

A Holistic Innovation Strategy for the Development of the Blood Supply Chain Management in Egypt

A Strategic Managerial Approach

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Abstract: *Human blood is a perishable and rare product - therefore it is an expensive and scarce resource. Transfusion of human blood can be life saving. Therefore, blood availability and safety present a serious requirement and a great challenge in many societies for many reasons. In Egypt, the national blood system is not serving the health system well. Many blood centers are working as isolated islands. The lack of blood availability statistics at the national level does not support the process of integrating both planning and distributing the available amount of blood in different locations effectively and efficiently. This serious deficiency of the current distribution system represents the main cause for the frequent unavailability of blood when it is imminently needed in several high risk and dangerous situations, specifically in periods of crisis. Although, there some preliminary efforts were done in creating the national blood-centers network, the actual outcomes were not as expected. In a knowledge era, establishing a holistic strategy to create, manage and optimize the blood ecosystem is an essential and innovative solution for this chronic problem. A mix of qualitative and quantitative studies have been utilized (face-to-face interviews) to have an in-depth understanding of the ecosystem, procedures and managerial approach and quantitative study (a questionnaire) to investigate the problems' roots. The proposed Integrated Blood Supply Chain Management in Egypt – called (IBSCMSE)- encompasses four main components (top management support, decision support system, accumulating resources and building a social awareness of the problem). This comprehensive approach expected to provide several practical benefits for the national and regional blood system such as: managing, analyzing, forecasting and supporting critical decisions in health care sector. This inclusive approach connects all blood centers in an integrated network, to provide adequate information and to simultaneously work as a dual large blood system that can help nationally and as a regional blood system.*

Keywords: *Blood centers, decision support system, holistic strategy, innovation and supply chain, blood donation, patients*

1. INTRODUCTION

Blood services are critical national demands especially in emergency and crisis situations. It should be considered as a high priority for the Egyptian ministry of health (MOH) and governmental officials to achieve many goals such as: save patients' lives, allows better decision making and enhances the health development projects, [1]. Global review showed that shortage in blood supply has become a calamity not only in Egypt, but also worldwide as declared by the (International Federation of Red Cross and Red Crescent Societies (IFRC) "There are chronic shortages of safe blood and blood products in many countries, so blood transfusion is not available for a substantial proportion of the world's population", [2].

Historically, Egyptian blood transfusion services were launched in 1938 as a Non-Governmental Organization (NGO) for blood donation services. In 1960, the higher council of blood was established as an effort to regulate blood services. However, before 1977, blood centers were scattered every - where with no clear records neither of blood availability nor of whom they report or refer to. In 1977, the Ministry of Health (MOH) signed an agreement of cooperation with the Swiss government for restructuring the blood transfusion service as a priority in the To-Do-List of the Egyptian government during that time. The signed contract worked on regionalizing a network of blood centers to cover all of Egypt, [3]. As stated in the Egyptian National Blood Transfusion Standards (NBTS) document - NBTC is the headquarters of the blood system, which develops policy that defines the strategy,

process and procedures required to ensure that documents are controlled through the blood transfusion service, [4]. This whole process was planned to take three years to replace the old MOH system and former Hospital Blood Bank (HBB) [3]. Unfortunately, because of some technical and bureaucratic obstacles, the results were not as predicted and the Egyptian national blood system continued not to serve the health development well, for example, the latest official published annual reports are those of 2005 and 2006. [1]

However, there were some partial enhancement activities done by the MOH officials in some blood centers, specifically in quality of used equipment and facilities and increasing the budget for the reconstruction of those centers. Unfortunately, the problem of isolated islands – yet existed in 2015. Meanwhile, there were no official statistics that show the whole blood supply chain flow (e.g. donors information, donated blood bags, processed blood bags, blood bags in stock, consumed blood bags and patients information). In other words, there are no statistical data that represents the supply and demand of the blood in Egypt.

