



Original Article

Computer and Pharmaceutical Software in Pharmacy and Pharma Industries

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ABSTRACT

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Software is a collection of programs that instruct a computer on what to do. It is made up of a string of code written in a programming language that a computer interprets. Software is utilized in the pharmaceutical sector to gather and keep track of all documents. Pharmacy area education and teaching now depend heavily on computers and information technologies. Pharmacy systems, which are used to store and manage medications in pharmacies, are regarded as computer systems. Pharmacy computers are used for business details, drug management (making, editing, adding, and deleting data in patient files to generate reports), and drug data, records, and files. The deliberate use of networked information and communications technology in teaching and learning is generally referred to as e-learning. Software, such as programs, is necessary for a computer to work. Our task is made easy and uncomplicated by this program. In pharmaceutical analysis, computers are mostly used for data processing, data storage, and file searching. The pharmaceutical industry now relies heavily on computer software. This somewhat extreme outlook on software's future aims to close the gap between society and technology. People, technology, process, quality, and standards were all considered in relation to the future of software development.

Keywords: Software, E-Pharmacy, Computer-Aided Drug Design, Molecular Docking, Drug Designing and Development.

INTRODUCTION

Software is a collection of programs that instruct a computer on what to do. It is made up of a string of code written in a programming language that a computer interprets. As a result, it makes our work easier by maintaining all the documentation, performing the necessary computations, and much more. Software has become an essential part of the pharmaceutical industry's drug discovery and development process, contributing significantly to the expansion of new bioactive drugs across a variety of therapeutic areas. Pharmaceutical handling, storage, and distribution are difficult tasks. Therefore, we handled all parameters using a variety of sophisticated software [1]. Software is utilized in the pharmaceutical sector to gather and keep track of all documents. Finding a substance that exhibits a biological action is the first step in the drug design process, which concludes when the biological action and chemical synthesis of the novel product or drug are improved. One of the fastest-growing recent developments in Molecular Docking is the development of computational tools for Novel Doses Drug design and discovery. The modern period is characterized by computers and technology. Every academic discipline has been impacted by the quick usage of computers, and pharmacy is no exception. Pharmacists employ software and specific programs to carry out a number of tasks [2]. Effective computer use in the pharmacy sector began around 1980. Since then, the pharmacy industry has had a high demand for computers. Computers provide various benefits of their own, including reduced time, accuracy, labor costs, speed, multitasking, non-fatigue, large memory, data storage, and many more [3]. Pharmacy area education and teaching now depend heavily on computers and information technologies. Different approaches are being incorporated into the educational process. The "Display and Deliver" strategy is replacing the "Chalk to Talk" strategy. It has been observed that using computers sensibly to teach pharmacy students is appealing and fulfilling. "Computer Aided Learning" (CAL) is starting to play a significant role in the educational system [4]. Pharmacy computers are used for business information, drug management (making, editing, adding, and deleting data in patient files to generate reports), and drug data, records, and files. The development of

upcoming diverse hard and soft goods has made drug discovery, design, production, and analysis nearly feasible [5]. The organized analysis and management of biological data made possible by advancements in computer technology applications is beneficial for the investigation of biological processes with the goal of improving the healthcare industry [6]. Using a receptor-based pharmacophore tool, bioinformatics also created novel drug molecules. Pharmacophore were created by optimizing structural targets at the protein level at a particular binding site, which were utilized in virtual screening to obtain a set of ligands that exhibit significant activity [7,8]. Digital libraries are essential to pharmacy field education because they provide up-to-date information on the most recent developments in drug discovery and novel treatments related to the disease. Computer-assisted learning is becoming an element of pharmacy school in order to easily access and organize the material. Self-evaluation of the decision-making process is aided by simulative techniques and two-way communication films [9]. Digital libraries are electronic collections of actual or virtual resources that may access data from anywhere in the world and are now widely used in all educational fields [10]. Drug design, commonly called rational drug design, is the creative process of developing novel drugs based on biological target information. Computer software can help with this kind of drug design. Depending on the input data, software will produce a variety of lead molecules, from which a chemical of interest can be created and examined. Such a process will be laborious and time-consuming if it is done by hand. However, using a computer greatly cuts down on time [11]. Software such as AutoDock (The Scripps Research Institute), CombiBUILD (Sandia National Labs), DockVision (University of Alberta), HINT! (Virginia Commonwealth University), LIGPLOT (University College of London), SITUS (Scripps Research Institute), DOCK (UCSF Molecular Design Institute), Sanjeevani (Indian Institute of Technology, New Delhi), Bio-Suite (Tata Consultancy Services Ltd.), Maestro, Macro Model 5.5, Delphi [12,13]. Additionally, the pharmacist devotes a significant amount of time to inventory management at the expense of other facets of his job, like ward rounds and counseling. When a patient does not pick up the results of a laboratory test on time, or when the doctor needs to ask the Records Department for a patient's prior medical records, the diagnosis is frequently delayed. When performing activities like assigning hospital card numbers to patients and filing and retrieving records, record department employees occasionally make mistakes. It might be challenging to get records when patients misplace or forget their hospital cards. Important medical records may be lost forever if paper documents are misplaced or destroyed, depending on how frequently and/or carefully they are handled. This computer application program was created to collect all patient and medication data at the hospital, which would then be shared on the hospital's Local Area Network (LAN) by the physician, pharmacist, recordkeepers, and lab personnel. This is entirely consistent with the objectives of the Pharmaceutical Care concept, where the patient is the primary focus and the pharmacist makes sure that the administration of medication therapy produces specific results that enhance the patient's quality of life [14]. Pharmacy systems are thought of as computer systems that are used to store and manage medications in pharmacies. Highly effective services including stock management and control, prescription labeling, patient medication history, and supporting hospital pharmacy operations have replaced the manual methods [15]. A Drug Management System (DMS) that expands the stocktaking management procedure was presented by Nurul Muhammad in 2010. The suggested system has an alarm that notifies the administrator of all medications that have achieved the minimal quantity and those that have expired [16]. Carlisle George published a book in 2012 that included a variety of algorithms with extensive data on the administration of medications as well as patient monitoring and control [17]. In view of the disruptive effect of the growing Internet of Things, the authors proposed a first basic method in 2017 to organize the services of the most significant hospital departments [18]. The author published a paper in 2018 that describes the current state of affairs pertaining to all aspects of hospital pharmacy operations [19]. Health care information technology, which is utilized to minimize various types of drug errors, is one of the promising medical techniques. The most popular technologies include computer-prescriber order entry (CPOE), barcode verification, and electronic prescribing technology [20].

