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Digitization model for costs and operating times reduction in Peruvian Banks

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Abstract

Deforestation is one of the problems that is producing a significant impact on the environment in countries that have large extensions of forests such as Peru, caused by different factors such as paper consumption, whose increase in recent years has also generated an increase in the costs and times related to the management and transportation of physical documents. These physical processes were further affected due to the COVID-19 restrictions, having a significant negative impact on customer satisfaction due to some processes that required their presence at bank branches. According to recent research, 90% of financial institutions continue to maintain a traditional document management system that consists of printing, storing and consulting physical documents, due to the lack of culture and activities aimed at digitizing processes; however, this change is possible with a model oriented to the transformation of said processes and the organizational culture; our main motivation to carry out this research was the change that the digitization of processes offers to companies and the environment. Our management model consists of 4 stages: collection of necessary requirements, identification of the main problem and improvement objectives, execution of the 3 management tools selected from our model and validation of the results obtained. The result obtained thanks to the application of the model in our validation case, shows a reduction of 65% of the costs related to document management in the first 3 months, in the following 3 months the reduction suffers an increase to 95.37%. In addition to this, the time to search and obtain documents will be reduced by approximately 99%. In conclusion, we determined that Change Management and Organizational and Infrastructure Management are necessary to be able to transform physical processes into digital ones since these three complement each other.

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Keywords: Change management; Digitization process; Business management; Banking; Green banking

1. Introduction

In Peru, the increase in paper consumption is not unfamiliar to the rest of the world, due to the banking culture that we live in and that generates a high number of this material being consumed in the financial sector due to

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the management of traditional processes such as physical contracts, product information in booklets, etc. This is relevant since it causes the costs and times related to the printing and storage of these documents to be high. In addition, it generates a negative environmental impact because the trees are used as raw material for the production of paper, causing a negative impact on the ecosystem due to the necessity of raw pulp to produce paper, obtained from trees.

Several studies indirectly sought to design a new digital transformation system to digitize their processes, including a statistical method to assess the use of eco-friendlier resources and a maturity model for digital banks to generate confidence in non-face-to-face transactions to clients. However, these proposals are not aligned with the reality of Peru because they do not have an impact on both costs and time caused by paper usage.

The foregoing leads to the main problem being the high costs and excess time used by banks to ensure the availability and review of physical documents. According to the IACCM (International Association for Contract & Commercial Management), contract administration has the limited use of technology as a weakness, due to this, 60% of companies lack software that helps them to continue advancing in the digitizing of their processes, making these profit losses on average 9.15% of their annual income. These losses would be unnecessary in case of digital transforming processes. The analysis of annual reports, allowed us to determine that the main banking entities in the country, registered a high paper consumption from year 2012 to year 2017. The highest consumption was found for ABC Bank (fictitious name for purposes of this investigation), with a total of 1226.8 tons of paper from 2012 to 2017.

In this paper we present a process management model that seeks to reduce the operating costs of financial entities through a process of constant digital transformation, reducing the use of paper and associated management, movement and storing activities. This process management model will contribute to environment care and preservation and considering the sensitivity of the exchange of information due to the standards set forth by SBS related to financial documents that contain customer information such as signatures and fingerprints. The proposed model also includes Change Management, Business Management and Infrastructure and Technology Management. These three management pillars interconnect with each other, since the adoption of the proposed model implies that the people involved in it progressively adapt to the technologies that will be implemented and the organizational change carried out.

In the next table we will describe the meaning of some abbreviations used in this paper and will include the page on each one is first used (see [Table 1](#)).

Table 1. List of abbreviations.

Abbreviation	Name	Page
CC	Cost of Paper Consumed per unit	14
CP	Bundle Sheets Cost	9
CTC	Paper Consumption Total Costs	9
CTCo	Total Cost of Paper (inquiry)	14
DB	Data Base	12
DT (i)	Time Decrease (inquiry)	9
DT (t)	Time Decrease (transport)	9
IACCM	International Association for Contract & Commercial Management	2
QFD	Quality Function Deployment	4
QH	Quantity of Paper Sheets by Bundle	9
QHo	Quantity of Paper Sheets by Transaction	9
Qo	Transactions Quantity	9
QTH	Consumed Sheet Quantity	9
SBS	“Superintendencia de Banca y Seguros del Peru”	2
TC	Total of Paper Consumed	14
TNP (s)	New Process Time (s)	9
TPA (s)	Actual Process Time (s)	9