Recently in 2016, Masr Al-khair (Non-for-profit organization) has agreed to finance a cooperation project with the Egyptian MOH and the ministry of communications and technology to establish a network for connecting 202 blood centers in all regions. The system will allow - as stated in the signed protocol - to help the decision makers know the available stock in real time, all over the republic, and facilitate discovering either the regional shortage or surplus to be redistributed. Additionally, the system permits the traceability of blood bags and allows for information exchange between all connected blood centers, [5]. This system is a promising step to help in mitigating the supply side of the problem but not the demand side problems as will be explained in this research.

Priesskalla mentioned the reasons that increase the potentiality of this problem and make it difficult to be solved. He said: First, blood is a perishable product and whole blood has many components, each of which has a different shelf-life before it expires. The preparation of each component incurs significant costs. Second, the supply of whole blood is a random collection process that depends on the donors' locations and varies from time to time. Therefore, it is difficult to plan and forecast the supply side in an accurate way. Third, the demand side is also a random factor because the amount and the frequency of the demand is unpredictable. Fourth, there are many changes that should be done in the decision making system, strategic policies and operational procedures [6]. All of these factors are impacted with the allocated cost and the need to decrease wastes. Fifth, the entire blood supply chain should be viewed as a single holistic system and not just a subsystem of some larger system as occurs in most other supply chains [6].

The goal of this paper is to answer the following questions:

1. What are the blood centers' supply chain components and their associated problems?
2. What are the pillars of the proposed strategic approach?
3. What are the expected benefits of the proposed strategy?

The paper consists of the following parts (e.g. a literature review, analysis of the blood ecosystem components and related problems, the pillars of the proposed strategy (IBSCMSE) and the expected benefits of the proposed system.

2. LITERATURE REVIEW

The idea of blood bank management system - to replace the old manual system with a computerized system - has been investigated and supported by many researchers. The suggested system was intended to be used to achieve maximum efficiency and effectiveness of blood bank management. Catassi and Peterson provided a proposal to manage the inventory of the blood bank with a computer system [7]. This system could control the allocation of the blood units between the blood centers and the local hospitals. This system was a limited solution and many components were missed. Dzik added a new advantage of the system [8]. They proposed the development of blood bank data management system that allows effective retrieval of the stored data. This advantage allows enhancing the data mining and recovery of the data for further analysis.

Choudhury viewed blood transfusion service as a very large cost of money (multi-billions) that needs a lot of attention to achieve cost-efficient approach [9]. So, it is required to combine the financial information to the system to monitor and control this large wealth. Yegul suggested a regional

management information system application that solves regional blood problems [10]. Kim et al suggested the usage of Radio Frequency Identification (RFI) and ubiquitous sensor network to achieve traceability of blood units through the whole supply chain [11]. Baesler et al developed a new modular system that contains three modules: donors, patients and blood. This system lacks to other important components of the blood ecosystem such as: Hospitals, private companies, some (MOH) entities and NGOs [12].

Benien and Force has introduced an interesting approach of supply chain management for blood and blood products terming the process as irregular and the demand for blood stochastic. This is of great implications if the management of blood banks were to become effective [13]. The system could not provide an integrated approach to control the whole ecosystem.

The literature highlighted the massive need for a holistic strategy that views the ecosystem big picture to investigate every component and solve its related problems. Therefore, the Egyptian blood supply chain should be analyzed to discover and mitigate the barriers through utilizing practical solutions. The proposed strategy requires a strategic vision, top management support and reformation of the blood centers network infrastructure. Part of this strategy is to use the knowledge based decision support system to create a coherent national blood system that can support the health development.

3. METHODOLOGY

In this study, a mix of secondary data (e.g. governmental documents and annual reports) and primary data that consists of qualitative and quantitative research instruments have been used to enrich the study and answer the research questions.