HISTORY OF COMPUTER IN PHARMACEUTICAL RESEARCH AND DEVELOPMENT

Pharmacy computers are used for drug management (making, editing, adding, and removing data in patient files to generate reports), business details, and drug data, records, and files [21]. A computer at every scientist's and business manager's desk seemed unimaginable twenty-five years ago. Computers are now necessary for handling, transferring, and storing data. Computers appear to be crucial not just for drug discovery but also for laboratory operations and the interpretation of clinical and experimental data in the research and development sector. As science advanced, scientists began to comprehend the relationship between a molecule's chemical structure, molecular characteristics, and biological function. Fischer's lock and key theory gave rise to the identical time concepts of how a medicine demonstrates its biological action by binding to some receptor within the body [22,23,24]. The first computers with stored scientific programs were obtained in the late 1950s and early 1960s; the programs, information input, and consequently the output were shaped like IBM punched cards. Dr. Edgar King's research statistics team at Lilly had been in charge of administering it. The computers at Lilly didn't start to get big enough, fast enough, and sophisticated enough to handle some of the computational demands of different assessment and design projects until Don Boyd joined the team in 1968 as the second theoretical chemist. A significant amount of the literature is produced by the individuals concerned, either through routine assessments of the status and advancement of different fields [25,26]. In 1960, almost all computational chemists worked in academia rather than in business. X-ray crystallographers were another group of chemists trained by computers. The IBM 7094 was one of the most significant computers used at the time by crystallographers and theoretical chemists. Drug discovery in the early 1960s was done by trial and error. The Cambridge Structural Database (CSD) and the Protein Data Bank (PDB) were two new computer resources introduced in the 1970s. The breakthrough occurred in the 1980s. Pharmaceutical businesses were

aware of the IBM laptop computers (PC) DOS, which made it challenging to operate. The introduction of the Apple Macintosh in 1984 raised the bar for computer usability. The 1980s were the Renaissance, the Baroque Period, and the Enlightenment combined, if the 1960s were the Dark Ages and the 1970s were the Middle Ages. The diverse methods of quantum chemistry, molecular mechanics, molecular simulations, QSAR, and molecular graphics came together to form modern computational chemistry in the final ten years of the 1980s. In the 1980s, a number of innovative technological developments contributed to the enhanced computer environment in pharmaceutical companies. The number of computational chemists hired by these chemists doubled every five years, from 30 to 150 between 1975 and 1985. The use of computers in marketing tools, analytics, and research has fundamentally changed [27].

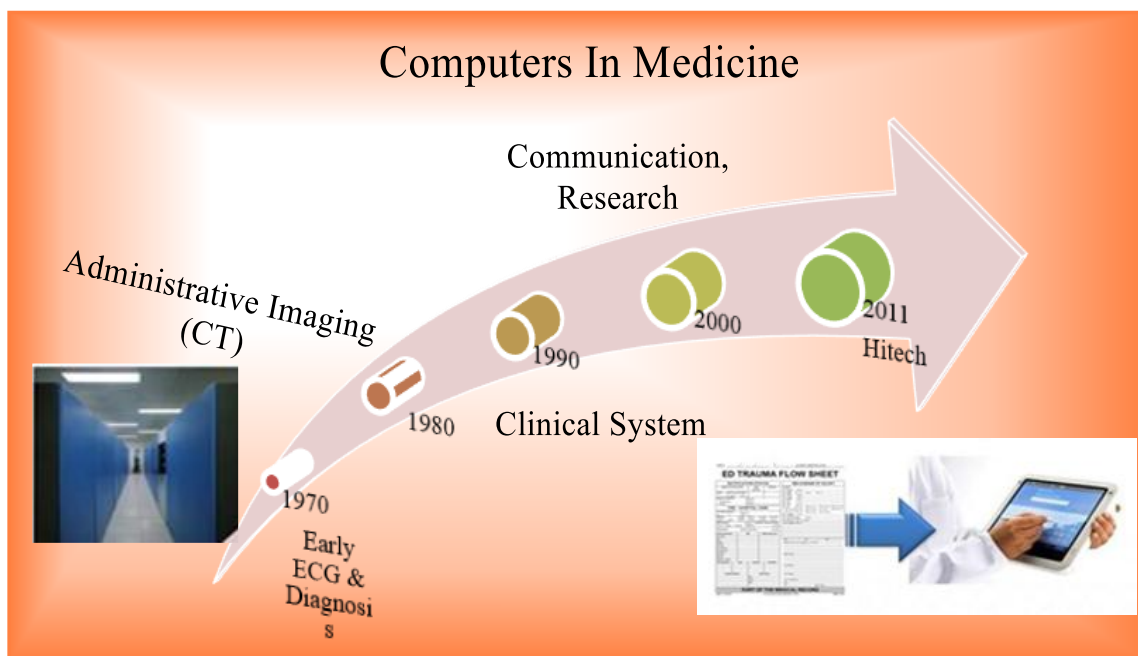


Figure: 1. How Computer Enter In Medicine [27]

Base of Drug Discovery

In order to explain how electrons flow through molecules and, consequently, how electronic structure affects biological activity, physics made a discovery. Bernard and Alberte Pullman of Paris, France, compiled an honest portion of this work in their 1963 book, which sparked curiosity in the potential of biomolecule computations [28]. Comprises the fields of neuroinformatics, bioinformatics, immunoinformatics, genoinformatics, metaboloinformatics, and healthinformatics that provide as a foundation for drug development [29,30,31].

