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GLANCE AT PHARMACEUTICAL OPERATION

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ABSTRACT

This is the short glance toward the pharmaceutical industry operation for the new comers or the non pharmacy background or fresher/trainee candidates to get understand the exact operation and departmental works in pharmaceutical industries.

KEYWORD: Pharmaceutical industries, subject of core pharmacy, Department of pharma industries and their operation.

INTRODUCTION

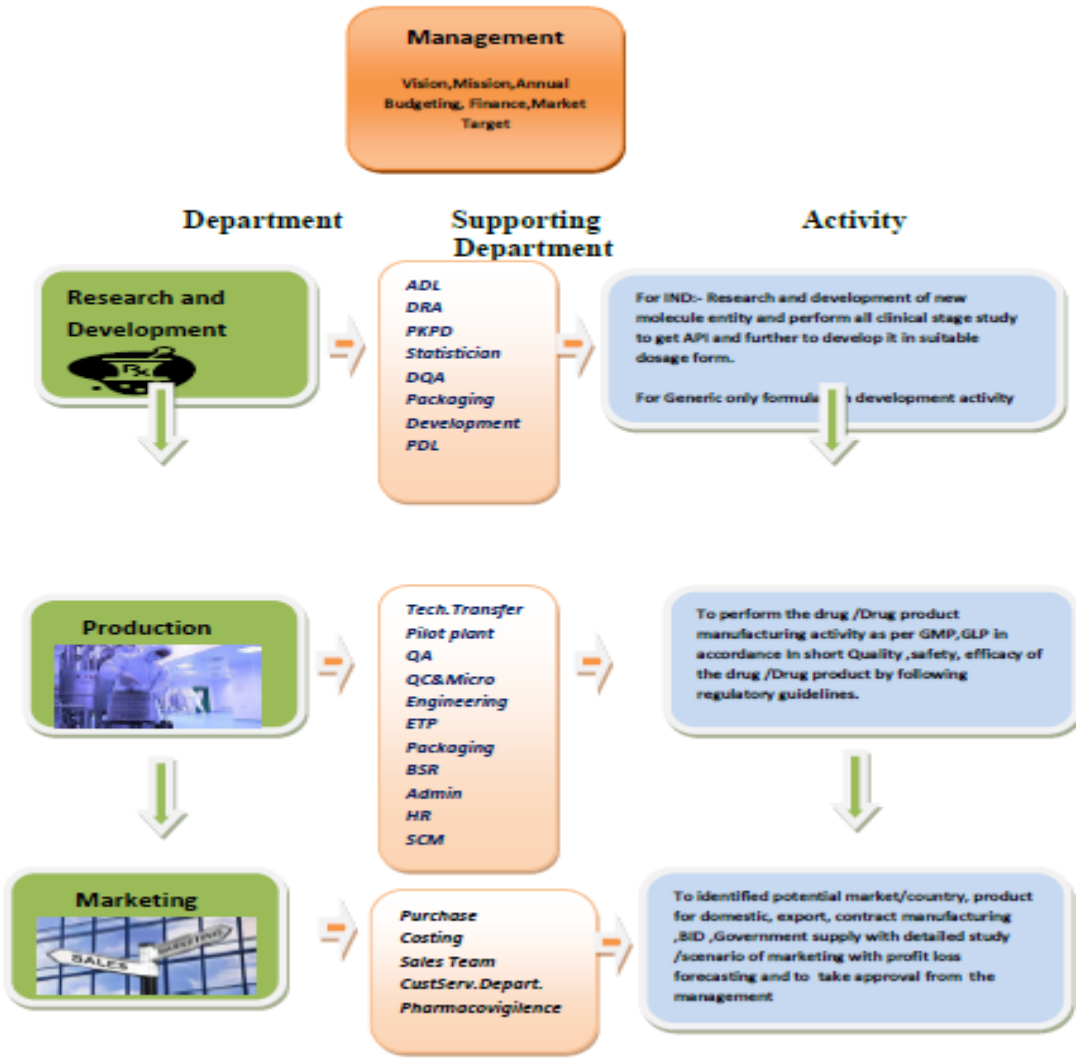
New comers pharma industries are always don't get exposure to each and every operation of the department. New pharmacy graduate or science graduate or the candidates willing to flourish their career in pharma industries shall have overall information about each department so accordingly they can choose or has choice to work in particular of their interest to explore their career.

