Role of ICT in Healthcare Sector: An Empirical Study of Pune City

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Abstract
Information technology has a critical role to play today in enabling progress in a multitude of areas which fall under the domain of development. It is a tool, which if properly utilized, can help mobilize resources and improve efficiencies by leaps and bounds. This study pertains to the intersection of Information and Communication Technology (ICT) and healthcare infrastructure and analyzes the level of digitalization and general utilization of information technology within the private and government hospitals; with regard to consumer interface, and secondly, regarding the knowledge and attitude of people towards the same. The research takes a dual focused approach to incorporate the views of two parties, mainly the service providers of healthcare and the consumers. Results show that citizens of Pune are largely aware of the e-health services available to them. Hospitals are also found to be sensitive to their need to keep up with technological progress as that not only helps them improve their internal administration but also improve their relationship with patients. A smart city requires a confluence of efforts both from the Government and a proactive citizenry to succeed and Pune city appears to be on the right path.

Keywords: Information and Communication Technologies (ICT), Healthcare, Smart City, Pune, India

Introduction
Given that a third of India's population resides in urban areas, and that these numbers are steadily rising with no slowdown in sight, it is imperative that our cities are able to expand and allow for the ever increasing numbers. For this reason, sustainable urban planning is a crucial need of the hour. In this vein, the idea of the Smart Cities has been gaining importance lately.

Though there is no one universal definition, a smart city is essentially an urban set up with a high degree of infrastructural development, both physical and in terms of information and communication technology (ICT), with a special focus on sustainable practices. It seeks to bring about a confluence of government resources, modern technology, citizen participation and the private sector, both the experience of the entrenched corporate sector and the enthusiasm of the entrepreneurial spirit, so as to develop innovative solutions for the age old problems associated with urbanization, ranging from issues like transportation to water scarcity. The concept is a fairly new one, popularized across the world in the past decade. In India, the Smart City Mission seeks to promote the development of cities that provide their citizens good physical, institutional, social and economic infrastructure in an inclusive and environmentally sustainable manner. These cities should then be able to serve as model for development that can be simulated further. A few basic aspects that are sought to be covered in a Smart

City are adequate water supply, assured electricity supply, sanitation, efficient urban mobility and public transport, affordable housing, robust IT connectivity and digitalization, good governance, especially e-Governance and citizen participation, sustainable environment, safety and security of citizens, particularly women, children and the elderly, and health and education (Ministry of Urban Development, 2015).

Pune is one of the largest cities in India, both in terms of population and domestic product, as well as a center for both academia and business activity. With factors such as strong human capital, an efficient municipal council and participatory citizenry, Pune is primed to succeed in its goal to become a Smart City. Given this background, this study explores the interconnected themes of good governance as well as citizen participation, both individual and institutional, in the context of the role of ICT in the healthcare sector in Pune city.

Literature Review

E-governance, short for 'electronic governance' is the act of using ICT at various levels of the government and the public sector and beyond, for the purpose of enhancing governance (Bedi, 2001).E-health is an emerging field in the intersection of medical informatics, public health and business, referring to health services and information delivered or enhanced through the Internet and related technologies. In a broader sense, the term characterizes not only a technical development, but also a state-of-mind, a way of thinking, an attitude, and a commitment for networked, global thinking, to improve health care locally, regionally, and worldwide by using information and communication technology (Eysenbach, 2001).

The application of e-governance in health care can help significantly in improving the efficiency, transparency and cost effectiveness of service delivery by providing a common platform for the healthcare providers, policy makers, professionals and the public at large. In public health, information management and communication processes are vital, and are in turn highly dependent on the availability of information. Though progress has been made in the area in the past few years since the early days of introduction of tele-medicine, a lot still remains to be done (Bhatnagar, 2014).

The Public Health Department under its e-Governance ambit has developed an assortment of applications providing for the inter-departmental needs of the organization. The focus of the department was primarily on five pillars as: Human Resource Management, Hospitals and Medicines, Communication, Administration and Citizen Centric. The wider use of ICT in healthcare is a basic condition for the development, implementation and further generation of innovative health care technologies. The collaboration of different sectors can create innovations beyond the capacity of any one institution alone. Public health leaders have a responsibility to understand and expand the beneficial uses of digital government (Kamlakar et al.).