E-Pharmacy

The primary goal of this program's development is to offer all medical-related solutions in a single application. E-pharma is a platform for direct communication between physicians and patients. Direct doctor-patient interactions, online shopping experiences, mail-order commerce convenience, and distance selling all allow patients to self-diagnose. With only one click, the patient can obtain prescription medications and consult with their physician. Additionally, patients can learn more about local medical stores and labs. Due to the widespread use of the Internet these days, we have a plethora of options to employ technology to its fullest potential, such as in medical solutions. The E-Pharms app will give patients a user-friendly environment and speedy delivery. Quick therapies are available to patients to help them feel better. Patients can communicate by phone, email, and chat by sharing their issues [32].

E-Learning

The deliberate use of networked information and communications technology in teaching and learning is generally referred to as e-learning. Online learning, virtual learning, distributed learning, network, and web-based learning are some of the various names used to describe e-learning. The following are the four fundamental models for e-learning:

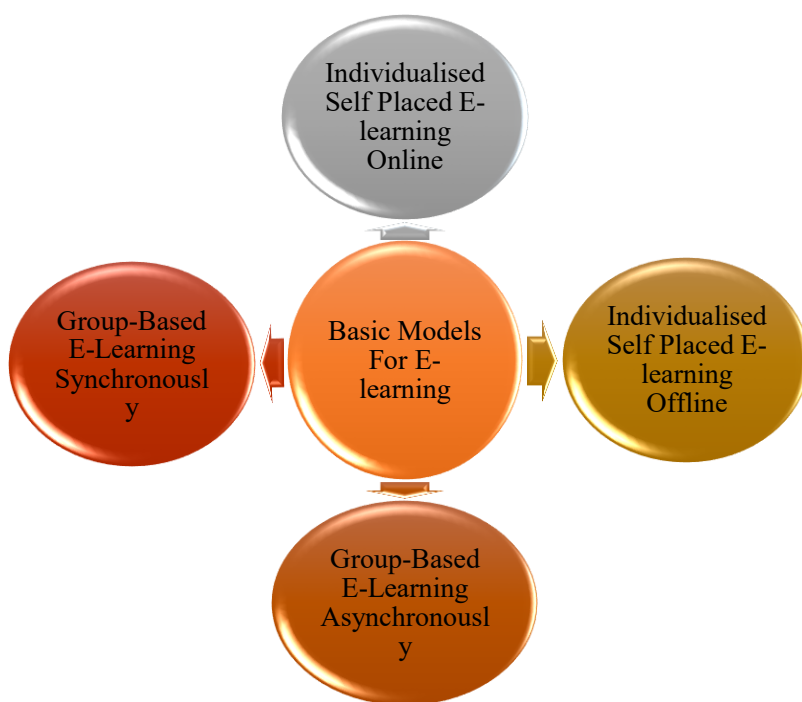


Figure: 2. Models For E-Learning [9].

Molecular Docking

One such structure-based drug design technique is molecular docking, which predicts the binding mechanism and affinity between ligands and receptors as well as how molecules interact with one another. These days, a lot of people employ technology that not only records data but also significantly increases productivity, lowers research costs, and, in the case of industry, lowers labor costs [33].

Drug Designing and Development

Finding a compound with a biological profile is the first step in the drug design process, which concludes when the biological profile and chemical synthesis of the new chemical entity are improved. Drug design and the creation of new pharmaceutical products are well recognized as complicated processes that need a significant investment of time and resources. It is a technique for developing novel drugs based on biological receptors and target molecules. It is sometimes referred to as rational drug design [34].

Software Used in Drug Designing and Development

Software, such as programs, is necessary for a computer to work. Our task is made easy and uncomplicated by this program.

