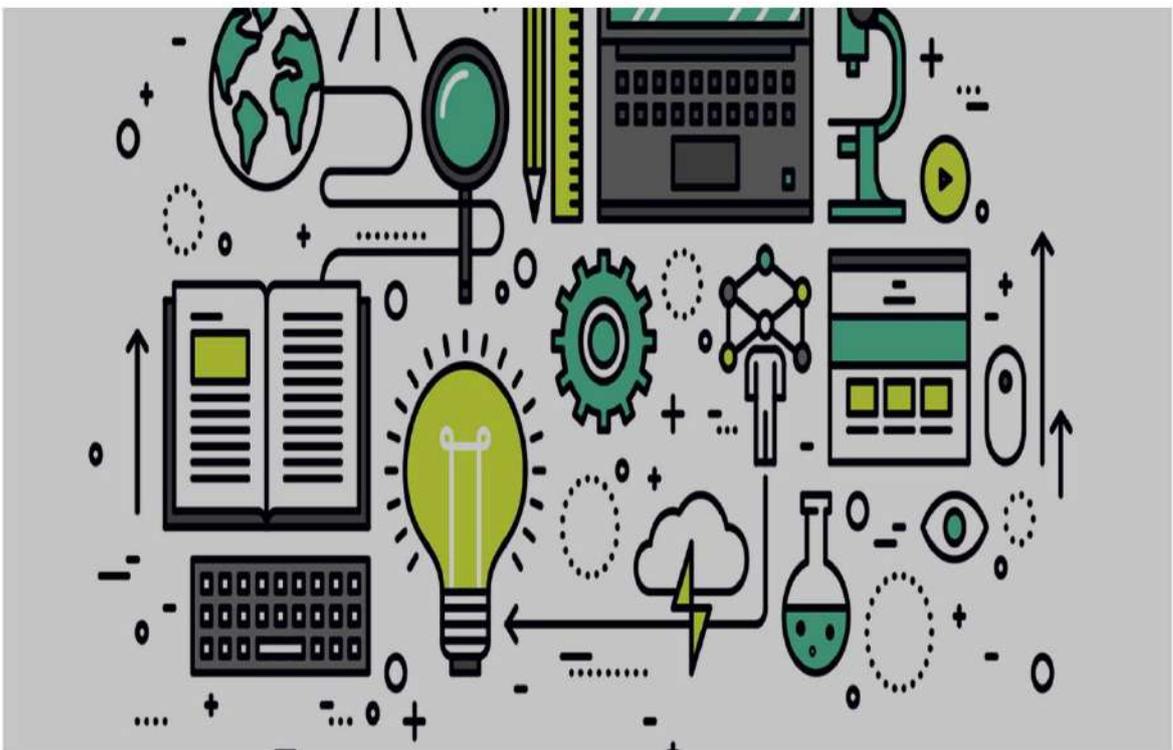


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ITIL Service Management Model for E-learning

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Abstract--- ITIL is one of the powerful approach to IT service management for any industries, such as in education. ITIL could help organizations use IT to reorganize business process and achieve the target. This paper presents a service management model for virtual education or learning management system from Petra Christian University in Surabaya, Indonesia. For the construction model, evaluation of the process of the ITIL along with virtual education components, which are: technological, administrative, communicative and pedagogical are conducted. Furthermore, the role and responsibilities of the involved actors in the system was discovered, and list of activities was defined to be developed for every step in a process of the service lifecycle, which are: service strategy, service design, service transition and service operation. The proposed model shows that the ITIL components can be adapted to the requirements of the education processes in virtual education.

Index Terms--- Virtual Education, ITIL, Service Management Model, E-learning.