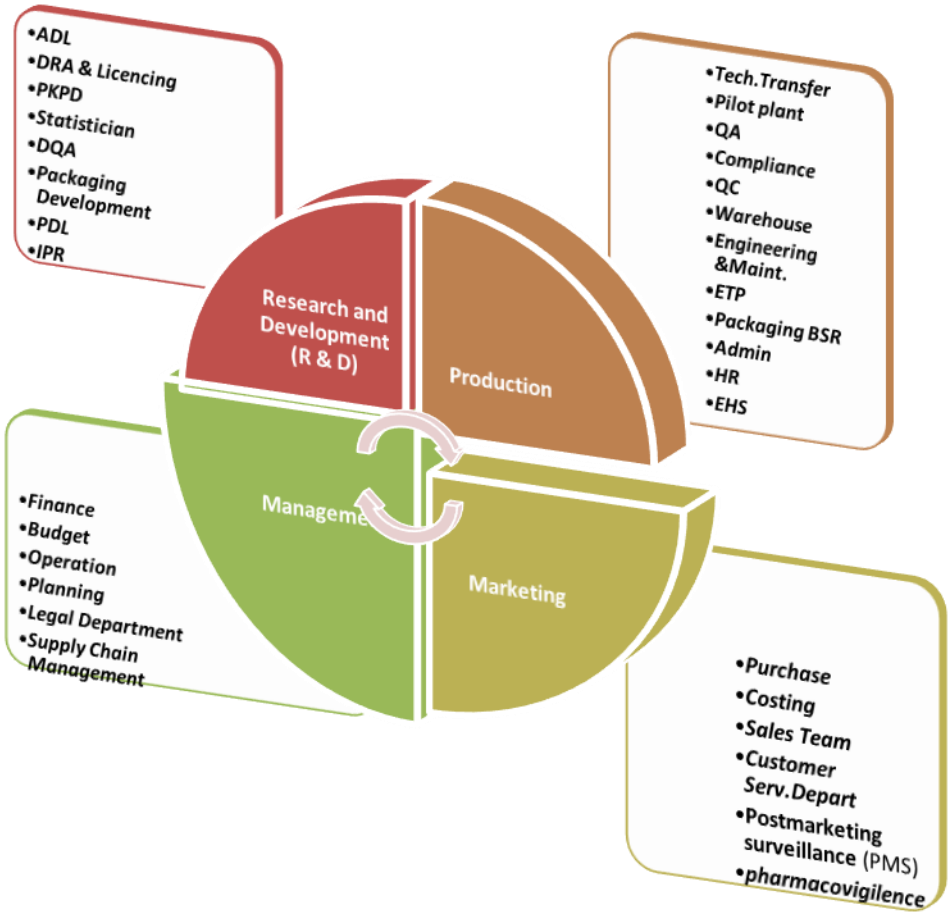
Hence this is my small try to get some ideas to the fresher's those willing to flourish there career in pharma industries.

1	What is pharmaceutical sciences The pharmaceutical sciences are a group of interdisciplinary areas of study concerned with the design, action, delivery, and disposition of drugs. They apply knowledge from chemistry (inorganic, physical, biochemical and analytical), biology (anatomy, physiology, biochemistry, cell biology, and molecular biology), epidemiology, statistics, chemo metrics, mathematics, physics, and chemical engineering. The pharmaceutical sciences are further subdivided into several specific specialties, with four main branches: **Pharmacology:** the study of the biochemical and physiological effects of drugs on human beings. · ***Pharmacodynamics***: the study of the cellular and molecular interactions of Drugs with their receptors. Simply "What the drug does to the body" · ***Pharmacokinetics:*** the study of the factors that control the concentration of drug At