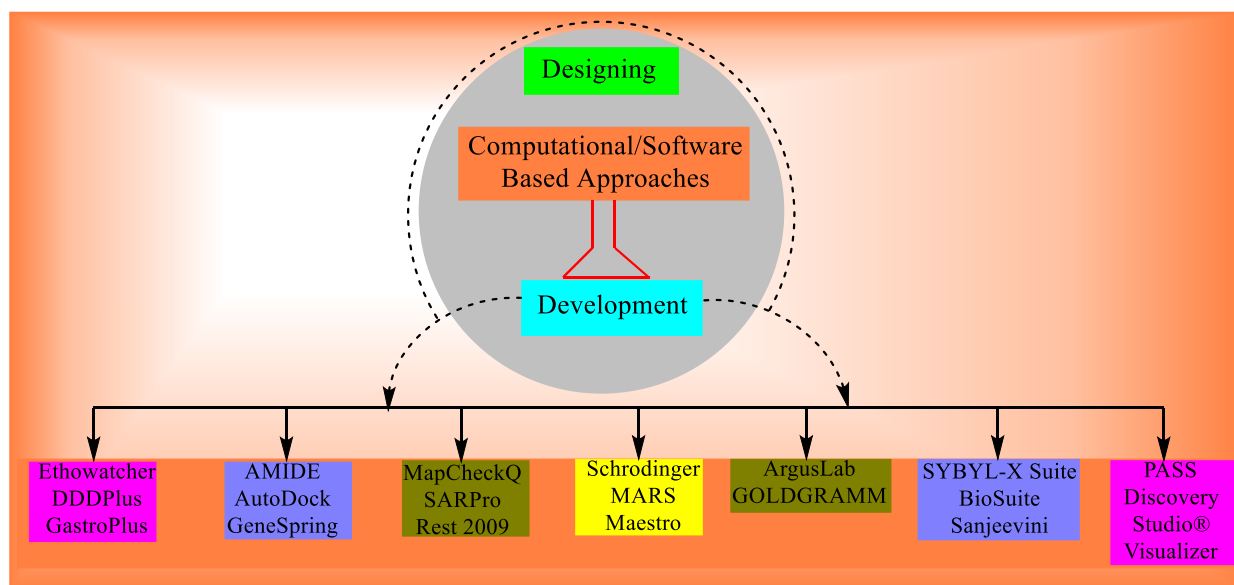


Figure: 3. Drug Designing Software [33].

Drug-Drug Interaction (DDI) Screening Software

Drug-drug interactions (DDIs) have been recognized as a significant component of prescription errors, and pharmacists are crucial in safeguarding the public against these risks [35]. Computerized DDI screening is one of the methods pharmacists use to examine drug profiles for DDIs. The majority of pharmacy computer systems used in community and hospital pharmacies incorporate computerized screening for DDIs and other possible medication-related issues. Pharmacy benefit managers also incorporate this screening into the prospective, online drug use review [36]. Therefore, compared to manual review alone, computerized DDI screening has the potential to greatly enhance the identification of potentially dangerous DDIs [37]. The capacity to deliver consistent information and screen for clinically relevant DDIs has been found to be problematic in studies on the effectiveness of computerized DDI screening software and the references they are based on [38-42]. Hazlet et al. examined how well nine community pharmacy systems screened for sixteen known DDIs in 2001 and discovered that up to one-third of DDIs went undetected [43]. Thousands of patients may have been exposed to potentially dangerous DDIs that computerized DDI screening procedures overlooked because these nine systems were utilized in more than 500 community pharmacies in Washington state. Both comparable assessments of hospital pharmacy computer systems and more contemporary assessments of community pharmacy computer systems have not yet been carried out. The purpose of this study was to offer more information on hospital pharmacy systems and to update the findings of Hazlet et al. in community pharmacies. Therefore, the goal of this study was to assess how well DDI screening software deployed on pharmacy computer systems in hospital and community pharmacies identified specific clinically important DDIs [44].

Computer-Aided-Drugs Design (CADD)

CADD is described as a unique and sophisticated method of drug design [45]. It is the procedure of announcing new drugs. The medicinal chemist has the ability to create new chemicals and increase their effectiveness by using a foundation of sophisticated graphical software or feed data [46, 47].

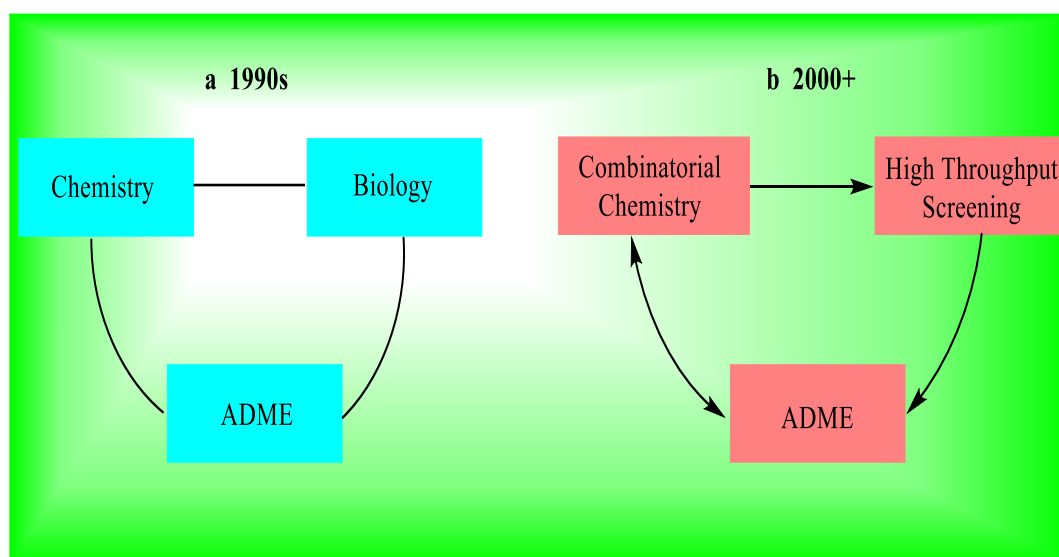


Figure: 4. Computer-Aided-Drugs Design [45].