I. Introduction

Nowadays, learning management system presents a series of challenges that must be solved to guarantee its quality. It needs standards and good practices that facilitate and substantially improve the conditions under which it works. For this reason, ITIL, which provides good practices that cover the most important activities of a service organization based on Information Technology (IT) [1], becomes an excellent alternative for the management of a virtual education system. This paper demonstrates the use of ITIL good practices in learning management processes and proposes a model that supports the management, development and proper functioning of this service both in supply and in support. It generates a methodology that can guide the process of implementation of any academic program with virtual methodology and where there is evidence of relationships between the different processes involved in the provision of the service. To achieve this, a bibliographic search was made of information regarding both virtual education, its evolution and its needs, as well as cases of application of ITIL best practices in the world, identifying objectives, methodologies and results, which served as a guide for the development of this. In addition, a fieldwork was carried out at the Informatics Department, Petra Christian University to achieve our objective.

The remaining part of this paper is organized as follows. Section 2 presents the background and the related work. Sections 3 presents the methodology of this research. Section 4 presents the discussion and analysis. Finally, the conclusions are drawn in Section 5.

II. Literature Review

Virtual Education

The traditional teaching model consisting of master classes, where the student takes notes, develops skills related to the search for information from different sources and faces a process of continuous evaluation [2] has characterized education since the last century. However, it needs such as: education throughout the different stages of life, the disappearance of time-space barriers and flexible academic schedules [3] give rise to a different education methodology that arises as a result of the implementation of information and communication technology (ICT) and the creation of systems of access to the network as a model of teaching and learning [4] called virtual education.

Virtual education has particular characteristics in the teaching process such as independence and autonomy [4] since students are the ones who manage and have their work rhythm; It also has Information Technology (IT) tools to make the experience of users interactive and dynamic, shifting the focal point from the teacher to the student and from teaching to learning [5]. The environment of virtuality is made up of four components identified as: pedagogical, technological, administrative and communicative [6], which in turn demand different levels of service and good practices.

Information Technology Infrastructure Library

The Information Technology Infrastructure Library (ITIL) was born from practical experience to incorporate IT in organizations to achieve their corporate objectives and goals. In globalized environment, it is important to have IT services with high quality standards that support compliance with its objectives. ITIL is a set of concepts and practices that allow the management of the IT service, its development and that of the operations that intervene in it [7]. For this purpose, ITIL describes in detail the designed management procedures to achieve optimum levels of quality and productivity in the provision of IT services. The library has undergone a transformation since its first version and today it has become a standard in terms of IT service management [8]. In its latest version, it describes the service life cycle, as can be seen in Fig. 1.

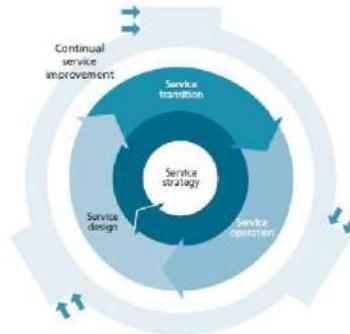


Fig. 1. ITIL V3 Service Life Cycle. [9]

Different research projects have shown notable improvements in the management of IT services. The research carried out in Hangzhou, China [10] in which ITIL processes were implemented in a company that manufactures garments, demonstrates a reduction in costs associated with the solution of problems and incidents, due to the short response times and the adequate management of resources and knowledge that led to its application. Latrache, Nfaoui, and Boumhidi, [11] propose an algorithm based on a multi-agent model through it which seeks to automate the process of response to incidents. It proposes a list of activities to be developed in its algorithm based on the ITIL incident management process guidelines, resulting in a reduction in resources and response times to incidents. Zhang, Wang, Zhigang and Zong [12], integrate ITIL processes and organization systems with Web services. These ITIL processes are not only integrated with the organization, but also across borders organizations that facilitate collaborative operations and exchange of knowledge on the Internet. Although the amount of research conducted based on the implementation of ITIL good practices is numerous, it is not easy to find research that address the subject of virtual education. However, for the case study, 3 papers were chosen where ITIL is implemented in higher education in search of the improvement of its processes.

