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THE ANALYSIS OF DIGITAL TIERED PHARMACY FORMATION

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Мета: Метою дослідження є аналіз використання окремих рівнів інформаційних мереж в аптеках України як першого етапу інтеграційних процесів інформаційних мереж окремих фармацевтичних організацій і можливостей формування цифрової фармації.

Методи: У дослідженні використовувалися метод маркетингового аналізу, а також історичний, логічний, порівняльний методи.

Результати: Представлені результати аналізу використання сучасних інформаційно-пошукових та прикладних технологій та їх можливостей для фармацевтичних організацій. Встановлено, що усі сучасні оболонки та програми потребують адаптування до особливостей використання в умовах фармацевтичного підприємства з урахування його особливостей. Опрацьовано значення поняття «мережеве суспільство» та термінів інтранет, екстранет та інтернет, а також оцінений ступінь їх використання в фармації. Встановлено, що в аптечних мережах України окрім розповсюджених касових модулів та автоматизованих робочих місць власники впроваджують сучасне програмне забезпечення, яке не лише дає можливість автоматизації більшості операцій в аптеці але й встановлює двосторонній контакт з кінцевим споживачем, формуючи його лояльність.

Висновки: Виділені інформаційно-пошукові та прикладні продукти, які використовують в аптечних мережах України, встановлено ступінь їх поширення і можливості, тенденції до формування цифрової фармації

Ключові слова: цифрова фармація, інтранет, екстранет, інтернет, інформаційно-пошукові технології

1. Introduction

Recently, formation of new economic relations based on key business processes informatization happens in pharmaceutical industry. The concept "business" by using Internet technology is transformed into "e-business", which is ultimately aimed at increasing the company efficiency by the modern opportunities to get, to save and to share information, as well as information flows communication within and outside the organization. Implementation of information technology into the real pharmaceutical economy promotes the new kind of economic order, which is defined in modern literature as "network (information) society" formation and "network economy" with regard to the economic sphere.

2. Formulation of the problem in a general way, the relevance of the theme and its connection with important scientific and practical issues

Maximum implementation of the company informatization system provides a significant competitive advantage, brings to a new level of business processes, promotes reasonable management decisions, and leads to structural transformation of the organization particularly and economy in general.

Implementation of the modern information technology can reduce the time required for specific marketing and production projects preparation, reduce inefficient spending in their realization, and eliminate errors possibility in preparation of financial, technological and other documentation that provides a direct economic effect to commercial company.

Nevertheless, for disclosure of all potential possibilities of the modern information search technology it is necessary to use in practice a range of software and hardware that are highly correspondent to the pharmaceutical enterprise objectives.

Therefore, nowadays there is a great need for pharmaceutical companies to improve their information network, which will support administrative work of the company, as well as allow using external information.

3. Analysis of recent studies and publications in which a solution of the problem and which draws on the author

Research works of the national scientists are devoted to the studies in area of modern information technology use in pharmaceutical practice: in [1] the research is focused on the development of automated medical and pharmaceutical systems; in [2] experience in digital receipts implementation is studied; in [3] the analysis of online pharmacies is displayed; in [4] improvement of logistics using modern technology, and others is examined.

4. Allocation of unsolved parts of the general problem, which is dedicated to the article

Compared to other high-tech areas, technological changes occur in pharmacy with some delay. Despite the development of individual processes informatization, there were no comprehensive research devoted to information management to provide pharmaceutical care.

5. Formulation of goals (tasks) of Article

The main goal of the given research is to analyze the use of the certain levels of information networks in Ukrainian pharmacies as the first stage of information networks integration processes of some pharmaceutical organizations and possibilities of digital pharmacy formation.

6. Statement of the basic material of the study (methods and objects) with the justification of the results

Nowadays, the area of information technology in Europe is experiencing a stage of evolution, based on a

creation of completely network economy. Increasing processor power, fall in information value and network cooperation promote work productivity increase, stimulate innovations and further technical changes in all fields, including high-tech and traditional, which include pharmacy [5].

The most fundamental factor of the Internet impact on pharmaceutical organizations business activity is qualitative changes in terms of information exchange between them and, consequently, in possibilities of their informational correlation in the Internet environment. Scientific study of information, which was sufficiently detailed in the works of many Ukrainian and foreign scientists [6], is devoted to the data communication technical problems.