2. State of the art

2.1. Digital transformation model

The digital transformation models found after a review consist of information management, saving them in reduced objects. Liu et al. [1] reviewed the importance of this tool for the adjustment of resources within an electronic banking project, providing a competitive advantage, and explored digitization as a concept to adjust its resources. Pourebrahimi et al. [2] proposed a framework for the implementation of digital banking, identifying the requirements and facilitators, this framework will capture digital banking as the future of the banking industry, exploiting its capabilities can be better adapted to banks. But Yablonsky [3] made use of a multidimensional framework, integrating business, technological and management innovations to provide a new approach for various platforms because companies are not adapted to new technologies. In addition to the concern to implement a digital transformation strategy within an organization that is in pre-digital development, looking for a financial services provider to join a new digitization strategy, building a dynamic model in which iteration is involved between learning and doing as Chanas et al. [4] explained is necessary to adopt this.

Digital transformation can help us convert a physical institution into an institution that contains digital philosophies, increased transactions, and customers. In the banking sector, it generates a lot of confusion among the employees and managers, making it very difficult for them to not accept this transformation, which is why extensive training is required to ensure that companies in the sector are able to change.

2.2. Organizational change management

This tool seeks to take advantage of developments within the business environment to benefit the organization, anticipating changes and building a flexible structure to respond to them. Obonyo and Kerongo [5] identified that the change must be adequately addressed, but there are no leaders who present the basic knowledge to solve the problems. Chatarina Skogland [6] explored how a company that has an organizational strategy to strengthen organizational change can provide a new concept of work, focusing on the interrelationship between artifacts and behaviors. Hechanova et al. [7] examined the differences between change management and the leadership of workers in a company, through path analysis and regressions, since the relationship of change in organizations with change leadership had not yet been examined, implicit.

Through change management we can deduce that many organizations require various training so that their workers can be suitable for the changes they are subject to. And finally, these changes must be driven by a person who has a variety of knowledge, expressing leadership in the organization.

2.3. Green banking philosophy application

This philosophy consists of practices carried out by banks so that their processes are sustainable in economic, environmental and social fields alike. Tara et al. [8] carried out searches on the relevance of the philosophy and why it should be adopted by banking entities since they seek to save the growing degradation of the environment, in addition to the fact that shareholders put great pressure on banking entities so that business are carried out ethically and with sustainable development. Other authors [9] implemented Green Banking practices within a bank in Bangladesh, to reduce waste and give priority to the environment and society, through certain tools such as Mobile Banking, Green Financing and Online Banking that reduce problems most serious in the India. In addition, Chandra and Pandey [10] explains that the concept of Green Banking was studied to identify the steps so that the entities adopt the philosophy and can create awareness in their workers, consumers and their public, among those steps is the use of solar energy panels as saving lights. Giridhar and Sudhakar [11] inquired about the drawbacks and challenges that banks face so that they can adopt the philosophy, considering the advantages and limitations that it has.

In conclusion, the use of this philosophy, its practices should be promoted not only by financial institutions, but also by governments and state entities should help people learn about this philosophy and know how it can be implemented for the care of our around; they even no longer present implementation limits, so that, on the part of the clients, financial entities are expected to assign a budget for each activity that requires such practices.

2.4. Lean Management and its application in service companies

This methodology offers better performance to customers, employees, and society in general, providing added value to the organization. Michal Demecko [12] describes that the tool can be implemented in any type of organization, if its focus does not change and it can be executed in a simple way, so they complete their study by identifying all types of waste that they can avoid. Hallam and Contreras [13] examined the integration of Lean and Green Management, proposing that their results give sustainable improvements and better performance through “win-to-win” scenarios. dos Santos and do Rosário Cabrita [14] identified that banks tend to be subject to structural changes that generate a negative impact on their activities, so they propose a methodology that allows “an investigation to preserve significant characteristics of real events”, concentrating on following new strategies that offer efficient and profitable services, while not jeopardizing the customer’s perspective. Also, Netland et al. [15] examined control practices and their relationship to corporate support program implementation, explaining the orientation of Lean for its implementation in global plants using a GEM evaluation, and then conducting a survey with exact measurements to assess plant yield.

In conclusion, the implementation of Lean Management provides many benefits and, together with Green Banking management, can generate much better value both in the market and for the customers themselves. This tool has been considered as a clever solution to the problems of the banking industry, as they dedicate themselves to shaping their businesses and seeking strategies to face the new challenges that appear from time to time.