	various sites in the body. Simply "What the body does to the drug. · ***Pharmaceutical toxicology***: the study of the harmful or toxic effects of drugs. · ***Pharmacogenomics***: the study of the inheritance of characteristic patterns of Interaction between drugs and organisms. **Pharmaceutical chemistry:** the study of drug design to optimize pharmacokinetics and pharmacodynamics, and synthesis of new drug molecules (Medicinal Chemistry). **Pharmaceutics:** the study and design of drug formulation for optimum delivery, stability, pharmacokinetics, and patient acceptance. **Pharmacognosy**: the study of medicines derived from natural sources.
2	**What is Drug and drug products:** Drug is a chemical substance, typically of known structure, which, when administered to a living organism, produces a biological effect. A pharmaceutical drug, also called a medication or medicine, is a chemical substance used to treat, cure, prevent, or diagnose a disease or to promote well-being. Traditionally drugs were obtained through extraction from medicinal plants, but more recently also by organic synthesis. Pharmaceutical drugs may be used for a limited duration, or on a regular basis for chronic disorders. It is also known as Active Pharmaceutical Ingredient (API)
3	**What Drug products?** Drug product is the finished product of any drug that is available in the market and is ready to use (this includes its packaging, see also below). A drug substance, because of multiple factors (sensitivity, stability, etc.) is required to be mixed with other components before being released for use in the market. The drug substance together with the added inactive ingredients also called as excipients manufactured with final dosage form like Tablets, Capsule, Cream, and Gel liquid, Injectable is known as drug product. Taking the example from above, the paracetamol tablet used in the market contains substances like Croscarmellose Sodium, Povidone, Pregelatinised Maize Starch, and Hydroxypropyl Methylcellulose, Polyethylene Glycol, and Magnesium stearate among others. The drug substance together with these added agents is called the drug product and within its packaging "finished product".
4	**What is dosage form?** Drug is available in its original form like powder, liquid gaseous form most time are not suitable to take direct to get its 100 % result at the site of action. Some time they are not physically, chemically or biologically stable in their original form or can't produce desired result of intended use. Therefore they have to develop / manufacture in suitable form (Like Tablets, Capsule, Syrup, gel, Cream, Injectable) to get its 100 % pharmacological action. In short Drug Product means a finished dosage form which is prepared from Bulk Drug Substance and is ready for administration to the ultimate consumer as a pharmaceutical. All dosage form available in the market.
5	**What is Excipients?** These are the additional agents added to the drug substance to make the drug product. The excipients may have different characteristics and may be used for different purposes. E.g. they might be filling materials to reach the required mass in case of low concentrated drug substances or binders to enable a good mechanical strength or coating agents. Other functions may be e.g. an enteric resistance by gastro-resistant film coatings, a prolonged shelf life by preservative agents or "taste corrections" by sweeteners in e.g. cough syrups for children. Different excipients are used according to their functional properties in different

	dosage form. They must be inactive and does not have any pharmacological activity as well compatible with drug (API) until shelf life /Expiry time of the drug products.
6	**What is GMP?** Good manufacturing practice (GMP) is a system for ensuring that products are consistently produced and controlled according to quality standards. It is designed to minimize the risks involved in any pharmaceutical production that cannot be eliminated through testing the final product. GMP refers to the Good Manufacturing Practice regulations promulgated by WHO (World health Organization) as well by the respective drug authority of individual country. So far In the healthcare system or market US ,Japan and Europe considered as standard advance drug regulatory authority .The US Food and Drug Administration under the authority of the Federal Food, Drug, and Cosmetic Act These regulations, which have the force of law, require that manufacturers, processors, and packagers of drugs, medical devices, some food, and blood take proactive steps to ensure that their products are safe, pure, and effective. GMP regulations require a quality approach to manufacturing, enabling companies to minimize or eliminate instances of contamination, mixups, and errors. This protects the consumer from purchasing a product which is not effective or even dangerous. Failure of firms to comply with GMP regulations can result in very serious consequences including recall, seizure, fines, and jail time. GMP regulations address issues including record keeping, personnel qualifications, sanitation, cleanliness, equipment verification, process validation, and complaint handling. Most GMP requirements are very general and open-ended, allowing each manufacturer to decide individually how to best implement the necessary controls. This provides much flexibility, but also requires that the manufacturer interpret the requirements in a manner which makes sense for each individual business. GMP is also sometimes referred to as "cGMP". The "c" stands for "current," reminding manufacturers that they must employ technologies and systems which are up-to-date in order to comply with the regulation. Systems and equipment used to prevent contamination, mixups, and errors, which may have been first-rate 20 years ago may be less than adequate by current standards. That means each operation, activity, process, documentation must be followed in pharmaceutical manufacturing unit as per GMP guidelines and that is monitored ,inspected or controlled by respective drug authority of the country. What is cGMP in the Pharmaceutical Industry? Current good manufacturing practices are defined by the FDA as systems to assure proper design, monitoring, and control over manufacturing processes and facilities in pharma and other FDA-regulated industries. These systems are designed to help organizations assure drug products are the correct identity, strength, purity, and quality. cGMP systems include a series of controls for quality focused operations, including: Management Systems Quality Raw Materials Operating Procedures Detecting Deviations Investigating Deviations Reliable Testing If cGMP are followed, organizations can avoid many of the most common causes of