Committee on Quality of Health Care in America and Institute of Medicine in the year 2001focused broadly on how the health system can be reinvented to foster innovation and improve the delivery of care. It aims for health care to be safe, equitable, patient centered, effective, efficient and timely. The committee took a set of ten general principles to redesign the health system, one of which included attention on developing care processes for common chronic health conditions. It also wanted to change the structures and processes of the environment in which health professionals and organizations function (Crossing the Quality Chasm: A New Health System For The 21st Century).

The United States is far behind other developed countries in the Health Information Technology (HIT) area and the major concerns lie between both the government with regard to its ability to encourage the healthcare system to adopt HIT through subsidies and to adopt HIT through subsidies and other incentives and the willingness of practitioners to adopt the same. This can be done by establishing new technologically driven services like tele-health, decision support tools, electronic ordering systems etc. (Anderson et al., 2006).

Ramani et.al. (2005) conducted a study to address the problems faced by urban public health sector due to rapid urbanization and provide a working model to improve primary healthcare services in Ahmedabad. It sought to develop a model on the public and private participation which was first implemented in Vasna ward. Another city project included the city of Uttarakhand, where the role of the government, hospitals and health care centers for putting tele-medicine into practice and the impact was monitored on the local population (Vaisla, Bisht & Pant, 2011). Orissa was also reviewed for the use of ICT applications such as tele-medicine, tele-referral etc. The results showed that there is great scope in the education and service provision sector but problems such as lack of financial and technical resources and resistance of practitioners to adopting new practices are identified (Subash, Das & Patra, 2008).

International Telecommunication Union (ITU) in 2008 had a detailed discussion on the general pattern of implementation of e-health services in developing countries by assimilating new practices with existing infrastructure. Emphasis was laid on the need for legislative, administrative and regulatory framework for effective e-health practices as well as sound financial planning. There has been a need for regional as well as inter-institutional cooperation when it comes to putting e-health initiatives into practice (Implementing E-Health in Developing Countries, 2008).

The National Knowledge Commission set up a working group which proposed to design, develop, and integrate e-healthcare informatics network framework in India. The Health Ministry also set up a National Telemedicine Task Force to evaluate the pros and cons of introducing e-health in India. Various initiatives were undertaken by various tertiary level super specialty hospitals in the public and corporate sectors to start telemedicine programs and tele ambulance for emergency health care, mobile tele-hospital for rural health (Mishra, Ganapathy & Bedi, 2008).

Integrated Disease Surveillance Project (IDSP) aims to connect district hospitals and state-run medical to detect early warning signals of a disease outbreak and begin effective and rapid health actions with the help of ICT at the district, state and national levels. Establishing the use of modern ICT for collection, storage, transmission and management of data related to disease surveillance within state-run medical colleges, infectious disease hospitals, public health labs satellite based allows speedy data transfer, training and e-learning for outbreaks and programme monitoring (Kant & Krishnan, 2010).

In the matter of incorporating ICT tools in the healthcare sector, the focus essentially centers around making the provision of healthcare services to the masses efficiently and with minimal costs. This requires investment in infrastructure development to enable adoption of the latest technology to increase the effectiveness of service delivery, in terms of cost, time and outreach (Bloom, 2002).

It is not just in terms of financial resources that the government has to be involved to promote e-health, but also by providing a legal and regulatory framework and favorable policies for the same. A critical problem that requires immediate redressal is the lack of technical skills among the practitioners of medicine. It is only by enabling stakeholders to use the resources available to them that a holistic e-

health system whose potential is realized be established in the healthcare industry. Furthermore, changing the mindset of current practitioners who may be resistant to radical new practices is of special importance to ensure that the benefit from these practices can actually be derived. Literature points towards the positive impact that can be brought about in due course of time with the expansion of said practices. Though spending a high proportion of the GDP in itself is not a guarantee of success in any domain, it has been noted that India spends less than the required amount in health sector, especially given the momentous in terms of infrastructure development and skill enhancement it faces. There is great scope for use of ICT in the education and research domains as well, which will serve long term benefits by exponentially increasing the capabilities of these institutions, heralding further progress (Ramani et al. 159-173).

Against this backdrop, this study analyzes the level of digitalization and general utilization of information technology within the private and government hospitals; with regard to consumer interface, and secondly, regarding the knowledge and attitude of people towards the same in Pune city.