The first method, secondary data collection, includes inspection of health ministry publications in order to know the structure of the system (e.g. components, goals, funding basis, culture, Management and relationships). Documentation analyses are, furthermore, used for coding particular concepts for analysis through interviews. The second method, a qualitative research mainly face to face- semi-structured interview, is characteristically exploratory, fluid and flexible, data-driven, context-sensitive, and the decision about design and strategy are ongoing and grounded in the practice, process and context of the research itself [14]. Robert Yin argues that qualitative study is appropriate to answer “how” or “why” propositions, and to analyze a contemporary phenomenon [15]. The interview agenda involved both open and closed questions to allow flexibility in the research. Closed question were structured to inspect the sense connecting the data to the proposed strategy. The interviews were conducted during the period of October-December, 2016. Regarding the analysis and the interpretation of the results, significant concepts were identified in document investigations based upon a constant comparison of the data. Some coding was done once interviews were transcribed and as documents were combined. The researcher conducted four interviews with officials managers of many Egyptian organizations involved directly with blood system such as: Governmental blood banks, Blood Donation service in private organization and non-for-profit organizations and researchers and managers of the Ministry of Health. These interviews explained the legislative policies and procedures that control the blood ecosystem. The third method, a questionnaire conducted by [1] to investigate the ecosystem problems. The survey was distributed among patients, donors and physician in many hospitals and blood centers in Egypt. The survey was based on a probability random sample selected of 2500 Egyptian citizens of different types (education background, income, class level and gender, patients, donors, employees). Questionnaires were sent by e-mail to participants using Survey Monkey software. Other participants were asked to answer the questions directly on a paper-based-questionnaire. Everyone received the survey in Arabic and English. Survey responses were analyzed using the SPSS statistical package into descriptive and inferential interpretations. The author found this questionnaire as a beneficial instrument to achieve integration and answer the second research question? - The quantitative analysis satisfied the research requirements and allowed exploring the associated problems with the ecosystem. The knowledge resulting from the interviews have confirmed through the survey. Meanwhile, using these three instruments enriched the research and allowed achieving the integration between the research components.

4. ANALYSIS OF THE EGYPTIAN BLOOD ECOSYSTEM’S PROBLEMS

In today’s global world, supply chains are more complex than ever before. Consumers’ demand for products as well as the continues-critical economic situation requires that governments, as well as

organizations, to be more innovative while also becoming more cost-efficient in the procurement and production of their products and services as well as their delivery [16]. Supply chains for time-sensitive products and, in particular, for perishable products, pose specific and unique challenges. By definition, a perishable product has a limited lifetime during which it can be used, after which it should be discarded [17]. Examples of perishable goods include food and food products, medicines and vaccines, cut flowers, etc as stated by Hung, and Li [18]. Zaroni and Zavanella stated clearly that not all perishable products are alike and, notably, in some cases, such as that of medicines, blood and vaccines may result in a matter of “life or death” for its consumers [19]. However, operations in blood system supply chain are a key component of the healthcare system all over the world [20].

In Egypt, there is an absence of a coherent and a comprehensive system that controls the whole supply chain which represents a critical situation and prevents any mitigation trials. In most parts of the world, blood banking operations systems conduct procurement and distribution in a regionalized manner. In other words, there is a regional blood center in each geographical area which is in charge of coordination and administration of its lower-level units. Nevertheless, despite advances in storage and distribution technologies, hospitals may need to acquire blood products from suppliers that are located in other regions, sometimes even hundreds of kilometers away.

The National blood bank supply chain consists of many components that work individually or partially together to supply the blood unit form donors to patients as shown in Figure1):