	quality failure which threaten patient safety, such as drug contamination, deviations, or mix-ups. The FDA is very clear that cGMP is designed for flexibility to provide a universal framework for the entire pharmaceutical industry. Also, the guidelines aren't a checklist; they're a set of "minimum requirements" for total quality management. The latest cGMP was published in 2016, the Q7 Good Manufacturing Practice Guidance for Active Pharmaceutical Ingredients. This 58-page document provided some excellent updates to prior cGMP for the industry, but it also sparked more questions than it answered in the eyes of many pharmaceutical organizations. The FDA followed up with a Q&A in 2018 to clarify some of the most common questions about the latest guidance. Some of these questions are addressed here, with insights from pharma industry subject matter experts.
7	What is departmental operation of pharmaceutical manufacturing plant? Pharmaceutical manufacturing activity consists of different department where they perform the different activity as per GMP as well regulatory guidelines. 



ADL:-Analytical Development lab: Taking care of analytical method development, Validation, to prepare specification of API, Excipients (Raw material), finished products (FG-Drug products).

DRA & Licensing: - Drug regulatory affair (DRA) is the departments which take care about the all compilation of technical documents as per drug authority guidelines for submission purpose to get approval /registration of products for marketing purpose. A set of technical documents also called Dossiers. They also involved in licensing activity required for operation and function of R&D, Manufacturing plant export, import of API, and Drug products from other country.

PKPD:-This is Pharmacokinetic and Pharmacodynamic department, They takes care about the clinical study of the drug products like clinical trial of new drug /drug products or BABE bioavailability Bioequivalent study of generic finished drug products. They also involved in technical documentation requirements like licensing, protocol preparation its review,

approval co-ordinate with all stake holders regarding study updates submission of there report from clinical site of study.

Statistician :- Now days FDA is encouraging and expecting to the drug industry to follow the Quality by design (QbD) approach to develop, validate ,justified the each stage of development process of drug /drug products to avoid any surprised /unknown issue while transfer of the product to the commercial site. We can define QbD as follow:
The pharmaceutical Quality by Design (QbD) is a systematic approach to development that begins with predefined objectives and emphasizes product and process understanding and process control, based on sound science and quality risk management. Quality by Design (QbD) is emerging to enhance the assurance of safe, effective drug supply to the consumer, and also offers promise to significantly improve manufacturing quality performance.

QbD performed by its different tool /Principle like Design of experiments through statically approach.

DQA :- Development Quality assurance takes care of all formulation development process and analysis development activity with documentation as per predefine SOP, try to set all activity through documentation and control to minimize the error and maintain quality and safety and good documentation practice at development stage. Follow GLP in analytical development. It's not exactly same as GMP but could govern the all activity simulate to GMP & GLP to make clear the activity of development with clear transference.

Packaging Development: - these departments takes care to design the finished products packaging details as per market trends, different country requirements as well they choose /design the packaging material as per reference sample or as well by considering stability criteria by discussion with formulation scientist and with stakeholders. Involved in documentation activity like specification, testing and BPR of packaging material, artwork design on packaging material as per guideline.

PDL: Process development lab is the middle operation /activity in-between R&D and /Technology transfer team /production. It's a prior activity of TT to check the feasibility of the optimized formula according to adopted method, process, and equipments. They verify the all process parameter which fixed in the R &D evaluate process with result comparison

with R & D optimized formula. Also identified the critical process parameter and troubleshoot it for the further tech transfer.

IPR: - Intellectual property right is the department which takes care of drug or drug product process related Patents, Industrial designs, Trademarks Copyright. It helps to formulator to develop non-infringement strategy for generic development as well to file new patent on drug, drug products or process. Trade Secrets so the way to protect is either by getting it patented or under trade secret. The problem with trade secret is that it the drug can be reverse engineered and hence your invention can be stolen. Whereas patent provides a much more water tight protection. IPR is very important for economic growth of a company. IP of an industry determines futuristic domination of its operating market. A well defined IP strategy is an essential ingredient of a successful business model especially in the current competitive scenario

Technology transfer: - This is one important department which take care of scaling the optimized R & D formula to the pilot as well commercial scale. Its works in collaboration with R & D and commercial plant team. They apply all technical aspects of scaling parameter as well set all process parameter with same replicate result of R & D formula.