In society, there are all conditions for the formation of a new type of economic order, which was called "network (informational) society", and concerning economic sphere – the "network economy", "network organization activities forms". But these concepts are constantly expanding, under conditions of modernization of the existing social and economic structures and creation of completely new ones.

At this time, it is already possible to analyze the relationship between the concepts of "network society", "network economics" and "network organization", which are precursors of the beginning of the changing process

of the dominant social and economic organization of society form.

In terms of the network society transformation, information is changed into a leading general production factor, and the activities devoted to its collection, processing, accumulation, storage, search and spreading is one of the most important spheres of social production. This suggests that nothing but informational course of development is a main direction of economic development in pharmacy [7]. Gradual creation of a network society is a real revolution, which involves political, social and cultural relations, in other words, it globally transforms lives.

Modern pharmaceutical organizations systematically automate the process of using information, proceed to the partnership expansion and creation of new business models related to the sharing of information, and thus get doubtless competitive advantages [8].

Nowadays, information functioning under interaction in virtual space exists at three levels, which are distributed in terms of information availability and protection (Fig. 1). Intranet is a private network that is usually created and maintained within the enterprise [9]. It may consist of many interlinked local area networks (HR, corporate CRM-system, corporate newspaper, products portfolio, documentation, etc.) [10]. The main purpose of intranet is to share information and computing resources among employees.

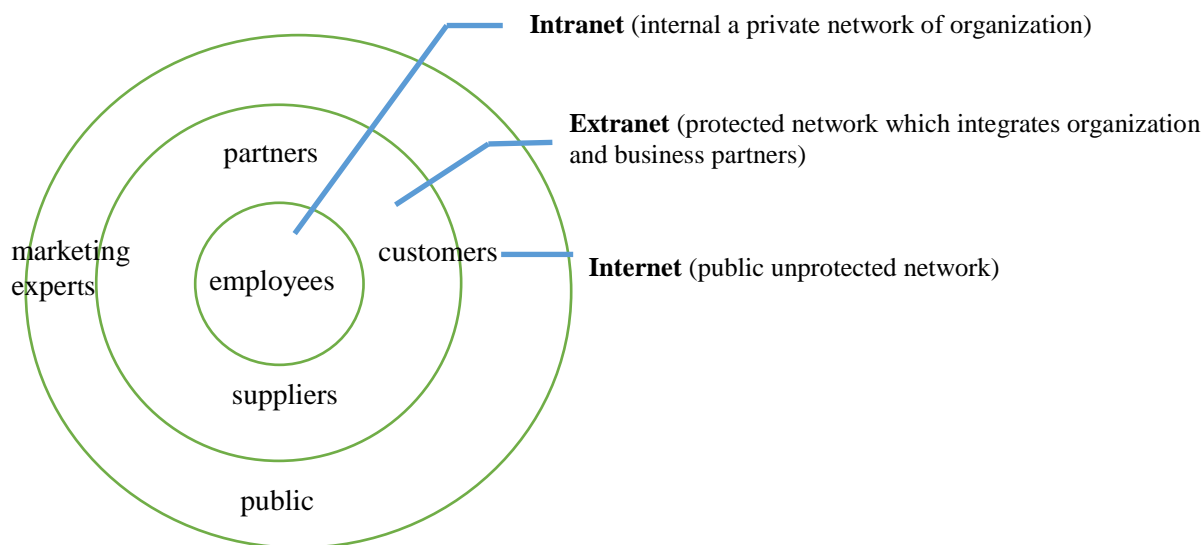


Fig. 1. Informational networks levels

It provides opportunities for simplified access to information, centralized management and information flows distribution, the use of internal databases, electronic document management, ensuring user interaction and their teamwork, access to corporate programs, information security, resource management, etc. Such networks are already operating in many pharmaceutical companies that have branched structure and large number of departments.

Extranet is considered as part of the company's intranet, which applies to the users outside the company, such as suppliers, partners, customers and market experts. Extranet transfers collaboration between partners into a single information space of the corporate social network. The company can use confidential information together with partners. Extranet allows:

- to save time and resources by increasing the speed of transactions;
- to reduce marketing costs by concentration of buyers and sellers in the same intellectual space;
- to access information about customers benefits and react quickly to changes;
- to reduce transaction costs as a result of exclusion of information duplication and deficiency.