Design of an information technology (IT) strategic management model for a university in Cartagena, Colombia was proposed, in order to standardize and optimize the management of the institution's processes [13]. To achieve these objectives, top management must actively participate in the change process, not only accompanying the change. Implementation of the proposed model will allow the institution to strategically manage IT so that it can be a competitive institution in today's world. Finally, top management can position their institutions to adapt to the new competitive environment. Dominguez and Aguilar [14] review the processes of Information Technology (IT) operating in an e-Learning Department in order to solve the problems in an educational institution. They proposed a combination of ITIL and Quality Matters (QM) rubric frameworks as a quality assurance model. By implementing this framework, high levels of monitoring and management of applications and infrastructure result in a satisfactory delivery of user service. Liu, Dong and Sun carried out a deep analysis on the IT services of School of Network Education and ITIL standards, in order to solve the problems in information technology (IT) services of distance education [15]. They propose an IT service management (ITSM) model for distance education that focus on service strategy model in the process of needs analysis and change management.

III. Methodology

The construction of the educational service management model with virtual methodology, based on ITIL practices, was developed as follows:

1. The processes of the virtual education, bachelor of Informatics at Petra Christian University were studied.
2. The ITIL processes that contribute to the development and improvement of the virtual program with respect to each component studied were determined.
3. The importance of each component was determined in relation to ITIL processes for programs with virtual methodology.
4. A model based on ITIL practices was developed that supports and interrelates the 4 components of virtual education.

Given the scope of the research, 16 of the 30 processes of the service life cycle were addressed, for which an examination based on two criteria, urgency and viability [10] was carried out.

Finally, it gives a priority to the processes listed below: Service Portfolio Management, Financial Management, Demand Management, Business Relations Management, Service Catalog Management, Service Level Management, Capacity Management, Availability Management and Service Security Management. In addition, the processes of Knowledge Management, Event Management, Incident Management, Problem Management, Access to Services Management and Requirements Compliance. Once the fundamental ITIL processes were defined for the case study, their relationship with each component of virtual education was analyzed and the existing relationships were marked with x as shown in Table 1.

TABLE I. Summary of interactions: ITIL processes - Virtual education components

	Pedagogical	Communicative	Technological	Administrative
Service portfolio management	x	x	x	x
Financial Management for IT services				x
Demand management			x	
Management of business relations		x	x	x
Management of the service catalog	x	x	x	
Management of service levels	x	x	x	x
Capacity management			x	
Availability management			x	
Service security management		x	x	x
Knowledge management			x	x
Event management			x	
Incident Management			x	
Compliance with requirements			x	
Problem management			x	
Management of access to services	x	x	x	x
Summation	4	6	14	7
Percentage	13%	19%	45%	23%

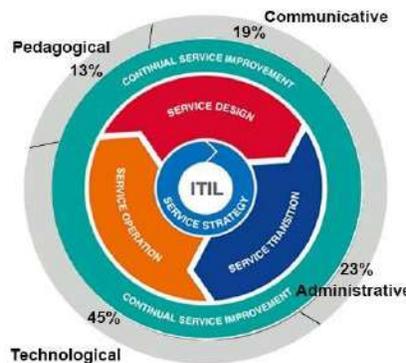


Fig. 2. ITIL life cycle in relation to the components of virtual education

Then, summation of the ratios by component was carried out and the weight of each one was calculated against the ITIL processes. From this, Fig. 2 was designed, which shows that 45% of the life cycle of the education service with virtual methodology is supported by the technological component, made up mostly of the processes of operation and transition of the service, while the pedagogical, communicative and administrative components (23%, 13% and 19% respectively), are based on the strategy, design and service transition processes.

IV. Discussion and Analysis

For the elaboration of the Management model for virtual education (MMVE) management model, the ITIL processes were related to the actors that intervene in the provision of the service and on whom their correct functioning depends. The model compiles and structures the processes throughout the ITIL life cycle, as a tool for the management of the virtual education service, applied to the case study in the Informatics Department, Petra Christian University, where the responsibilities associated with each of the involved actors are: Ministry of Research, Technology and Higher Education of Indonesia, college and students.