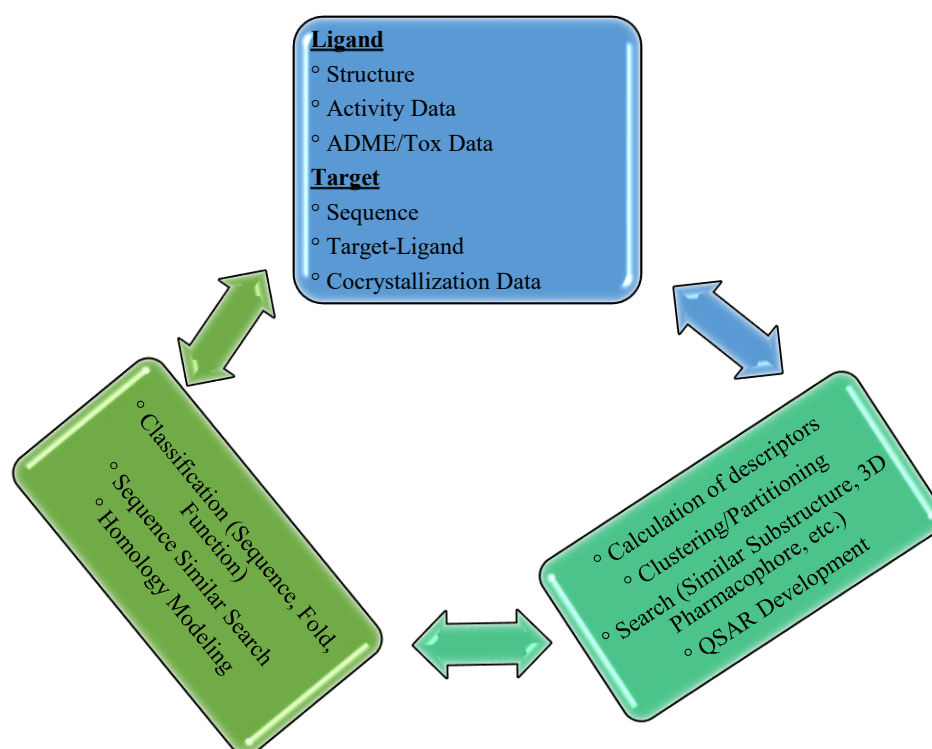


Figure: 5. Illustrates Advancement In Computer Aided Drug Design [46].

Open-Source Software Development For Drug Discovery

The license establishes the official definition of open source in terms of intellectual property management (usually copyright). "Free software" is a notion that is closely associated with open source. It is essentially the same as open source, but with a political twist: proponents of free software think that all software ought to be publicly accessible and that private software ought to be eliminated. The Open-Source Community adopts a more accommodating stance, permitting private software to utilize open-source components as long as the licensing permits it. FLOSS (free/libber/open-source software) occasionally combines the two words [48]. Compared to open source, "open innovation" communicates a far more expansive concept. Open innovation, advocated by Henry Chesbrough of the University of California, Berkeley, encourages businesses to actively augment their internal knowledge stocks with external sources [49]. The term "open access" is broad and can indicate several things depending on the situation. It usually refers to open access to books, journals, movies, etc. when discussing content [50]. "Open knowledge" extends the notion of open source beyond computer software. It is meant to safeguard copyrighted data (music, literature, scientific data, etc.), but not software, since open source provides sufficient protection for this. The Open Definition provides an 11-point definition [51].

The history of open-source dates back to the early days of computer software development. Early software was freely shared among developers and wasn't regarded as a commercial product, even though it wasn't labeled open source at the time. Linux, an operating system that resembles UNIX, is the most well-known and successful example of free and open-source software. It was created in 1991 by Linus Torvalds and is licensed under the GPL [52]. The commercial potential of computer software became apparent in the 1970s and 1980s. In 1980, Microsoft joined the operating system market [53]. In 1982, AT&T started offering a licensed version of UNIX for sale [54]. The growing commercialization of computer software worried Richard Stallman, a programmer at MIT's artificial intelligence lab. In response, he created an open-source operating system that resembled UNIX in 1983 with the GNU Project, a recursive acronym for GNU's Not Unix. He founded the Free Software Foundation in 1985 with the intention of promoting "free software" with the previously described political slant. Originally, all free software was licensed under a brand-new license known as "copy left," which was chosen to highlight the distinction from copyright.[55]. The first copy left license was the GNU General Public License (GPL), which allowed anybody to use, alter, and distribute software as long as they followed the GPL. As a result, the original license "infected" all subsequent goods, which must continue to be GPL-compliant (free to use, modify, and distribute). Copy left licenses were dubbed "viral licenses" because to this disclaimer [56].

Pharmaceutical Industries In Emerging Market

The pharmaceutical industry, sometimes referred to as "pharma," is the sector that deals with the process of finding, creating, and producing medications by both public and private entities. After a number of health issues prompted research into the therapeutic qualities of plants, minerals, and animals, the pharmaceutical industry was founded in the 19th century. The sector is believed to be worth \$300 billion annually, and this amount is predicted to increase [57]. While the US pharmaceutical market declined in 2011, the pharmaceutical markets of nations including France, Germany, Italy, and

Canada had notable stasis with growth of less than 5% [58]. Numerous reasons have been identified as contributing to the pharmaceutical emerging markets' quick growth. A number of branded medications that have been on the market for decades are impacted by the patent cliff, which is the first factor. The second is the growing availability of biosimilar medications and the trend toward the usage of generic medications in both developed and developing nations. The shift in disease patterns in developing nations is the third component. Lastly, a key element in the expansion of the pharmaceutical industry was the notable gap between manufacturing costs and prices [59]. In addition to being appealing for investment, emerging nations are also powerful outsourcing markets due to their rising incomes, accessibility to human resources, and cheap labor [60].