This network similarly allows customers:

- quickly access the variety of goods and services in real time;
- extended possibilities for search and comparison of the offers, making more reasonable decisions;
- lower cost of transactions and information search;
- rational manner of getting information;

– the efficiency of offers analysis of suppliers and others.

Internet is worldwide familiar to everybody public computer network, which contains many different interconnected networks. It provides public access to information, but in this case, the network is not protect-

ed and there is a high probability of false information. Pharmaceutical companies use all three levels of information networks today (Table. 1). The difference is only in the programs used; it depends primarily on pharmacies requests, pharmacy network size and financial capabilities.

Table 1

The use of information networks levels in pharmaceutical companies

Information search and application technology	Determination	The content	Possibilities of use
<i>Intranet</i>			
Cash register or POS terminal	Cash program that supports a wide range of commercial equipment. Operates as a part of a trading system or offline	The search of synonyms of drugs; ability to put the goods to check by the barcode; activation of discounts and bonuses; the possibility of goods packaging division (piece sale); check closing and printing; deferred receipt and return receipt creation; surrender calculator; cash work reports; service operations; buyers and customers databases	Receiving and saving the information about customers, pharmaceutical company clients database formation Regular contacts inside the organization and within the network (chat, group) Remote access possibility The acceleration of all operations Unique internal databases creation (customers, employees, suppliers, etc.). Transformation of human, time and financial resources concerning product development, promotion, pricing and distribution Protection of internal information, users limitation
Automated workplace	Individual set of hardware and software designed to automate pharmacist's work which provides preparation, editing, searching and delivery on the screen, as well as printing of necessary documents and data	Search and selection of drugs synonyms (therapeutic or generic substitution); the search for the drugs in warehouses and pharmacies of the given network; ability to put the goods to check by the barcode or the product name; additional information for the pharmacist (prescription drug, location, expiration date, algorithms of actions); history of refusals (due to price or presence); expanded opportunities for work with receipts; surrender calculator; the ability to print quality certificate of drugs, map location of other network pharmacy; buyers and customers databases; bonuses and discounts system; possibility of goods packaging division (blister sale); work with customer information, discount, bonus and other cards, information about sales assistant; cash work reports	
Internal corporate portal or social company network	Internal information resource management system for tasks, projects and documents teamwork, for effective internal communications (mainly used by manufacturers and other large companies)	Help information about the staff, the structure of the company and its divisions, departments' location (especially important for pharmacy networks with a large number of employees). Integration with highly specialized information systems and services, financial accounting and planning systems, project management systems, file sharing and others. Resource of corporate dialogue, chat, create and video conference room. Timely information about corporate changes and innovations (statutes / regulations / orders), promotions, news, employees' dismissal, plans of measures, birthday of colleagues, etc.	
<i>Extranet</i>			
"Treasure" software	Multifunctional and professional software for pharmacies, which performs all accounting functions at the pharmacy – starting from primary incomes, sales, and new product optimal order.	Stock-out formation and sending orders to suppliers, automatic calculation of needs for goods (both for certain pharmacy, and for the network); grouping of the same types of product for correct needs calculation; embedded system for work with supplier price lists; automatic requests formation for providers and the use of providers price lists for different conditions (priority, lower price, etc.) supplied in the provider's format. Product receiving and posting, profitable document manual or automatical creation (*.mmo, *.exp, *.xls); manual or automatical pricing; stickers and price tags printing; expiration dates and "stop series " control, the application check; easy documents transfer; distribution of goods. Retail prices formation according to the law (constantly changing): rapid pricing on random groups of goods and outlets; quick revaluation (manual and automatic); automatic price adjustment in accordance with the legislation; discount regulation according to the customers categories and types; customized pricing; fixed extra charges exceeding control; extra charges state control. Distribution of goods between outlets: goods classification; centralized and personalized pricing; formation of centralized order and distribution of the goods; centralized financial and planning and economic accounting; logistics (transfer of goods from the warehouse to retails).	Accounting functions automation starting from admission to selling. Personified work with key customers (direct mail – standard targeted e-mail newsletter, call center). Permanent loyalty (dynamic discounts, services, etc.). Customers monitoring and maintaining. Regular real time interactive contacts supported by Internet (possibility to order any time). Senior managers and other levels managers create favorable marketing environment to interact with customers and other organizations in the network.