Ministry of Research, Technology and Higher Education of Indonesia has responsible for requiring educational entities content, resources and learning environments in accordance with pre-established quality standards.

College has responsible for providing a quality service that meets the needs of students and the requirements of the Ministry of Research, Technology and Higher Education.

Students have responsible for demanding quality academic content and adequate resources for their learning activities, identify disagreements and make suggestions, complaints and requests, in the first instance to the University and second to the Ministry of Research, Technology and Higher Education. From the study of the institutional guidelines, described in the Strategic Plan of Incorporation of Media and Information Technologies in the educational processes and the needs found from the research, activities were established to be developed during each process of each of the stages of the life cycle that seek to satisfy the needs of each component of virtual education as shown in Tables II - V.

Table II lists the activities planned for the service strategy stage, who should provide guidelines to establish and prioritize the objectives of the virtual program. Market study and harmonize the supply/demand relationship to propose services that provide added value are necessary. It is essential to manage the necessary resources to provide the services that are offered that consider their associated costs and risks. The most important during this stage is to develop plans that allow sustainable growth, which is why it becomes a feedback stage that guides and supports the program academic.

TABLE II. Activities to be develop during Service Strategy

Service Strategy	Activities
Financial management	1. Consolidate strategies for the growth and adaptation of virtual spaces that guarantee tools that generate learning environments where the student, the tutor and the university interact and build a quality academic program.
	2. Manage the acquisition of equipment and platforms allowing viability and competitiveness of virtual education programs.
Management Portfolio of services	3. Develop contents that involve the student's learning activities and collaborative tools that facilitate the appropriation of knowledge.
	4. Establish multimedia content and interactivity tools that allow dynamism in the platform.
	5. Define the ICT infrastructure that supports the construction of teaching-learning processes and compliance with established standards.
Demand Management	6. Support through the infrastructure of servers, the concurrent services on demand and ensure the provision, accommodation and storage in the deployment of services.
Business Relations Management	7. Establish relationships that are generated in the communicative exchange student-teacher and student-student.
	8. Establish causal relationships that are generated between teacher-student with the resources assigned to each of them.
	9. Establish relationships between the actors involved in the process of planning, design and operation of the service, guaranteeing the integration of knowledge.

Each activity of this stage is directly related with one or more of them, for which synergy is required in the execution of the set to ensure proper performance of the proposed model, Fig. 3 describes these relationships and they invite to logically follow each one of them.

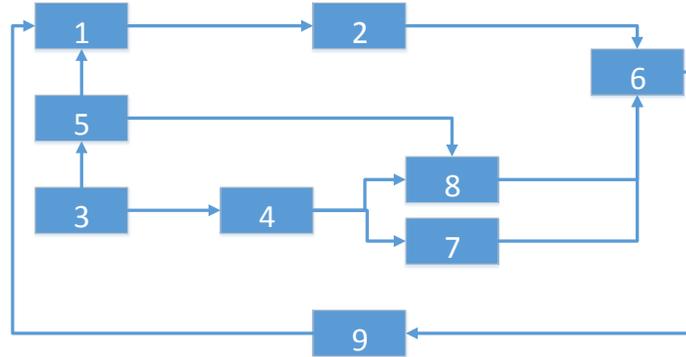


Fig. 3. Flow Diagram of Service Strategy

Service design is a stage that strictly depends on the objectives and guidelines, taught by the previous stage. It must take charge of adapting the services provided by the academic program to market needs and it works as an evaluator of capacity, security, availability and service levels.

During this stage, requirements must be satisfied, something indispensable for the feedback that needs the life cycle of the ITIL service. The established activities for the Service Design are shown in Table III.