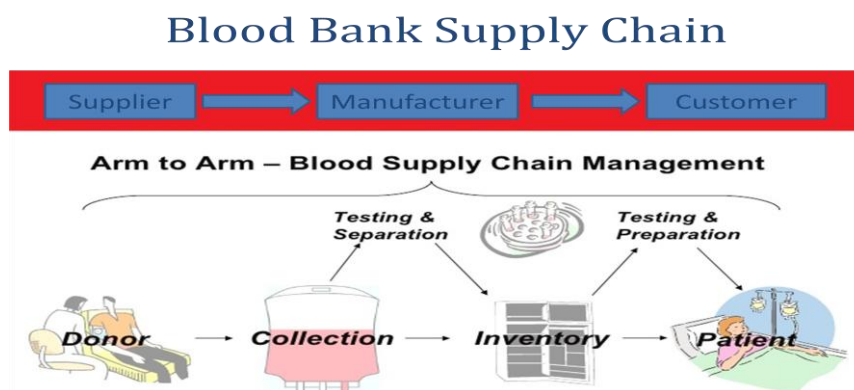


Figure1. Egyptian Blood Centers Supply Chain

Source1. Author's work

Human blood has a legal lifetime of 21 days from collection, during which it can be used for transfusion to a patient of the same type, and after which it has to be discarded. It is collected in units of one pint from volunteer donor at various collection sites such as a Regional Blood Center, and after a series of typing and screening tests, it is shipped to Hospital Blood Banks in the region. Once at the Hospital Blood Bank, a unit is stored and is available to satisfy the random daily demand for transfusions to patients. Since not all units demanded for a patient are generally used, a unit can be issued several times during its lifetime until transfused or outdated.

4.1. Donors (Suppliers)

Blood donation occurs when a person voluntarily has blood drawn and used for transfusion. Donation could be of whole blood which used rare now or of specific components directly. Blood banks prepare and participate in blood collection campaigns and the followed procedures. Today in developed countries, most blood donors are unpaid volunteers who donate blood for community supply. Meanwhile, in developing countries, with the severe shortage of blood stock, donors are paid money and received extra advantages such as: paid time off. The Egyptian health system suffers from a severe shortage in the blood donation supplies as announced by some health officials in Egyptian central blood bank “approximately, every three seconds, there is a patient who requires blood, thus there is an urgent need ranging between 2.5 to 3 million bags annually. Tragically, only 60% of the country’s needs are met, [1]. There are too few donors due to lack of social awareness. Additionally, infected donors with Viral Hepatitis or Anti-bodies(C, B, A) are considered a serious challenge in Egypt that having the highest recorded prevalence of HCV antibodies in the world. (Omran et al, 2013). There are many corrupted donation process (drugs addicted, and dealers). In many poor areas,

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blood donation could be a source of money for some unemployed people. Although, there is a small electronic database or manual book registration system inside every bank to register the donors information, but every database is an isolated islands and its information cannot be shared by other parties. The following (Table1) shows the total blood donation during FY 2006 TO 2011.

Table1. Blood Donations statistics per governorate (2006 to 2011)

Year	Total Blood Donation in Egypt per Governarate (2006-2011)										
	Total Mobile Drive Donations				Total Mobile	Total In-House Donations				Total In-House	Grand Total
	Cairo	Alexandria	Sohag	Aswan		Cairo	Alexandria	Sohag	Aswan		
2011	42902	37073	3548	2422	85945	3382	4405	9476	7405	24668	110613
2010	48426	31754	6105	3511	89796	3389	2640	8078	4964	19071	108867
2009	32064	15967	2797	1781	52609	1203	1412	4064	1928	8607	61216
2008	78553	30915	3494	4261	117223	3886	5967	5424	2488	17765	134988
2007	61373	22458	2517	4744	91092	3325	11480	2918	1087	18810	109902
2006	56216	18461	2898	2814	80389	3320	15965	935	1003	21223	101612

Source2. Egyptian Ministry of Health statistics [1]

4.2. The Ministry of Health (The Manufacturer)

The Egyptian MOH (Ministry of Health) is holding the responsibility of assembling, testing, stockpiling, processing and issuing blood bags for patients with other parties who are working either directly or indirectly with the ministry. There are many components that control the collection of blood shown in the following Figure):