Information search and application technology	Determination	The content	Possibilities of use
		Sale to final customers: the search by product name, price, manufactory bar code, internal bar code; selection of product using recommended products or analogues guide; various categories of discounts; cash book and a central cash program; processing of all kinds of fiscal and non fiscal prints.	
"ANR pharmacy" system	Automated system of pharmaceutical retailers business process management	<p>Posting: online registration of goods; products record accounting; incoming quality control of the products, defective series; return delivery; electronic quality certificates storage; pricing and retail price control – the maximum extra charge, price history, flexible pricing system that takes into account various factors; administrative costs calculation; "targeted" storage providing; sale preparation (price tags and labels printing, product locale, product bar-coding).</p> <p>Moving between storage locations, moving goods from department stocks in trading room, and back; master of moving – automatic formation of moving invoices based on stock-out of storage locations.</p> <p>Inventorization: inventory; surpluses posting and shortages write-off; preparation of inventory letters in the context of products, groups of products and storage locations; revaluation (revaluation and write-down of products); cancellation of goods with explanation of reasons.</p> <p>Discounts: privileged and free prescriptions accounting; flexible algorithm for discounts formation; work with doctors; products sale by insurance policies; franchise accounting.</p> <p>Retail sales: fiscal registers connection; information about availability and price of products in pharmacies and pharmacy network; product identification by name, bar code, manufacturer code, local bar code and internal code; search for substitutes by international name and pharmaceutical groups; additional units support; product reservation; refusal statistics; advance payment for the goods records; customer card; returns from buyers; work with doctors; cashless payments; work with cash register (income and spending cash order, cash book); work with suppliers (contracts, financial terms monitoring, payment schedules creation, bank statement); export data to external systems; the data exchange between base and remote pharmacies.</p> <p>Reports can be formed any time in different sections – pharmacy, customer, product, manufacturer, pharmaceutical group, brand, category, VAT, ABC group, supplier, delivery terms, physician, pharmacist, etc.</p>	
Goods movement accounting system "Pharmacy"	Software for goods movement automatization in pharmacy.	<p>Consignments accounting minimizes the possibility resorting, tracking the goods movement, etc.; ability to determine position as "not fiscal" and then continue this type of product taxation.</p> <p>Revenues: known formats of electronic invoices import; incoming inspection filter; price history; blocking goods from profit invoices and possibility to remove the product from the remnants until clarifying the problem with it; expense receipts and movement documents creation on the basis of revenue invoices content; products extra charges correction; product labels (barcode) printing for handheld and floor scanners; return to suppliers, clients and customers returns; detailed extra charges depending on the metioned conditions, the possibility of various types of restrictions accounting including price.</p> <p>Remains: incoming inspection filter –problematic positions revision; blocking of goods for sale; the ability to search for information by synonyms, series, references; indexation of goods at retail outlets; goods movement between the branches; the possibility various types of discount programs (fixed, cumulative); sales history of a particular physician prescriptions, bonus system.</p> <p>Expenditures invoice: search by consignment code, barcode,</p>	