Computational Chemistry

Many early career scientists are interested in computational chemistry since it has developed into a significant component of the pharmaceutical business and is predicted to increase [61, 62,63]. These scientists frequently search for information regarding the various professions available to computational chemists in the business world. A special edition of the Journal of Computer-Aided Molecular Design titled "Computer-aided drug design (CADD) strategies in pharmaceutical research" is one such source [64]. In addition to the pharmaceutical sector, computational chemists have a plethora of additional prospects in many industries, such as astrochemistry, as Herma Cuppen stated in a job interview [65], or climate change, as John Keith [66]. Zaid (M. Jaber) Al-Obaidi, Xavier Lucas, György Ferenczy, Victor Sebastian Perez, Giovanni Bottegoni, Gisbert Schneider, Ferran Sanz, Filipa Ramilo Gomes, Ana Sofia Newton, Davide Benedetto Tiz, Ana Amic, and Antti Poso are among the computational chemists interviewed on the European Federation for Medicinal Chemistry and Chemical Biology website. A few viewpoints on the shift from academics to industry have also emerged in recent years [67, 68]. Individual interviews shed light on the daily lives and motivations of computational chemists from a variety of backgrounds and career choices [69, 70].

Computer In Pharmaceutical Analysis

In pharmaceutical analysis, computers are mostly used for data processing, data storage, and file searching. Additionally, specific software is included with a variety of devices, including UV visible spectrophotometers, infrared instruments, HPLC, microscopes, and mass spectrometers. These programs carry out every procedure needed for analysis. Additionally, many systems have built-in libraries that are helpful for searching for information about various chemical entities. For instance, if an unknown chemical's mass spectrum is obtained, the program can be instructed to identify comparable mass spectra among the library's contents, which will aid in identifying the unknown chemical entity. Commercial software programs are available for IR spectrum interpretation. More than 1,20,000 spectra can be found in the Sadtler Standard and Commercial infrared collections [71].

Computer System In Pharmaceutical Industries For Validation

The pharmaceutical industry now relies heavily on computer software [72]. Pharmaceutical factories require an IT system since it manages, supports, and records procedures. Verifying computer and IT systems guaranties that every application operates as intended. Verifying that computers that manage procedures or collect analytical data are operating correctly is known as computer system validation, or CSV. Verifying all hardware and software that directly or indirectly affects product quality is part of this [73]. Structured testing, which is essential for a successful CSV, is made easier by the V-model. Validation relies on a set of documented checks and tests, like design qualification (DQ), installation qualification (IQ), operational qualification (OQ), and performance qualification (PQ), to validate that the computer system operates exactly as it was supposed to [74]. Pharmaceutical facilities must ensure real-time adherence to quality standards and regulations and compliance with current good manufacturing practice (cGMP) requirements specified by regulatory bodies. Validation acts as concrete confirmation that the process aligns with established standards [75]. Software tools are frequently used in the design, development, and testing of computer system software [76]. The FDA is the organization in charge of safeguarding public health, and its regulations specify the prerequisites for CSV: The FDA 21 CFR part 820.70, FDA 21 CFR part 11.10, FDA 21 CFR part 11, European Union Annex 11, GMP Directives, ISO 13485, and Good Automated Manufacturing Practice (GAMP) [77,78]. The two classification categories of GAMP 5—GxP impact, needs for digital records and verification, DI, and a risk-based lifecycle plan—are the foundation for CSV's efforts [79]. According to GAMP 5 (Global Association of Pharmaceutical Industry), the computer system life cycle consists of four stages. The engineering features of drugs are the focus of Pharmaceutical Engineering (ISPE, 2008). Phases of planning, specifying, creating, confirming, and reporting are all part of the computer system project's validation. Complete CSV utilizing the V-model is necessary during the project phase. The V-model Figure is frequently used by IT and CSV to reduce quality concerns related to computer-aided systems [80]. Code development and assessment, functional specifications (FS), design specifications (DS), IQ, OQ, PQ, and user requirement specifications (URS) are all included in this method. As long as software development is included in the validation process, the aforementioned approach is great. However, several important procedures, including vendor assessment, are not covered. Furthermore, it seems too complex for true off-the-shelf commercial modification [81].

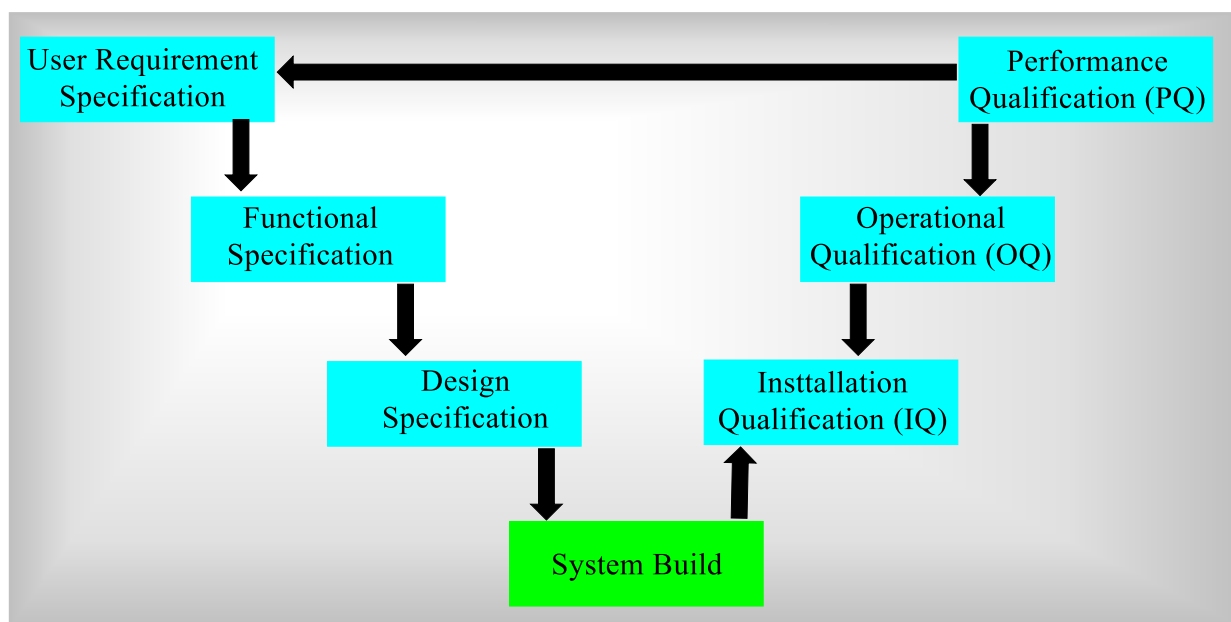


Figure: 6. V-Model of Qualification [80].