2.5. Application of the QFD matrix in processes

The QFD orders data coming from a user to establish what are the requirements or important needs for that user. Jin and Choonjong [16] used the tool for a study of 3 banks regarding their complex services, to collect the most important needs within said banking entities; considering that previous tests results were ineffective; however, Shahin et al. [17], integrated the QFD with the side roof matrix and TRIZ, a better basic knowledge base to resolve contradictions between customer requirements, generating favorable and detrimental results at the same time and with the help of C-shaped QFD 3D Matrix developed by Shahin et al. [18], a concurrent three-dimensional “house of quality” is simultaneously created, reducing the cycle time and generating better management over the design process; another way of using QFD is to renew the service to customers, implementing the matrix in technological processes.

Designing an exclusive supplier process for electronic services oriented to internet banking as Zanjirani [19] developed; inspecting the need to provide a model to stand out in the market through QFD, improving processes or services to be of high quality, in addition to satisfying the changing needs of consumers is also important as stated by Morteza Ghayour [20].

Thanks to the QFD tool, it is possible to define the most important requirements of a bank’s customer, resolving contradictions and generating results, whether useful or not. By implementing an effective QFD matrix, it is possible to identify what can be improved to optimize processes and design new products, or redesign existing products that to better fit customer needs.

3. Contribution

3.1. Proposal justification

Previous research used frameworks and models to modify processes within financial entities, describing multiple benefits that a change would bring to organizations in the field. The proposed model is based on the Lean Management model developed by Hallam and Contreras [13], according to this author the integration between the Lean and Green Management philosophies have been largely weak, but the strongest evidence indicates that implementation of Lean functions as a catalyst for Green Management through the reduction of operational waste that impacts the environment and related costs. Likewise, the Green Banking model was used to measure and identify the processes that generate costs in banks and that can be modified to reduce the waste and costs generated, using India as an example, where some initiatives were successfully implemented. Regarding the QFD proposal, we use the model approach in banks to guide and mold the document digitization solution for internal users. Finally, the

Table 2. Benchmarking – Proposals comparison.

Evaluation	Costs	Times	Data storage	Paper consumption
Lean Management model (Hallam & Contreras; 2014)	X	X		X
Green Banking model [21]	X			X
QFD proposal (Shanin, Bagheri & Vaez; 2018)			X	
Process Transformation model [2]	X		X	
Contribution	X	X	X	X

Process Transformation Model allowed us to identify the factors and prerequisites that are needed to digitize bank processes (see Table 2).

Our proposal achieves all expected benefits of previous research by combining and using the different tools of these in a sequential manner, including change management, to achieve the adaptation of workers to the new digital processes.

3.2. Proposed model

Based on the interactions between Change Management, Business Management & Infrastructure and Technology, the proposal was divided into four phases: Requirements Definition, Planning, Implementation and Closure; These phases make the model applicable to all types of banking processes that still require the use of paper. Here, we provide detail on functions of each of the parts:

- Phase 1: Identify the main requirements to modify the actual process with the use of QFD tools, Lean Management, and the Green Banking philosophy. In addition, measurements of costs, times and waste generated in the current process must be obtained.
- Phase 2: Define the improvement objectives and plan the implementation of the tools over a pre-established timeframe.
- Phase 3: Implement Change Management, Business Management and Infrastructure and Technology in the process to be modified, generating input data to provide comparison with results before implementation.
- Phase 4: Carry out the comparison of the Output of the modified process with the data obtained initially, thus measuring the performance, proposing additional improvements if needed.

3.3. Model components

- Definition of Requirements: The definition of requirements of the organization helps to define where you want to direct the processes, the culture and technology of the desired change with the proposed model and what tools to use. Also, the model includes QFD matrix, the use of the Green Banking philosophy and the use of Lean Management, this based on other models that used only a single tool.
- QFD Matrix: The matrix identifies the requests of internal users, covering the most important needs of banking entities with our proposal through 5 items. They have been oriented towards the need for a web platform to allow access of scanned and stored the documents after they have been scanned and stored on a server.
 - Current Company Analysis: Run the cost, time and waste analysis of the current process that will be transformed, to make possible comparisons after model implementation.
 - Green Banking: Develop or change long-term sustainable processes with a positive impact on the environment.
 - Lean Management: With the main problem identified, our proposal is based on the use of Lean to analyze the current processes to be intervened, in such a way that the following outputs are obtained: waste elimination, implementation of the Green Banking philosophy and New Process (see Fig. 1).
- Planning: The improvement goals of our model need to be aligned with the goals of implementing the new processes, and they need to be quantifiable. They must have the following characteristics:

– *Specifics*: Concrete goals.