Information search and application technology	Determination	The content	Possibilities of use
		<p>name; display of goods synonyms that are in the remains, even if the product is not available; stock out preparation (order); display the check amount on the fiscal printer before printing; cash or bank transfer; prescription sale, for insurance companies, at prime cost.</p> <p>Full and partial goods inventory; acts of cancellation, income, inventory full act.</p> <p>Calculation of needs; construction of various types of analysis depending on individual processes in client.</p>	
<p>“1C: Enterprise 8. Pharmacy for Ukraine” software</p>	<p>The program is designed to automate the management and accounting for pharmaceutical companies of different types of activities and financing.</p>	<p>Serial accounting of drugs: by production date, shelf life, producer etc.; counterfeits and expiration date control.</p> <p>Pricing settings: the possibility of pricing considering series; pricing setting for commercial network; maximum and minimum extra charges control, pricing rules formation; marketing campaign administration (discounts under certain conditions of the goods sale at the pharmacy, discount cards use, etc.).</p> <p>Accounting: each pharmacy (trading room) can be attributed to a specific organization (company); analogues of drugs accounting (selection and search for analogue drugs for the current nomenclature position); work with electronic documents, supporting various formats for external files to upload data from external files.</p> <p>Work with customers' orders: formation of suppliers purchase orders, assortment needs analysis; goods reservation; formation of various reports (sales, returns, product reports and so on.).</p>	
<p>“Paracelsus” software</p>	<p>The program for accounting and sales of drugs and related products in pharmacy.</p>	<p>Product transactions: purchasing, statement for customer, statement to a branch (pharmacy), account statement followed by bill registration, cancellation specifying the reason, return to the supplier, return from the buyer, return from branches and, of course, retail with support of different types of registers.</p> <p>Suppliers documents import (MMO and EXP format), expenditures export in DBF-format, Excel, MMO and EXP.</p> <p>Revaluation, cancellation, inventorization, return to supplier, return to buyer.</p> <p>Print of price tags and labels with barcode (both manufactory and personal); stock out automatic account.</p> <p>Analysis of product by manufacturer, pharmaceutical group, type, trade name, international name</p> <p>A detailed reporting system that contains information block concerning residues, document statistics block and reports generator.</p> <p>Commodity circulation analysis, ABC analysis and orders formation.</p> <p>Work with discount cards, different discount tables, and common network customers' database formation.</p> <p>Different types of recipes accounting, followed by the register.</p> <p>Automatic invoices creation for retail outlets.</p> <p>Setting up the system without developers.</p> <p>Permissions setting for any user in the system.</p>	
<i>Internet</i>			
<p>Pharmacies Websites</p>	<p>Reliable information about companies, products and services.</p>	<p>Allows pharmacy quickly provide its clients with information about the schedule, drugs availability and prices. Reservation of certain drugs formation. Details about the drugs, dosage and compatibility with other drugs, and so on.</p>	<p>Distribution of suggestions about product/brand/service (customer focusing on certain key products).</p> <p>New customers engaging.</p>
<p>Drugs handbooks</p>	<p>Online handbook allows getting information about the drug.</p>	<p>Information about the drug.</p> <p>Description and instructions concerning the use of drugs, their synonyms and analogues, information about the composition and the dosage forms of drugs, pharmacological action, indications and side effects, methods of use, dosage and contraindications, interactions of drugs, notes about the use in children, newborns and pregnant women, storage conditions, prices and drugs reviews, information about pharmaceutical companies.</p>	<p>Product/brand/service offer (the possibility to point out both on individual drugs and the pharmaceutical company in general).</p> <p>Online ordering single transactions, medical products purchase.</p> <p>Non-personal contact with customers (FAQ).</p> <p>Dialogue with consumers using Internet technologies (online chats)</p>
<p>Electronic</p>	<p>A set of electronic</p>	<p>Providing timely information.</p>	

Information search and application technology	Determination	The content	Possibilities of use
periodic issues	documents that passed editing and publishing preparation, intended for distribution unchanged and have initial information	The wide availability of information. Easy subscription and storage. The availability of interactive content.	with doctor or pharmacist) Loyalty (online discounts, promo codes to purchase medical products, etc.) The ability to aim communications to a specific segment of consumers (pregnant women, young men, etc.)
Forums, social networks	Bilateral information sharing between stakeholders	Creation by the users (Forum visitors) their themes and their subsequent discussion, by posting messages within these topics.	Contacts with many consumers to gather information about them (age, ability, preference in treatment, awareness of drugs, etc.). Constant improvement of recognizability, the image of the pharmaceutical company Mobile application development for quick search of drugs

Practical use of all three levels of information sources provides both competitive advantage and significantly reduces the cost and facilitates the work of pharmaceutical companies.

Further studies are focused on the analysis of medical and pharmaceutical information provided by senior managers, the quality and availability of information for various levels of pharmaceutical organizations.

7. Findings from the research and prospects of further development of this area

1. The meaning of "network society" and the terms Intranet, Extranet and Internet were processed, and the degree of their use in pharmacy was estimated.