Methodology & Data Collection
The objective of the study is to analyze the use of ICT by Government and Private hospitals in their daily functioning and whether the citizens of Pune city are aware of the advantages of ICT in the healthcare sector. The study is based on primary data collected from seven healthcare providers[1] (institutional respondents) and fifty-five citizens (individual respondents) spread across the city. The individual respondents included visitors in the hospitals. Special care was taken to include people of different economic backgrounds to be able to further observe and analyze the role that factor plays on shaping people's awareness levels and attitudes.

The data collection was carried out using two structured questionnaires. The first sought information from both private and government hospitals while the second collected responses from the receivers of healthcare services, that is, patients and citizens at large. For easier understanding, enhanced comparability and better interpretation of data, tools such as bar graphs, pie charts and flowcharts were used.

Result and Analysis
Given the use of two sets of respondents, the analysis of data has been split into two parts.
  ➢ *Individual Respondents*
The data was collected from 55 respondents across different hospitals which were part of the survey pertaining to the matter of use of ICT by these institutions. The respondents belonged to diverse ranges, based on their age and income levels. Of the total respondents, 30 (56.6%) were below the age of 30, 20 (37.7%) between the age group of 30 to 60 and 5 (9.43%) above the age of 60. Similarly, the randomized selection of respondents resulted in inclusion of people from different income ranges- 10 with less than a monthly income of less than Rs 10,000, 9 between Rs10,000 and Rs 20,000, 15 between Rs 20,000 and Rs 50,000 and 21 with above Rs 50,000.

i) Access to internet: Of out the 55 respondents, eight, all of whom belonged to the below Rs 10,000 per month income bracket, did not have access to internet. For those respondents, some of the following questions were not applicable. Figure 1 shows, 33 or 70.2% make use of the information available online pertaining to the field of medicine, which includes looking up information regarding symptoms, institutions, ratings etc.

Figure 1: Usage of Internet to Acquire Medical Information
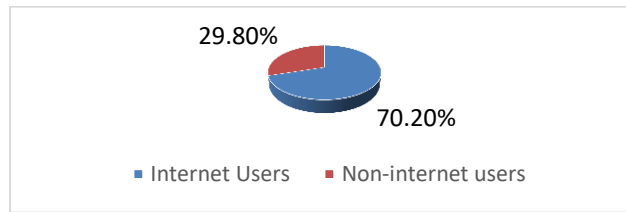
The reasons cited by the respondents who do not use information available online essentially was a lack of trust in the quality of information as well discomfort with using the internet by a minority. From the people who do use online information, responses were sought on the level of usefulness and reliability they believe the information to have.

ii) Satisfaction and trust in quality of content: The level of utility that users derive from online information based on its usefulness. Only one person was entirely unsatisfied with the quality of information, a majority thought of it to meet at least a basic level of satisfaction.

Figure 2: Degree of Satisfaction with Usefulness of Content
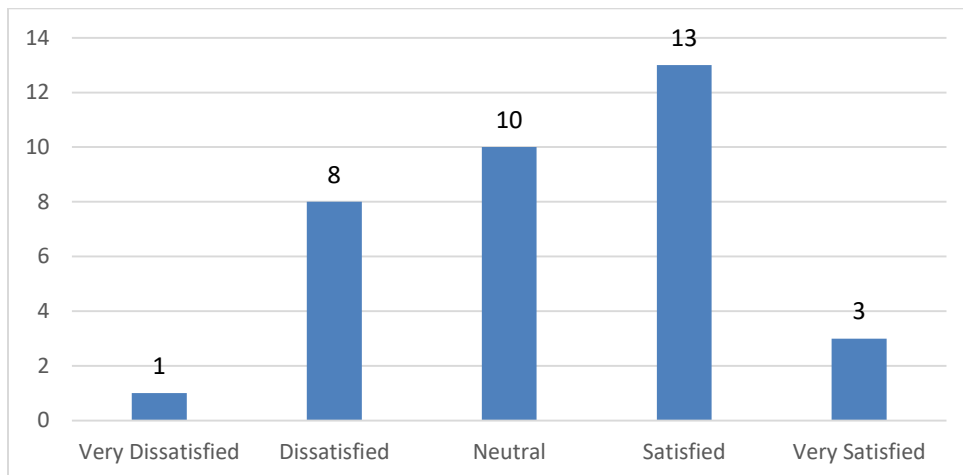

As for the matter of the level of faith they placed in the accuracy of such information, as shown in Figure 3, the numbers were close with 15 of the 33 respondents stating that they don't entirely trust information available and 18 saying that they do.