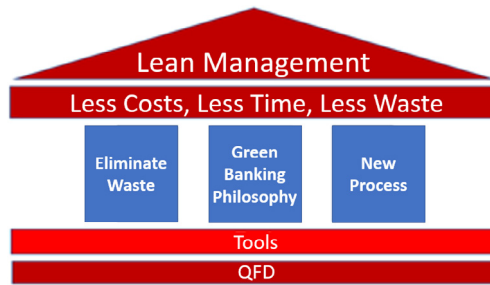


Fig. 1. Lean Management.

- *Measurable*: They must be quantifiable and start from a current situation with a starting value and a future situation with an objective to be achieved.
- *Achievable*: Must be within the scope of the proposed tools and methodologies; must have a defined timeframe and must be aligned with the budget and available resources.
- *Relevant*: It raises the importance, for the company, of the objective and the prioritization with respect to other improvement objectives. The benefit to be achieved must compensate for the efforts to be made and the potential costs that may be generated.
- *Time*: They must be affordable within the established time limits and according to existing needs. Also time limited for not postponing the enhancement.

● Implementation

– *Change Management*: Change Management is essential when digitally transforming an organization, change brings benefits such as organizational flexibility where innovation is constant; In addition, the changes that are going to be managed must be communicated, so that adverse reaction by people of the company on whom the new culture will be instilled, decreases; our proposed model uses this tool to improve acceptance in terms of process change and adaptation oriented to digitization, and adds an additional step involving introduction to new digital tools (see Fig. 2).



Fig. 2. Change Management factors.

The Change Management of the model must be handled through four variables; these are:

1. **Organization’s Culture**: It includes all the values, rules and tangibles of members of the organization and their behavior. The culture that is created through the influence of management, in which the people who hold the reins of the organization and the employees, assume roles when solving problems, serving customers, and carrying out their activities. In addition to providing a sense of how to run the company and its top priorities. The culture forms that sense of duty that people have when striving, to create a vision of the future to achieve the objectives of the organization.
2. **Organization’s Structure**: Refers to the grouping of tasks and people into smaller groups. Organizational capacity is also strongly tied to developing long-term sustainable change and operational capacity.

3. Leadership: Leaders must be able to perceive the need for change and make it a priority, managing as much time and attention as possible.
4. Digital Tools: Training should be carried out on the new digital tools that will be used for the new processes. These trainings must be carried out gradually to improve acceptance by users.

– *Technology & Infrastructure*: These are the technological and infrastructure levels (see Fig. 3):

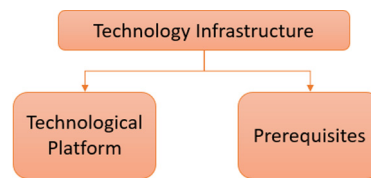


Fig. 3. Technology & Infrastructure levels.

1. Technological Platform: Platforms that store information in clouds or databases and that can be used by the organization.
2. Pre-requisites: Technological capabilities and resources that will assist in the implementation of information support platforms.

Business Management and Infrastructure and Technology, its levels and sub levels, depend on the internal and external resources of the organization, since, if they are not available, the digital transformation will present difficulties or cannot be carried out. Internal resources refer to resources related to internal operations and embedded in business flows and organizational culture (such as communication between units and the organizational structure for decision making). External resources refer to customers, available technology, and partner relationships.

– *Business Management*: These are the Business Management levels (see Fig. 4):

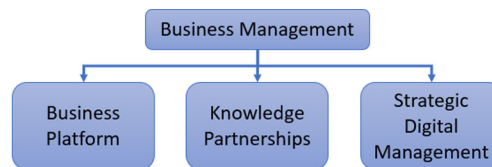


Fig. 4. Business Management levels.

1. Knowledge Partnership: Individual or business networks that receive feedback from groups to help the company to determine and achieve its goals.
2. Strategic Digital Management: Knowledge of Strategic Management focused on forging relationships with strategic digital partners.
3. Business Platform: Value-added Business Models that facilitate exchanges between independent groups.

– *New digitization Process*: The two components mentioned above (Business Management and Infrastructure and Technology, together with Change Management) of the proposed model, will serve as the basis of the process that will be transformed, from a traditional process to a digital process; later the information resulting from the new process is stored in a database, because the model helps digitize all types of documents (not all documents can be digitized because certain documents requires a standard to store a physical copy).