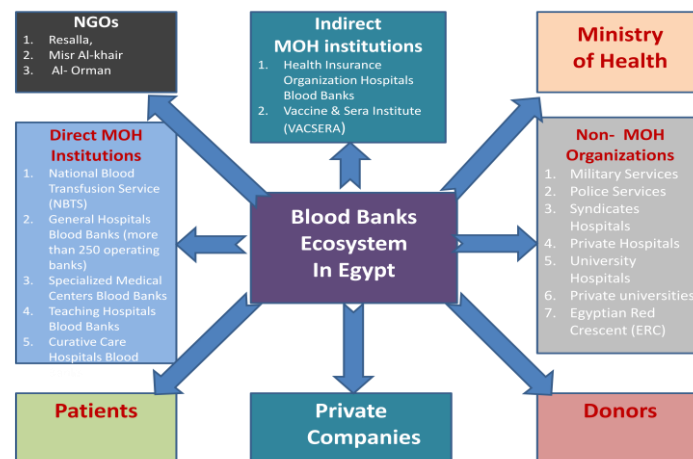


Figure2. Blood Banks Ecosystem

Source3. Author's work

Although, there are 202 blood centers located in all governorates. There are some barriers that hinder the testing, processing and storing the blood units.

4.2.1. Storage & Testing Process Problems

There is a lack of infectious disease effective testing equipment. Many blood centers in rural area have no enough equipment for storing blood units which enforce blood specialists to terminate many of stored blood units. Additionally, there is a centralized distribution of blood centres in Cairo and other urban cities and lack of information about donors for some rare diseases.

4.2.2. Delivery system to patients

The delivery system has many critical issues. For example, the private banks compete to sell blood with unfair expensive prices by attracting donors to receive more money for donation. In addition, there is a lack of transparency. There is no way to know the actual demand because there is no available database to register the patients orders either fulfilled or not. Furthermore, There is an over

required Blood in operations by physicians and surgeons to be put in reserve just –in-case they are needed and terminate the surplus. There are many bureaucratic and over restricted rules to deliver blood units specifically in rare categories.

4.3. Blood Management Information System

Many of the above components were working as isolated island without integrated centralized system that allows the full control of the supply chain. The responsibility is distributed between many organizations which affected the decision making and the development of this essential system. However, there is a lack for a full integrated database that contains patients' information (e.g. emergency cases, chronic diseases and others), donors' information and donation quantities except from 2006 to 2011 that shown in this research. This information is highly essential to prevent corruption and allow distribution of the supply based on actual needs. Additionally, there is no integrated network to connect the blood centers to allow the decision maker to know the stored blood units and related information. There is no available data for the donations' activities.

5. PILLARS OF THE PROPOSED STRATEGY (IBSCMSE)

This holistic strategy mainly the Integrated Blood Supply Chain Management in Egypt (IBSCMSE) aims to create, manage, optimize the blood centers' problems and optimize its efficiency and effectiveness. This strategic approach understands the blood ecosystem as a large system that can be divided into subsystems to be analyzed, mitigated and optimized and then hocked with other components to achieve the synergy and the full system optimization. This strategy consists of four main pillars as shown in Figure (the follows):



Figure3. Integrated Business Supply Chain Management Strategy in Egypt

Source4. Author's Work

5.1. Top Management Support

Firstly, Egypt has a strong culture. One of its main components is the traditional respecting of the power distance. Therefore, there must be a commitment and support from the top management in the government hierarchy (e.g. president, prime minister and health minister). Without buy-in from the head of the country, there is a lot of doubt that other members will be supportive in the planning and eventual implementation process. Commitment and support of the strategic-proposed initiative must spread from the Minister of Health and all the way down through the ranks [21]. Secondly, radical innovative change is achieved by actions - not by statements or talks. The skills that are needed to lead and direct the traditional old system - are significantly different from the skills needed to overcome the challenges and risks characterized the global dynamic environment. There is a need to manage the complex process of balancing relationships between formally management board and other internal and external stakeholders (e.g. patients, Donors, employees, hospitals and physicians) [23]. According to Maak, innovative leader should have the following characteristics: 1) Understanding of supply chain process, 2) Connecting and networking the components of the ecosystem, 3) Advancing the system's capacities and facility layout, 4) Removing hierarchical barriers and supporting success factors and enablers, and finally, 5) Building shared culture and ways of doing things. There is a need for a new type of leaders that act the talk and change plans into real tangible results [24].