**Figure 3: Level of Trust in Information Available**
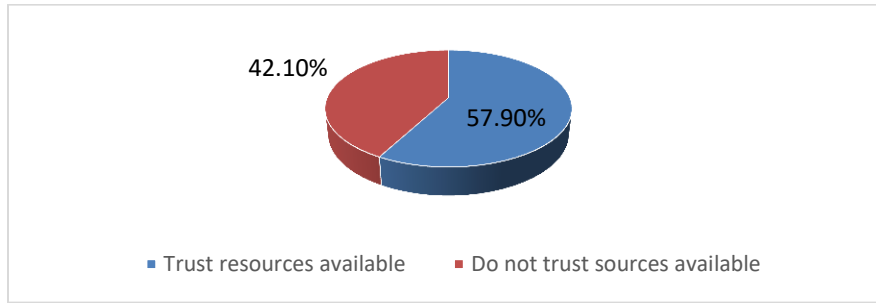
iii) Use of Online Grievance Addressable Platforms: With regard to the use of online portals set up both by the PMC as well the web pages of hospitals to express grievances, make suggestions etc., 19 of the respondents answered positively with regard to the usage of such platforms. However, of them 42.1% felt that the response to their inputs was inadequate.

Figure 4: Use of Online Grievance Addressable Platforms
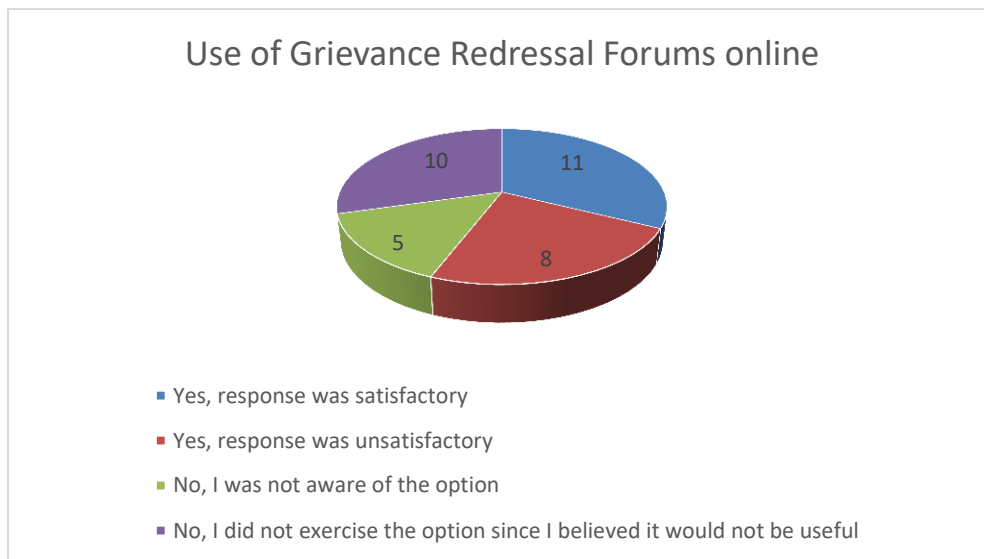
iv)Telemedicine and tele-counseling: Another area of focus was the response of people to the availability of telemedicine and tele-counselling facilities by respondents, which included even those respondents who do not have access to the internet. Of the total 55 respondents, 16 had availed these services before, with a majority of them satisfied with the quality of service that they received.