TABLE III. Activities to be developed during Service Design

Service Design	Activities
Management Service catalog	1. Review and adjust the service portfolio if it is relevant, according to the needs of the student based on the pedagogical models used in the learning. 2. Implement digital content in an appropriate way so that it is received efficiently in the learning process. 3. Propose modernization and process improvement services. 4. Permanently update contents stipulated in the virtual course development plan.
Management Service levels	5. Establish communication tools between alumni and tutor-student, that allow feedback in the executed processes. 6. Design and update the protocols that show the calendar of activities, opening hours and the communication channels that will be established whether they are synchronous or asynchronous. 7. Advise the licensing of software and the creation and administration of virtual users. 8. Define user-service responsibilities in terms of information security, technological infrastructure, software and connectivity. 9. Implement policies that generate a favorable climate in the university community.
Management Capacity	10. Guarantee the operation and update of the virtual campus 11. CMS support (content management systems) and LMS (learning management system)
Availability management	12. Manage access to 24x7x365 platforms. 13. Set hours of Help Desk 8-4.
Management Security of the service	14. Ensure confidentiality in evaluations, and follow-up on the progress of the course. 15. Define mechanisms that ensure that the virtual course modules correspond to the indicated theme. 16. Ensure that the content complies with the established copyright standards. 17. Protect information and be governed by rules of access level and confidentiality. 18. Establish security plans and levels. 19. Define security policies according to ISO27001. 20. Monitor the correct access to the allowed content. 21. Consider the methodology of legal aspects that directly intervene or have relations with the degree: student statute, teacher, academic, intellectual property.

It can be seen in Fig. 4, the flow diagram of the dependence between processes that make up this stage.

The service transition stage must manage all the information relevant to the provision of the service in order to ensure that it is available to the agents involved in the design, development, implementation and operation of any update of the virtual spaces, therefore it becomes the MMVE focus; the point at which all the management activities proposed for this model, constitutes the main support of the continuous Improvement stage, which is transversal to all the others and requires all the accumulated information to manage improvements in services borrowed

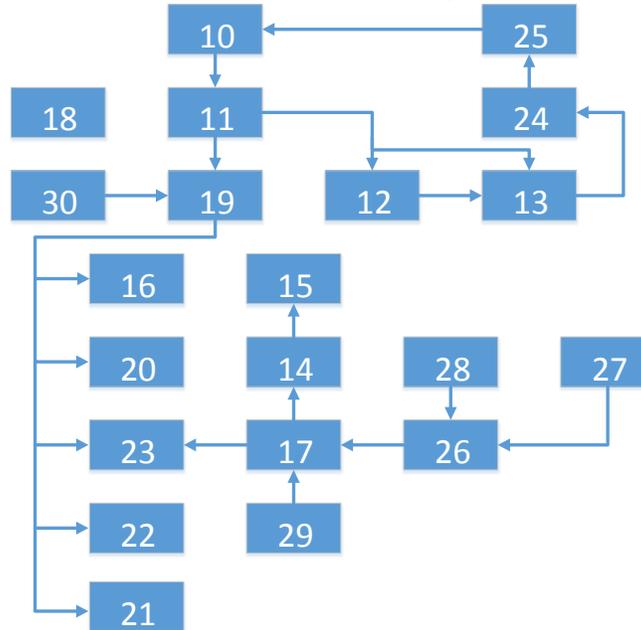


Fig. 4. Flow Diagram of Service Design.

The incidents that occur and how they should be solved are recorded during the operation. Moreover, all the aspects considered as problems in the service and are transformed into opportunities for improvement. The own knowledge management process of this stage established the activities that appear in the Table IV.

TABLE IV. Activities to be developed during Service Transition

Service Transition	Activities
Knowledge management	22. Updating the platforms, software and networks, together with an implementation and deployment plan that guarantees a successful change process. 23. Manage a database configurations, where all the relevant information is available for consultation and use.

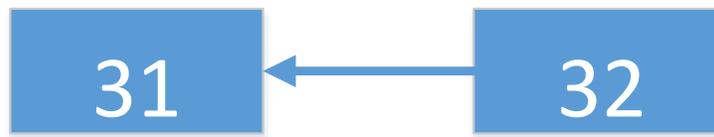


Fig. 5. Flow Diagram of Service Transition

The flow chart for this stage in this initial model is simple, since it has only involves two activities. The flow diagram can be seen in Fig. 5.