5.2. Integrated Decision Support System

It is a well known fact that, Decision Support System (DSS) is an effective tool in decision making and facilitates the organizational processes. Besides its ability to handle the daily running processes, it is a highly effective platform for unstructured, underspecified problems that top management face to mitigate critical situations. DSS permits the combination of integrating many modules and the usage of advanced analytical techniques to analyze big data and retrieval functions. In addition, DSS is a result oriented approach that provides realistic features and allows non-computer people to use it in an easy way. Furthermore, DSS has many advanced characteristics such as: flexibility, adaptability that allows the customization of the system to satisfy the organizational needs. Therefore, the researcher suggests this integrated DSS to create a well structured system to connect the blood centers together to build a real platform for decision making. The system consists of many components such as:

- The first: A data warehouse that consists of five data marts. Each one serves a specific part of the blood banks supply chain:
 1. Blood banks data mart has full information of the blood centers in Egypt e.g. (bank information, expiry dates, categories, quantities of each group etc.)
 2. Blood Donors data mart contains all information about donors e.g. (name, health test, ID, blood category, demographic information, social information etc.)
 3. Patients’ data mart maintains patients’ information (name, permanent disease, temporary request, demographic information and location, etc.)
 4. Hospitals data mart contains full information of hospitals and clinics e.g. (name, location, capacity, needed quantities, departments etc.)
 5. Blood units consumption contains a tracing system of the blood unit from donor to manufacturing, then to storing and finally to the patient.
- The second: An Integrated Network: to connect all the components together. Communication network is one of the most important components to achieve the successful implementation of the DSS. Therefore, the system should depend on the most reliable methods of communication networks to inter-connect the components of the system and to achieve the desired goals. Virtual Private Network (VPN) is considered the suitable choice to accomplish the ease of use and reduce the communicating costs.
- The third: A user interface: to connect the system with the all users to allow the easy communication between the system and the targeted users. It has to show data and information in a simple way and to be able to answer the required questions just-in-time.

The following Figure2) shows the Integrated Blood Decision Support System.

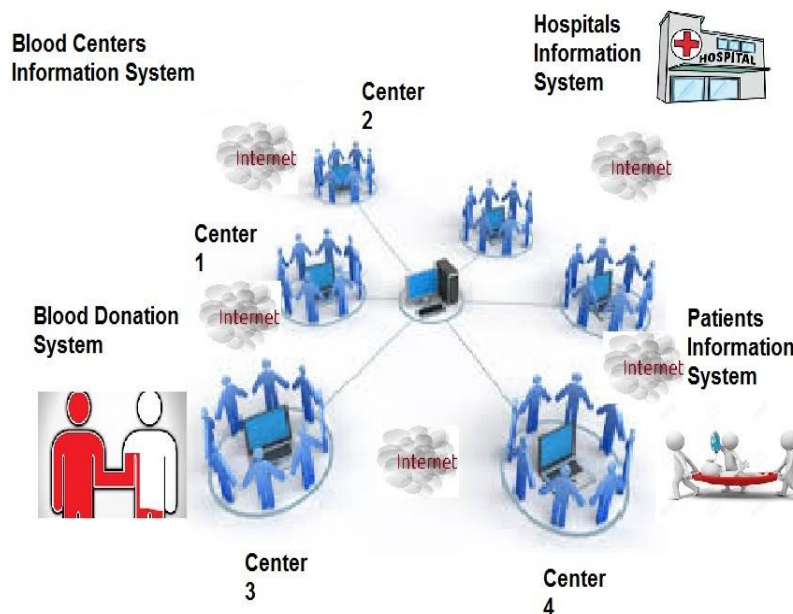


Figure2. Integrated Decision Support System

Source5. Author's work

5.3. Accumulating Required Resources for the New Strategy

This highly potential system for saving lives should have sustainable financial sources that generate adequate resources to manage, maintain and optimize the system. These financial resources permit the strategic board of directors to update the system with the advanced technologies that are used in developed countries. As a result, the Egyptian government has to establish a broad financing network that allows the generation of financial resources to support the system. As a public organization, the governmental support represents the most important share of the budget. Patents should pay fair fees which considered as an important contribution to finance the proposed system's activities. Additionally, endowments, gifts and non-for-profit organizations aid will be important to enhance the provided services. The top managers of the strategy should focus its resources in order to develop the services and allow achieving faster and beneficial social satisfaction. Availability of incentives for high qualified employees will support the building block of the strategy. Therefore, the managers have to find new resources to engine the budget through partnership with other organizations (e.g. industry, governmental agencies and Non-for-profit organizations).