Types of Pharmaceutical Software Used In Industries

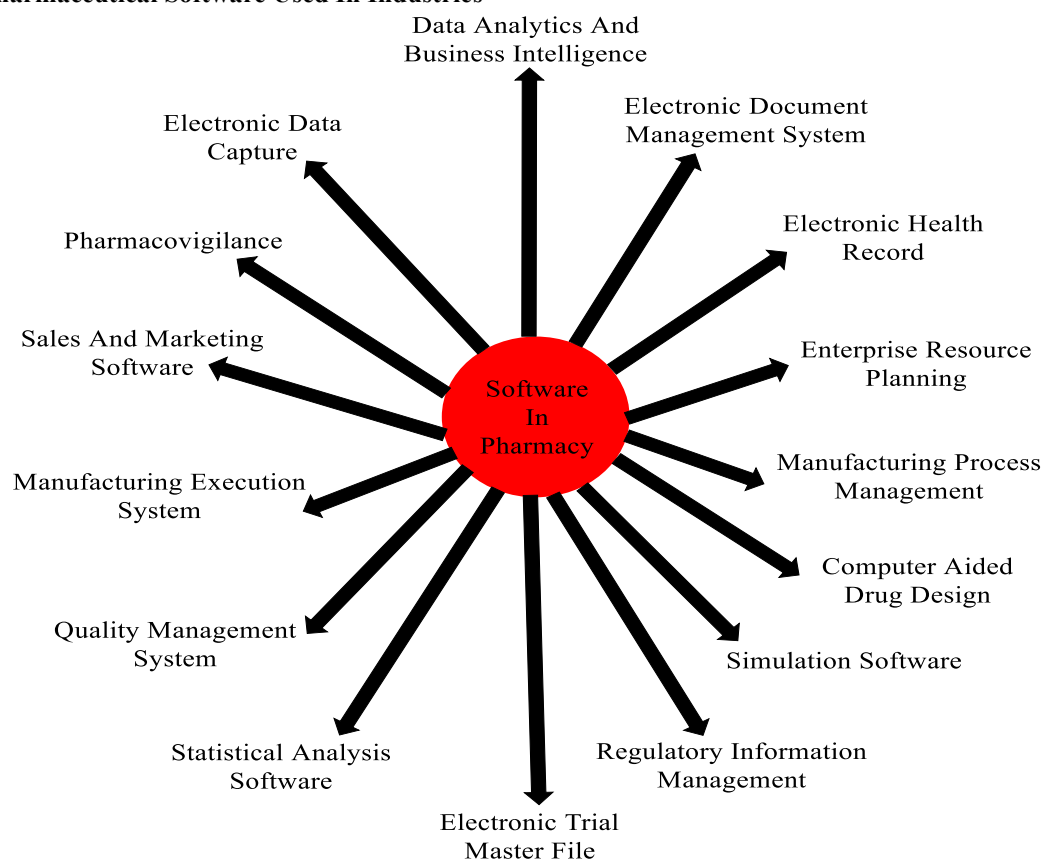


Figure: 7. Types of Software Used in Pharmaceutical Industry [82].

Software Development In The Pharmaceutical Industry

The pharmaceutical business is described as a highly regulated, innovative sector [83]. The software business and the pharmaceutical industry are at odds. It is challenging to combine the software industry's attempts to produce software more effectively with the strict regulatory requirements of the pharmaceutical business [84,85,86,87]. Software developers are required to consider various laws and regulations, which may originate from subject-specific regulations (e.g., HIPPA, GxP, CFR Part 11), industry-specific agencies (e.g., EudraLex, ISPE), country-specific agencies (e.g., FDA, MHRA, CBG-MEB, PMDA), and overarching agencies (e.g., EMA, ICH). As a result, the software developer must make a significant initial investment in order to comprehend the industry, evaluate the regulatory requirements, and match them with the

needs of the clients. The legislative requirements change somewhat quickly, which adds another level of complexity [88]. While agile approaches prioritize "working software over comprehensive documentation," software development stakeholders in the pharmaceutical industry must create a substantial amount of documentation to stay fully compliant [89]. He eager and Nielsen emphasize the growing expenses of approval of medical devices and hence the increasing demand to be compliant from an early stage of development. But employing standard approaches for project estimation and resource allocation can result in exceeding the budget and timeframes. The cause of this excess is mainly related the fact that the estimations are done by other persons which are not part of the development team [90]. In every organizational setting, managing software development projects is a challenging endeavor [91]. Managing uncertainty, including project estimation, minimal viable products, and resource allocation, is a major challenge in the implementation of agile approaches [92].