Pilot plant: - This is the intermediate scale GMP facility in between R & D and production plant facility to check the set process, parameter and feasibility of the R & D optimized formula.

All process is carried out as per predefined protocol /BMR and all scale up challenges are identified and checked. The batch size shall be 10 times bigger or 1/10 of the commercial facility (Like 30,000 unit to 100000 unit batch/30 kg to 100 kg/30 L-100L).

Drug products manufactured in this facility can be sent for pilot bio-study to get the idea and correlation of in-Vitro and in vivo performance of the drug products. Based on the result obtained minor level-1 changes can be done in formula and process.

QA & Compliance:- Quality assurance is the department which takes care of all compliance activity of the manufacturing plant, from dispensing of material to dispatch the drug products. They Governed all activity as per GMP /regulatory guidelines to maintain Quality, safety, and efficacy of the drug products.

QC:- Quality control is important GMP /GLP compliance analytical department which ensures the quality of the drug /Drug products by analyzing the sample as per predefined SOP procedure with integrity under QA Observation.

Warehouse: - This is store department for all raw material, packaging material which takes care of inventory, storage, dispensing material management as per predefined SOP /Written procedure of GMP.

Engineering & Maintenance: - This department takes care of all machines wear, tear and maintenance responsibility and ensures the system working or running as per guideline of GMP compliance. Taking care of all plant utilities required for the operation of the plant run.

ETP:- Effluent treatment Plant this is one of the environmental safety concern department dear with the local government authority to take care of hazardous, dangerous effluent cares. Which take care of the treatment of effluent which comes out the manufacturing unit. They ensure proper treatment on the hazardous chemical and convert it to normal non hazardous wastage or recycle or used it for the gardening purpose. Pharmaceutical and chemical industry to purify **water** and remove any toxic and non toxic materials or chemicals from it. These plants are used by all companies for environment protection.

Packaging BSR:- Packaging –Bonded store Room is taking care of packaging configuration of finished drug products also involved in commercial deal and government legel sales requirements process.

HR: The human resources department handles many necessary functions of business. It is instrumental in providing labor law compliance, record keeping, **hiring** and **training**, compensation, relational assistance and help with handling specific performance issues.

Administration: - The main job responsibility of an **administrator** is to ensure the efficient performance of all departments in an **organization**. They act as a connecting link between the senior management and the employees. ... All the tasks & all the departments are relates to the **administration.**

EHS:- Environmental health safety departments plays important role in organization. An EHS manager works at a company to identify, remove, reduce, and otherwise control hazards and risks. As the Institute for Safety and Health Management puts it: "An

Environmental Health and Safety manager looks over the development and implementation of all the health and safety programs in the company.

Purchase: - This department takes care of purchasing of daily, monthly, annual consumable items as well equipment, instruments or any items required in factory by comparing different quotation from different suppliers with technical approval from the concern cdepartments.

Costing:- Cost accounting provides the detailed cost information that management needs to control current operations and plan for the future. **Cost accounting** information is also commonly used in financial accounting, but its primary **function** is for use by managers to facilitate their decision-making.

Sales Team: Marketing functions include research and development, pricing, distribution, customer service, sales and communications. In its narrowest form, a sales department advises the marketing department based on its feedback with customers and focuses on customer contact to drive sales.

Customer service department: - Team will be responsible for developing and maintaining a quality reputation in the marketplace, building public relations and increasing sales through excellent service/support. Responding to inquiries from customers and sales personnel. Determining the professional needs of customers when receiving or placing calls.

Post marketing Surveillance:- Post marketing surveillance (PMS) (also *post market surveillance*) is the practice of monitoring the safety of a pharmaceutical drug or medical device after it has been released on the market and is an important part of the science of pharmacovigilance. Since drugs and medical devices are approved on the basis of clinical trials, which involve relatively small numbers of people who have been selected for this purpose – meaning that they normally do not have other medical conditions which may exist in the general population – post marketing surveillance can further refine, or confirm or deny, the safety of a drug or device after it is used in the general population by large numbers of people who have a wide variety of medical conditions.[1]

Postmarketing surveillance uses a number of approaches to monitor drug and device safety, including spontaneous reporting databases, prescription event monitoring, electronic health records, patient registries, and record linkage between health databases.[1] These data are reviewed to highlight potential safety concerns in a process known as data mining.

