support in the area of tools such as data mining systems are in their infancy. Research into dynamic forecasts, particularly in the area of simulated-use forecasting, is much needed. Simple extensible systems for multi-stage problems are also long overdue.

Despite our current experience, we believe that the important future moves for industry and academia alike will come from systems that facilitate business use of statistical tools and build comforting models for top management. Simple to implement forecasting systems in an ever-more dynamic commercial world are needed. The advent of the Internet and the many commercial possibilities that it offers mean there is an urgent need for university business departments to better forge links with industry on the types of joint projects that can make current DSS support systems more fruitful for business. The time spent by companies in developing feedback links with academia can help these companies better focus on their own research and implementation priorities for the future. Thus, the implementation of such systems for easy use in a diverse range of business applications could prove the industry-academia ventures' worth.

1.9.1. Final Thoughts and Future Directions in Support Systems

Foundations and Applications of Operational and Business Support Systems in Retail and Manufacturing - Final Thoughts and Future Directions in Support Systems

It is important to note how large and large-scale distribution have been concerned in recent decades with a series of values as a way to maintain the competitiveness of the current scenario marked by globalization, requiring the constant search for new resources that favor the cost/benefit relationship, as well as quality and differentiated service, keeping themselves directly impacting the entire production chain. Distribution is an essential logistic component, since its function is to make products and services reach the consumer in the quickest way possible, since at that moment the company realizes its income. It is in this important logarithm that many companies have started to deploy support systems.

The use of decision-making support systems and operation support systems has gained more and more ground, incorporating new technologies, increasingly benefiting

distribution companies. The direction for the future of Decision Support Systems is to create intelligent systems that help users to make decisions in less time. Despite the considerable development of packagings, capable of making the system unique and attractive, it is still necessary that there exists specialized manpower available to translate the peculiarities of each company in the decision process. In Operation Support Systems, the trend is for systematization, either for the functions that executives have, or for the operationalization of the processes that have been standardized. It is a reinforcement of what we should already know: perfect logistic system, according to the rules of optimization of resources, are able to streamline activities, avoiding the redundancies present in the inefficient use and absence of technology. There is still a field that can be explored, which is the relationship between the different systems, that is, how a Product Data Manager is allowed to integrate data with a previously created Decision Support System, more specifically, Merchandise Forecasting, or even with Logistic Operation Support Systems for Route Optimization and Inventory Management.

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