Figure 5: Use of Telemedicine and Telecounseling Facilities
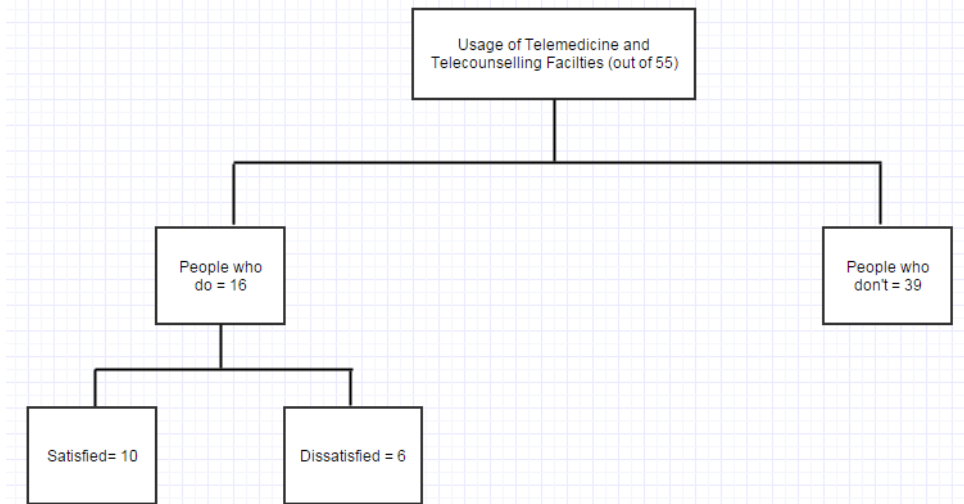
v) Impact of government initiatives to inform citizenry: Government initiatives to inform citizens regarding various health concerns such as vaccination programmes and to generate awareness about health concerns like diseases such as dengue, H1N1 flu, etc. reached 41 respondents, either through cellular or internet based communication, with 30 of them stating that they found the information received useful while 11 did not.

> ➤ *Institutional Respondents*

Of the seven hospitals, two (both government hospitals) did not have a separate wing of their IT departments that focused on the expansion of e-health services provision. The general areas currently covered to improve internal administration were billing, admission, setting up a website, use of online HMIS (Hospital Management and Information System), equipping doctors with personal computers and promoting use of telecommunication and paperless work.

To improve their interface with patients, the hospitals incorporated measures such as seeking online feedback, direct videoconferencing and treatment, and use of emails and text messages to communicate information to patients. However, these are measures implemented solely by the private hospitals. No such measures to enhance communication with patients were seen in the government hospitals.

Two private hospitals provide patients online access to their medical records and three hospitals i.e. two private and one government are equipped with videoconferencing facilities for internal, inter institutional and patient oriented interaction. None of the hospitals provide teleambulance facilities and only one provides telemedicine facilities.

The hospitals are evenly split on their opinions regarding the level of utilization of these facilities offered by the patients and those seeking information about them in a broader sense.

The private hospitals conduct regular trainings to keep updating the ICT skills of their staff. The government hospitals focus on ensuring that personnel are trained well to use the equipment and devices at their disposal, through tools such as the HMIS.

Most government hospitals were not found to be proactive in the area of generating awareness among patients, though one suggested the use of public displays to inform patients about the availability of these services. The private hospitals too stated the importance of better patient awareness to fully utilize the potential offered.

With regard to future plans, responses ranged from a general intention to keep up technological advances to more concrete goals such as improver user interface with target audience (government hospital) to implementation of a drone service to fly patients to the hospital (private hospital).

With the exception of one government hospital that has not implemented any significant ICT tools to improve administration, all hospitals responded extremely positively to the increased level of administrative ease and general return on investment upon implementation of e-health services by them, resulting in a general positive attitude regarding their rate of success at present.

Figure 6: Satisfaction from Using ICT Tools
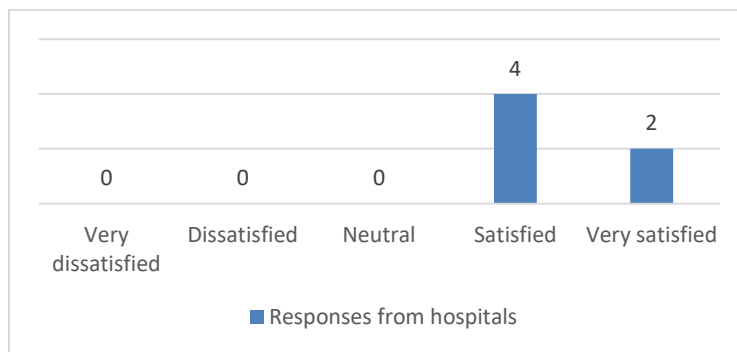
Findings

The primary research conducted focused on two aspects of the provision of e-health services in Pune to get a comprehensive understanding of the present status of the same in Pune.