Service operation is the last stage of the life cycle and it is critical because it depends on the perception of user to the service. During this stage, they coordinate and implement all the necessary activities for the provision of the agreed services with the quality levels required. This stage is responsible for supporting users through the management of the technological infrastructure and provide the service in the desired conditions.

TABLE V. Activities to be developed during Service Operation

Service Operation	Activities
Events Management	24. Report by users of the operation of the platform. 25. Report of incidents. 26. Design of formats for the management of events that became incidents in charge of the help desk.
Incident Management	27. Lines of work at a virtual level must be supported by cloud computing or another mechanism and an alternate server of the university in case of failures. 28. The help desk is responsible for providing incidents support to the user.
Compliance with requirements	29. Perform periodic tests of connectivity of the servers, attend requests for improvement.
Problem management	30. Establish service performance indicators. 31. Monitor the service in search of incidents and their causes. 32. Carry out control and monitoring of each incident and generating reports that allow traceability.
Management of access to services	33. Have free consultation resources for users with relevant content such as schedules, support materials and interaction processes. 34. Ensure the ability to access the different resources of the course at any time, consider the configurations of visualization, functionality of the tools and access regardless of the type of software to use. 35. Manage access to software according to criteria for all users in any scenario. 36. Guarantee the services of virtual classrooms, video-conferences, Webinars, Weblogs, Employment, Ecommerce and system of online assistance.

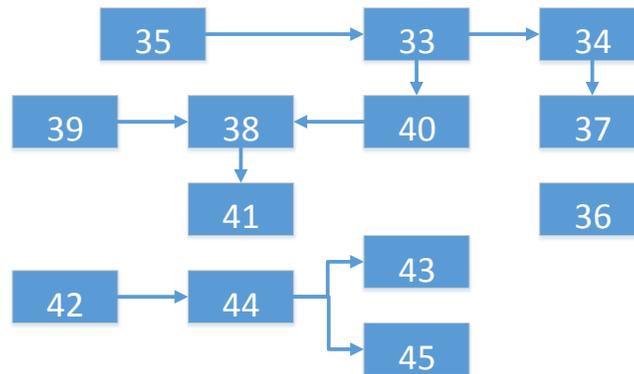


Fig. 6. Flow Diagram of Service Operation

The objective of service operation is to comply with the proposed guidelines and developed throughout the other stages of the life cycle. The contribution results and indicators are driven by the continuous improvement and managed from the start of the life cycle by the service strategy stage.

The activities that appear in Table V are vital for meet the objective of this stage. The flow diagram of Fig. 6 shows the relationships for each of the proposed activities

V. Conclusions

The proposed model shows that the ITIL components can be adapted to the requirements of the education processes in virtual education. It can facilitate the management in the provision of this type of services.

Success stories in the implementation of ITIL practices demonstrate the added value that provide a service and apply a model based on these practices that seeks to satisfy pedagogical requirements, administrative, communicative and technological. Moreover, a system of direct interaction and immediate user – service is studied, where the response times to incidents and requests become in the indicators that measure customer satisfaction.

Finally, it makes MMVE an excellent option for achieving of the objectives of a system with these characteristics.

It is expected to consolidate this model as the basis of a academic program with successful virtual methodology. In addition, it is necessary to carry out the respective deployment of the processes raised by MMVE, follow up on each one and establish performance indicators during the provision of service. It is necessary to detect opportunities for improvement over the model and implement in it the remaining processes of the ITIL library in order to complete the life cycle in its whole.