Regulatory Requirements for pharmaceutical Software Validation

According to the FDA's review of 3140 medical device recalls that took place between 1992 and 1998, software errors were responsible for 242 of them (7.7%). [93, 94] 192 (or 79%) of those software-related recalls were brought on by flaws in the program that were added after it was first created and distributed. One of the main ways to prevent such flaws and the ensuing recalls is through software validation and other associated good software engineering practices covered in this guide. The quality system rule, which went into effect on June 1, 1997, and was published in the Federal Register on October 7, 1996, requires software validation [95, 96]. Software used as parts of medical devices, software that is a medical device in and of itself, software utilized in the manufacturing of the device, and software used to implement the quality system of the device maker are all subject to validation criteria [97].

Use of Internet In Pharmacy

The internet is a vast data collection. We only need to click to access this info. Internet is important instrument in literature survey. Books are also available on the internet. Various research journals may be conveniently accessed via online [98]. There are number of web-sites which are linked to pharmaceutical field. Some of these online pages are as follows [99].

1. www.phrma.org :-
Organization representing America's pharmaceutical research companies provides details of drug development, industry news, and health guides.
2. www.healthcareforums.com :-
Created to facilitate interaction among healthcare professionals on specific topics which includes discussion of cases, research and other relevant issues.
3. www.astra.com :-
This is official web-site of ASTRA pharmaceuticals which produces medications for respiratory tract, cardiovascular and gastrointestinal diseases, and for pain relief.
4. www.biogen.com :-
Company principally engaged in developing genetically-engineered human pharmaceuticals. With career advice, and drug information.
5. www.gene.com :-
Develops pharmaceuticals mostly for the treatment of genetic disorders. Includes a listing of the major drugs and their uses.
6. www.genzyme.com :-
Company that specializes in biotechnology and health care products. With career, product, and services information.
7. www.pfizer.com/main.html :-
Find out about research projects and career opportunities at this Pfizer pharmaceuticals. Includes health education pharmaceutical advice section.
8. www.roche.com :-
Roche and produces pharmaceuticals and products for treatment of HIV, obesity and cardiac conditions. Offers news and company information.
9. www.pharmweb.net/pwmirror/pwk/pharmwebk.html :-
Listing of international pharmaceutical regulatory bodies including the US Food and Drug Administration.
10. <http://www.druginfonet.com> :-
Drug information, disease information, Ask the Expert, Pharmaceutical Manufacturer Information, Healthcare news and information, Medical References / libraries.
11. <http://www.fda.gov/default.htm> :-
Useful for checking adverse reaction reports for dietary supplements and drug interactions.
12. www.ijpc.com :-
Alphabetical Index of formulations found in the International Journal of Pharmaceutical Compounding. Specialty compounding.
13. <http://www.pharmainfo.com> :-
Pharmaceutical News, articles on Pharmaceutical Articles, and Pharmaceutical blogs.

14. www.fda.gov/cvm/ :-
Searchable listing provides facts and figures on all animal drug products approved by the FDA.
15. www.aaps.org :-
Information on officers, activities and membership from the American Association of Pharmaceutical Scientists.
16. <http://www.sciencedirect.com> :-
Contains research and review articles related to pharmacy field [13].

Use of Computers In Hospital Pharmacy

- In receiving and allotment of drugs
- Storing the details of every individual
- Professional supplies
- Records of dispensed drugs to inpatient and outpatient
- Information of patients records
- Patient monitoring (blood pressure, pulse rate, temperature) [100].

In Future Pharmaceutical Software

Therefore, it is crucial to think about how software and society will interact in the future. This includes thinking about whether development processes in the future will be influenced more by social factors than by technological ones. This somewhat extreme outlook on software's future aims to close the gap between society and technology. People, technology, process, quality, and standards were all considered in relation to the future of software development. In a broad sense, we anticipate that the majority of software will be created by end users, who might not even be aware that they are creating it. For instance, they could be working on many locations at once while creating software in multi skilled teams [101].

Customer and user sites will take up management of service development from software centers.
There will be a shift in the way that development and customer sites operate, with development teams becoming more globally integrated and users becoming more involved in system delivery.
One perspective on quality will give way to several perspectives, each with its own method of assessment.
To increase adoption and utilization of new technologies, attitudes around software development and business practices will shift.
The incapacity to forecast service behavior will give way to complexity management.

Table: 1. These Hypothesis Identify Some of the Ways Software Design, Development and Use May Change Over the Next 10 Years [101].

CONCLUSION

We concentrated on pharmaceutical software in this review study. Software is a collection of programs that instruct a computer on what to do. Software is utilized in the pharmaceutical sector to gather and keep track of all documents. The computer systems used to manage and store medications in pharmacies are referred to as pharmacy systems. Applications for the pharmaceutical and biotech industries fall under the wide area of pharmaceutical software. These are employed at many phases of drug development and healthcare delivery to improve efficiency, guaranty regulatory compliance, and enable data-driven choices. Digital systems created specifically for the pharmaceutical business, pharmaceutical software automates and streamlines procedures across a drug's whole lifetime, including research, manufacture, quality control, clinical trials, regulatory compliance, and patient management. Pharmaceutical software encompasses a variety of platforms, including ERP software (business and resource management), Manufacturing Execution Systems (MES) (production standards and batch control), Clinical Trial Management Systems (CTMS) and Electronic Data Capture (EDC) software (clinical data collection and analysis), Laboratory Information Management Systems (LIMS) (lab management), Pharmacovigilance software (drug safety monitoring), CRM software (customer and hospital relationship management), and Regulatory Compliance Tools. Additionally, there are a lot of benefits to using computers in pharmacies. They lower the possibility of human mistake by increasing the accuracy of prescription processing and medicine delivery. Pharmacists can swiftly access vital information thanks to computers, which facilitate the effective administration of patient records, inventory, and medication information. Through software programs that offer medication interactions, dose computations, and treatment recommendations, they also aid in clinical decision-making.

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