2. The possibilities of the different software products of the different levels of information networks were analyzed. It was found that the systems of technical facilities and software for internal databases formation (customers, employees, suppliers, etc.) and to accelerate the implementation trade operations are mainly used on the Intranet level.

3. It was determined, that the programs used on the Extranet level allow pharmaceutical companies to reduce labor costs and facilitate the work of all employees of the pharmacy, carry out full cycle of transactions accounting at all stages of the goods movement from the decision to purchase from the supplier to implementation to the end customer and the following reporting.

4. It was shown that pharmaceutical companies for dissemination of information and suggestions about their products or services, as well as for a direct dialogue with consumers (online chat with the pharmacist or doctor) mainly use the Internet level.

5. It was found that in Ukrainian pharmaceutical networks information already been used search and applied technologies. Besides widespread cash modules and workstations, owners implement modern software, which is useful both for most operations automation at the pharmacy and for a two-way contact with the end user, forming his loyalty. Thus, we can say that Ukraine begins to form a network (digital) economy in pharmacy.

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ИССЛЕДОВАНИЕ АНТИАРИТМИЧЕСКОЙ АКТИВНОСТИ ЛИПОСОМАЛЬНОЙ ФОРМЫ ЦИТОХРОМА C

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Цель: целью работы явилось исследование антиаритмического действия свободной и липосомальной форм цитохрома C.

Методы: липосомы получали методом липидной пленки с последующей гомогенизацией при высоком давлении. Определяли размер частиц и степень включения. Проведено изучение аритмии с использованием хлоридбариевой модели. Регистрировали время возникновения и продолжительность аритмии у каждого животного электрокардиографическим методом. Бария хлорид, в соответствии с общепринятой методикой, вводили в дозе 4 мг/кг. В качестве стандартного образца использовали амиодарон в дозе 5 мг/кг. Обе формы цитохрома C вводили внутривенно в дозе 10 мг/кг.

Результаты исследования: авторами предложена технология получения липосомальной формы цитохрома C, изучено включение субстанции в состав липосомы (не менее 95 %) и размеры полученных наночастиц (100–170 нм). Показано достоверное снижение времени аритмии при использовании цитохрома C. Липосомальная форма цитохрома C (10 мг/кг) проявляет более высокую активность по сравнению со свободной формой препарата и снижает время аритмии по сравнению с контролем более чем в 2 раза.

Выводы: липосомальная форма цитохрома C является перспективным антиаритмиком т.к. по сравнению с амиодароном, обладающим широким спектром побочных действий, отличается крайне низкой токсичностью. В дальнейших исследованиях планируется изучить дозозависимый эффект липосомальной формы цитохрома C и мембрано-стабилизирующие свойства в модельных экспериментах при ишемической болезни сердца и аритмиях

Ключевые слова: аритмия, цитохром C, липосомы, технология получения липосом, липосомальная форма цитохрома C

1. Введение

Одним из препаратов, используемых в лечении сердечно-сосудистых заболеваний является цитохром C (ЦС) – периферический водорастворимый мембранный белок с М.м. 12,5 кДа. ЦС является одним из ключевых белков дыхательной цепи митохондрий, переносящий электроны от III к IV комплексу дыхательной цепи [1]. Антиоксидантная активность ЦС обусловлена его способностью окислять супероксидный радикал с образованием молекулярного кислорода. При выходе из митохондрий в цитоплазму ЦС запускает каскад реакций, заканчивающихся апоптозом – запрограммированной смертью клетки. Этому предшествует образование комплекса ЦС с кардиолипином, анионным фосфолипидом внутренней мембраны митохондрий, в результате чего происходит изменение

конформации ЦС и появление у него высокой пероксидазной активности [1, 2].

2. Постановка проблемы в общем виде, актуальность темы и ее связь с важными научными или практическими вопросами

Недостаток содержания ЦС сопровождается резким нарушением процесса поглощения кислорода и окислительных процессов в клетке, приводящих к гипоксии и аритмии [3]. ЦС применяют при комбинированной терапии критических состояний: показана эффективность при отравлении снотворными средствами, окисью углерода, токсических, инфекционных и ишемических повреждениях миокарда, пневмониях, нарушениях мозгового и периферического кровообращения, при асфиксии новорожденных и инфекционном гепатите.