It is evident that e-health services can only be used for the benefit of people above a certain income and education level. There were several respondents who do not have access to the internet. Even among those who do, a few people who are not comfortable with using smartphones or computers do not use the internet for such purposes. Among the internet users, over 70% use the internet to acquire information regarding medical issues, healthcare providers etc. There generally prevails a positive attitude regarding the usefulness of information with only seven respondents expressing dissatisfaction with the content available online. However, a larger number of respondents distrust the reliability of the content. This occurs due to the high quantity of online content, not all of which is useful and not distinguishable from the legitimate information.

Out of all the people who use the internet for information, only 57% use the platforms provided by the PMC and hospitals to provide feedbacks, suggestions and express grievances. The others mostly do not believe that doing so would produce useful results, with a third unaware of the fact that that was a service they could avail. Among the people who do use these platforms, almost half are dissatisfied with the response to their queries, problems etc.

Only a third of the respondents know of and use these telemedicine services, many of whom belong to the category of individuals who either do not have access to or use the internet for informational purposes. It is therefore clear that these services should be focused on certain target groups that are previously identified to ensure that resources are not wasted.

It is clear that though government awareness campaigns have significant outreach, they still have to have higher visibility to expand their audience. A quarter of the respondents claim not to have found the content of such campaigns useful, exhibiting a need for the quality of content to be upgraded as well. Suggestions provided indicate that among those who actually use the internet are informed people who can actively contribute to recognition of key improvement areas. Respondents want more government involvement in the dissemination of information regarding critical health issues since there is an undeniable element of reliability given the source of information. Furthermore, respondents want the convenience of internet connectivity and therefore desire an improvement in the current status of interaction with hospitals through the use of more sophisticated websites, apps etc.

Primary data suggests that most of the hospitals recognize the need and benefits in investing in adoption of ICT tools to improve their ability to administer better care for their patients and organize themselves. However, the extent of digitalization is clearly dichotomous when it comes to government and private institutions. Government hospitals are at a more nascent stage in the adoption of such tools, and at this point seek to meet certain basic goals that will lay the foundation for future developments in the same direction. The use of systems such as the HMIS is helping in increasing accountability, transparency and efficiency, raising their overall competitiveness. Both private and government hospitals, though at different stages in the process of bringing themselves up to speed with rapid technological advances. There are instances of well advanced government hospitals that are better off at the moment than some of the private ones. In the matter of providing telemedicine facilities, majority of the respondents' fared poorly. This is an area of concern since that is the only option for better connectivity for people who do not use the internet to enhance their experiences for whatever reasons. Though strides have been made in all areas of incorporating e-health tools to improve the quality of services provided, identification of different sets of consumers and their varying needs will enhance streamlining of efforts and delivery of services both by the local government and hospitals. Furthermore, in a rush to modernize themselves to better serve an increasingly technologically proficient clientele, hospitals shouldn't lose focus of the importance of reaching out to the other side as well.

Conclusion
It is evident that the citizens of Pune are largely aware of the services available to them in the domain of e-health services as well as of the particular limitations to these services. They try to actively engage in the dialogue to improve the given situation. Similarly, hospitals are sensitive to their need to keep up with technological progress as that not only helps them improve their internal administration but also improve their relationship with patients. Hospitals are proactive when it comes to challenges and want to constantly improve their capacities. This reflects positively on the government, hospitals and private individuals' desire to actively engage in the constant process of improvement. Keeping in mind the subject of e-governance, the PMC can improve the services provided by its health department, both in terms of better responses to complaints and suggestions, and by improving the quality of the content and outreach of its awareness campaigns. There is a need for increasing the level of outreach to create awareness regarding the spread of communicable diseases as well as general health concerns such as proper nutrition. Further, need for more user friendly apps to provide access to online records and a consolidated database to provide contact information of various doctors was emphasized.

Endnotes

[1] 7 hospitals (4 Government and 3 Private)- The government hospitals were Kamla Nehru Hospital, Sasson Hospital, Cantonment Hospital near Golibaar Maidan and Naidu Hospital. The private hospitals chosen were Dinanath Hospital, Siddharth Hospital and Ratna Hospital.

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