5.4. Building Social Awareness and Changing Culture

The proposed strategy needs a radical change in the culture to increase people's awareness and to mitigate the chronic strategic implementation problems which is the talking-doing gap. In this sense, the government has to solve two problems, first is to specify the structure of the new culture and second is to identify the mechanism to change this culture. There is a need for a national program to educate, motivate, capture, and recruiting a growing public attention, directing them to enthusiastically contribute in the blood system restructure, in a responsive and responsible way. A friendly welcome of donors, with focus on listening and identifying their needs, enables the information sharing about the user and the identification of aspects that may be interfering in the bonding/regularity of donors, which make follow up actions and service assessment feasible [1]. It is necessary to introduce methods, and messages through the available marketing communication channels to inform and expose the donation effects, awaken generosity, solidarity, and educate about the need for healthy donors, basic principles for the voluntary donation. Meanwhile, scanning and categorizing the patients' needs with full transparency in all process to have a quick response in normal and urgent situations will increase the trust between the ecosystem components. There is a need to develop a clear philosophy to harmonize the relationship among the ecosystem components to be able to have a common understanding of the importance of such a cooperated system. A part of the system is to have effective listening methods for patients' requirements and to answer frequently asked questions. It is also highly valuable to implement improvements to the aspects that are directly related to the work execution in order to achieve the welcoming environment such as demand administration, and a better physical space and facilities, providing more comfort and well-being to the users, thus, conquering regularity [1].

6. BENEFITS OF THE DSS

This decision support system is a knowledge based system that can play a vital role in advancing the top management decision making in many disciplines (e.g. Forecasting, Managing, Analyzing and Reporting)

6.1. Forecasting

- a. The supply (No. of donors, blood categories, and quantity of blood based on location demographical characteristics)
- b. The demand (No. of Patients, geographical location needs, blood categories, and quantity for every disease category)
- c. The manufacturer (The Financial and human resources required for blood collection and process.
- d. The time needed for collecting, manufacturing and providing the required products
- e. The redistribution of the blood centers and no of new ones that are required to be built.

6.2. Managing

- a. Registration of complete information about the whole supply chain (donors, patients and centers) to categorize, analyze and make decision

- b. Effective automation of the system instead of manual handling to save time, cost and better quality to increase customer satisfaction
- c. Faster decision making based on accurate facts, faster communication and information sharing
- d. Achieving traceability of every blood unit and how it is consumed or terminated.
- e. Achieving transparency and mitigate corrupted processes.

6.3. Analysis

- a. The system plays a vital role in national crisis (Forecasting, Analysis and Managing)
- b. The system can be a foundation for a complete map of the national health problems and diseases
- c. The system can categorize and provide essential statistics about the national health problems e.g. (reasons, effects (economic, social) and methods of treatment) for further medical, social and economic studies

6.4. Reporting

- a. Numbers of donors available in every blood category and location
- b. Geographical locations that need more attention to direct collection campaigns
- c. Managerial information about financial budget spent or required
- d. Essential information required for short and long term planning
- e. Numbers of patients in every blood category and location
- f. Availability of blood quantities and categories to share and provide to other locations

7. CONCLUSION

This holistic system provided a comprehensive solution for the chronic blood system supply chain problems in Egypt. The research analyzed the ecosystem components to identify the associated problems. Then, a holistic strategy called (IBSCMSE) has been proposed. This strategy consists of four main components: 1) a top management support mainly the Egyptian president and the prime minister to give a full support to establish this system and consider it as a national security problem, 2) an integrated decision support system, 3) accumulated resources and 4) building social awareness through replacing the current culture with responsible culture. The research can also achieve many strategic managerial benefits such as: forecasting, managing, analyzing and reporting. The importance of the research sourced from the logical idea that mitigating this problem which affects the majority of the Egyptian population (more than 40 million citizens) is highly critical and can achieve many potential benefits in many sectors (e.g. health, economic, social, and governmental sectors).