Pharmacovigilance: - is responsible for monitoring the safety of medicines in normal clinical use and during clinical trials. In the light of the experience acquired and following an assessment by the Commission of the Union system of pharmacovigilance, it has become clear that it is necessary to take measures in order to improve the operation of Union law on the pharmacovigilance of medicinal products for human use. The marketing authorization holder should be responsible for continuously monitoring the safety of its medicinal products for human use, for informing the authorities of any changes that might have an impact on the marketing authorization, and for ensuring that the product information is kept up-to-date. Marketing authorization holders (MAH) record all suspected adverse reactions occurring in the European Union or in the third countries, and which are brought to their attention spontaneously by the patients or their health care, or occurring in the context of post-authorization study. For all medicinal products is mandatory to maintain a pharmacovigilance system master file (PSMF). According to the Legislative Decree 219/2006 the MAH must submit to the competent authorities the information on suspected adverse reactions of a medicinal product, in form of a periodic safety update reports (PSURs). Pharmacovigilance (PV or PhV), also known as drug safety, is the pharmacological science relating to the collection, detection, assessment, monitoring, and prevention of adverse effects with pharmaceutical products.

Finance:- Finance Department is the part of an **organization** that is responsible for acquiring **funds** for the firm, managing **funds** within the **organization** and planning for the expenditure of **funds** on various assets.

Budget: - A budget is an estimation of revenue and expenses over a specified future period of time and is usually compiled and re-evaluated on a periodic basis. Budgets can be made for a person, a group of people, a business, a government, or just about anything else that makes and spends money. In Pharma industries budget team under management guidance plan and forecast the yearly budget by considering all stake holders inputs and expenses.

Operation:- The term “pharmaceutical operations” encloses a great variety of different activities, covering at 360 degrees all the different aspects of the production and distribution of medicinal products. The final goal of operations management is to guarantee the put in place of the proper marketing procedures, in accordance with cGMPs. From the supply and qualification of raw materials to production processes, from quality control to logistics and distribution, according to modern business models the entire flow is coordinated by the

industrial function usually identified as "operations management", which monitors all the different manufacturing activities under a single umbrella. Six Sigma methodology is being adopted in the Pharmaceutical sector to enhance productivity, reduce waste and cut cost. Six-Sigma is a five phase improvement cycle the five phases are DMAIC, which stands for: Define Measure, Analyze, Improve and Control. In this excerpt an industrial case study is presented to exemplify use of Six Sigma in Pharmaceutical manufacturing.

Planning: Planning is the process of analyzing the current situation; assessing needs establishing goals; setting objectives and measurable targets and determines the strategies, responsibilities, and resources needed to achieve the expected result. The three levels of planning differ in purpose, time, frame and focus of details. There are strategic planning, program planning, Work planning. Planning department works under management's instruction.

Legal Department:- National drug **legislation** generally includes provisions relating to the manufacturing, importing, distribution, marketing, prescribing, labeling (including language), dispensing, and sometimes pricing of **pharmaceutical** products, as well as the licensing, inspection, and control of personnel and facilities.

Supply Chain Management: - In healthcare, the supply chain stretches from the basic chemicals bought by pharmaceutical manufacturers, and the materials and components used by device manufacturers right up to the patient, and has different functions depending on where you stand on that continuum. The patient wants assurance that at each stage every care has been taken to ensure the product is precisely 'what the doctor ordered'. The lawyers and regulators want complete traceability of every ingredient, material and component, the healthcare providers want products available when needed and production managers want everything 'just in time'. Sales and marketing want to monitor downstream distribution and accountants want everything at the best possible price at a time when budgets are constrained.

Of course a lot of the same issues apply in any business and supply chain management software has been used for a long time. Many supply chain applications can be adapted to healthcare, but some providers make it a specialism. Even within that specialism, some providers are favoured by manufacturers, others by healthcare providers.

Some common trends are emerging; increasing integration between supply chain management and ERM tools such as SAP and the ability to import data from disparate sources to inform purchasing decisions, and the provision of supply chain ‘software as a service’ (SaaS). One company we spoke to offers both SaaS and traditional locally installed versions of their system, but 95% prefer SaaS.

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