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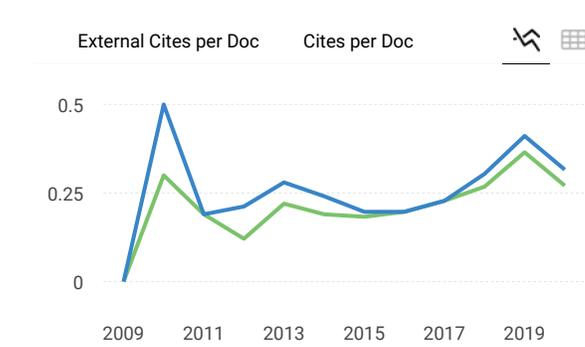
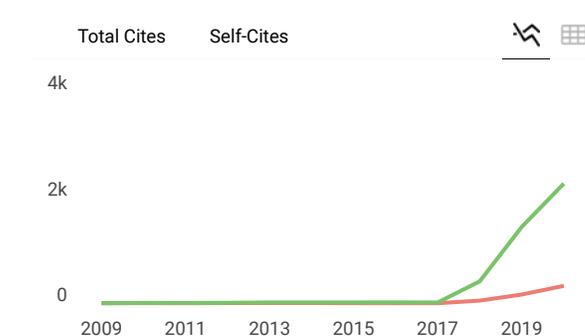
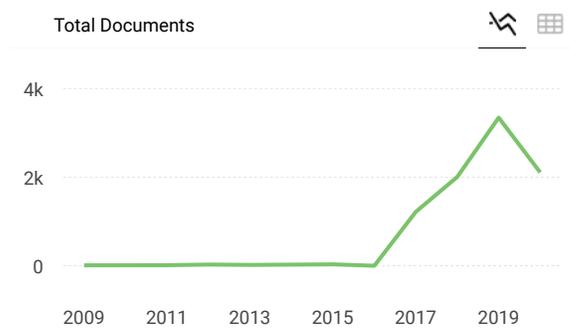
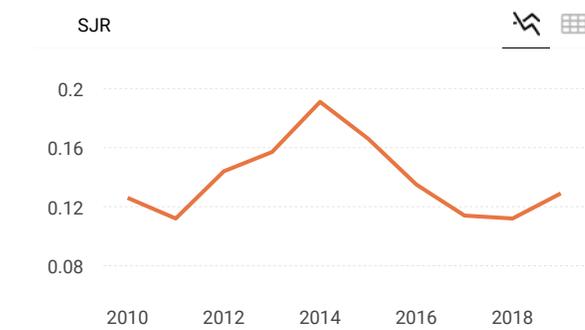
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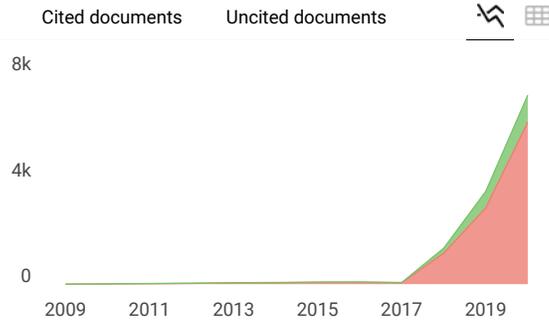
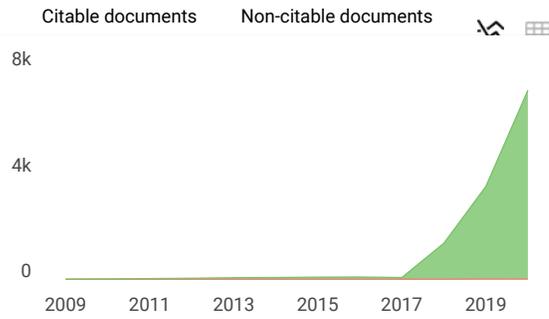
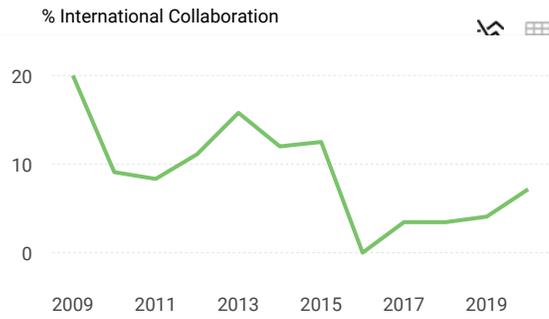
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