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REFERENCES

- [1] Shafie, A. " Increasing Blood Donation In Egypt- Master Thesis." The American University in Cairo, School of Global Affairs and Public Policy , 2013.
- [2] IFRC Blood Services. "Blood Services." The International Federation of the Red Cross and the red Crescent Societies (2012).
- [3] Moftah, F. " Regionalization of the Blood Transfusion Service in Egypt." (2002).
- [4] National Blood Transfusion Services (NBTS): <http://nbts.gov.eg/pages/ar.html> *NBTS Egyptian National Blood Transfusion Standards.. (2007a) Retrieved January-April.*
- [5] Alahram Gate. "connect 200 blood centers in Egypt- Masr Alkhair- Project." Cairo : <http://gate.ahram.org/News/709567.aspx>, 2015.

- [6] Pierskalla, w., Supply Chain Management of Blood Banks, International Series in Operations Research & Management Science, (2004), Vol (70) pp 103-145
- [7] Catassi, A. and Petersen , E., "The Blood Inventory Control System - Helping Blood Bank Management Through Computerized Inventory Control", Transfusion ." (1967): 7:60.
- [8] Dzik, W. "transfusion safety in the hospital. ." Emily Cooley Lecture 2002 43.9 (2003): 1190-1199.
- [9] Choudhury, N. "Management in Indian blood banking system: True reality." 3 .9 (2009): 57.
- [10] Yegul, M., Simulation Analysis of the Blood Supply Chain and a Case Study. Master's thesis, Middle East Technical University, Turkey, 2007.
- [11] Kim, S.-J., Yoo, S., Kim, H.-O., Bae, H.-S., Park, J.-J., Seo, K.-J. "Smart Blood Bag Management System in a Hospital Environment Personal Wireless Communications ." (2006): 506-517 .
- [12] Baesler F, Nemeth M, Martinez C, Bastias A. Analysis of inventory strategies for blood components in a regional blood center using process simulation. Transfusion. 2014; 54:323–330.
- [13] Belien, J., Force, H., Supply chain management of blood products: A literature review. European Journal of Operational Research (2012) , Vol 217(1), 1–16
- [14] Mason, J. Qualitative Researching, SAGE Publications Ltd., London, U.K. (2002) 2nd Edition
- [15] Yin, Robert K. *Case Study Research: Design and Methods*. Thousand Oaks: Sage Publications, 1994. Print.
- [16] Ahumada, M. and Villalobos,C. "Application of planning models in the agri-food supply chain: A review." 196.1 (2009): 1-20.
- [17] Federgruen, A., G. Prastacos and P. and Zipkin. "An allocation and distribution model for perishable products." 34.1 (1986): 75-82.
- [18] Hung, H. & Li, Y. . "The Influence of eWOM on Virtual Consumer Communities: Social Capital, Consumer Learning, and Behavioral Outcomes ." 47.4 (2007): 485. .
- [19] Zanoni and Zavanella . " Single-vendor single-buyer with integrated transport-inventory system: Models and heuristics in the case of perishable goods ." 52.1 (2007): 107-123.
- [20] Stern, N. . " Key Elements of a Global Deal on Climate Change." (2008).
- [21] Maak, T., Waldman, D., Pless, N., Different approaches toward doing the right thing: Mapping the responsibility orientations of leaders, The Academy of Management Perspectives, (2012) 26 (4), 51-65
- [22] Zeleny, m., Strategy as Action: from Porter to Anti-Porter, International Journal of Strategic Decision Science, (2010) Vol (1), pp. 1-22.
- [23] Frooman, J., Stakeholder Influence Strategies, the Academy of Management Review (1999) 24(2):191–205-191–205 .

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