● Closure

- *Calculation of Costs, Time, and Waste Reduction after implementation*: Costs, times and reduced waste are considered after implementation depending on each improvement objective set out in the model.
- *Comparison Results (Before vs. After)*: The results obtained after the implementation are compared against the initial status of the company to determine if the improvement objectives were met, or an additional adjustment is required to achieve these.

3.4. Indicators

- Costs

Total Cost of Paper Consumption: Referred to the total cost of the sheets consumed per package and by number of packages based on the total number of operations carried out in the process to be improved, the less paper used during the process, the indicator decreases.

$$CTC = \frac{CP}{QH} * (QHo * Qo) \quad (1)$$

- Paper Consumption

Paper consumption: Referred to the number of sheets consumed during the different operations whose process needs to be improved, the number of sheets per operation is multiplied by the number of operations.

$$QTH = QHo * Qo \quad (2)$$

- Time

Percentage Decrease in Time (Transportation): Referred to the decrease in document transport time as a percentage of the current process vs. the process to be improved.

$$\%DT(t) = 1 - \frac{TNP(s)}{TPA(s)} \quad (3)$$

Percentage Decrease in Time (Inquiry): Referred to the decrease in document inquiry time as a percentage of the current process vs. the process to be improved.

$$\%DT(i) = 1 - \frac{TNP(s)}{TPA(s)} \quad (4)$$

4. Validation

4.1. Current condition of the company

The bank (for the purposes of this research we will change the name of the company) known as “ABC Bank” is one of the oldest banks in Peru, with 130 years of service. The corporation, currently, holds the first place in the banking market in terms of loans, assets, and account openings in Peru. Our validation focuses on the process of account openings and the subsequent needs of other areas for the signed contract due to legal issues (most common cases, for example, client’s complaints) in the lapse of 6 months (from October 2018 to March 2019).

4.2. Current process analysis

4.2.1. Costs associated with paper consumption

The unit cost of the sheets and the unit weight per sheet of paper were considered, thus obtaining the total cost of paper consumption from 2014 to 2018.

$$\text{Unit Cost of paper} = \frac{\text{US\$3.00 sheet package}}{500 \text{ papers}} = \text{US\$0.006 per paper sheet} \quad (5)$$

4.2.2. Costs associated with paper storage

The paper storage costs (Table 3) are associated with the storing and delivering of these contracts when other areas need them (see Table 4).

4.2.3. Time associated with document transportation to warehouse

The documents are sent from the agencies (Lima and Province) through bags, destined for the central warehouses. The average time per route has been considered (because the routes are carried out by the classification of agencies by region, both in Lima and in Provinces) (see Table 5).

Table 3. QFD matrix design.

Relationships	Friendly design	Connection with main servers	Staff performance	Updated technologies	Adaptation to organizational change	Row weight	Relative row weight	Importance
(X) Strong relationship								
(Y) Medium relationship								
(Z) Weak relationship								
Security								
Product								
Staff								
Work system								
New technologies								
Product transportation								
Absolute column weight								
Relative column weight								
Importance								

Table 4. Total monthly cost of paper storage (from October 2018 to March 2019).

Total cost of storage per document entered (in USD)						
As March 31st, 2019						
Total per month	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
	US\$ 86,431.90	US\$ 94,296.77	US\$ 93,516.19	US\$ 90,871.14	US\$ 92,133.66	US\$ 94,446.12

Table 5. Document submission times (from October 2018 to March 2019/hourly).

Average documentation delivery time (Per hours)						
As March 31st, 2019						
	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Lima	2.42	2.35	2.28	2.46	3.02	3.1
Provinces	11.46	12.35	12.18	12.56	12.35	12.45
Total per month	13.88	14.7	14.46	15.02	15.37	15.55

4.2.4. Time associated with document inquiry

The documents are requested by the corresponding units (legal, after-sales, etc.) and then sent by the supplier to the location of the unit that needs this document.

4.3. Objectives

- Create a new system of work since many continue using the traditional system.
- Reduce high indexes related to paper use, these include the times, costs, and consumption of the product.
- Hire trained people to implement the digital transformation and who can adapt to the changes during the process for better business performance.
- Implement technologies according to the available budget of the organization, so you can start with a basic system, but which can improve working conditions.

4.4. Implementation of a new digitized process

Based on the requirements of the company (QFD Matrix) and our proposed model to digitize processes, we will simulate the new process to optimize the document inquiry time (we will graph one of the new processes as example) in the opening account process in ABC Bank (see Fig. 5):

4.5. Results

As we can see, after the comparison between the costs in the period of six months in the current process and the costs with the simulated process, we could observe that there is a considerable reduction in the total costs associated

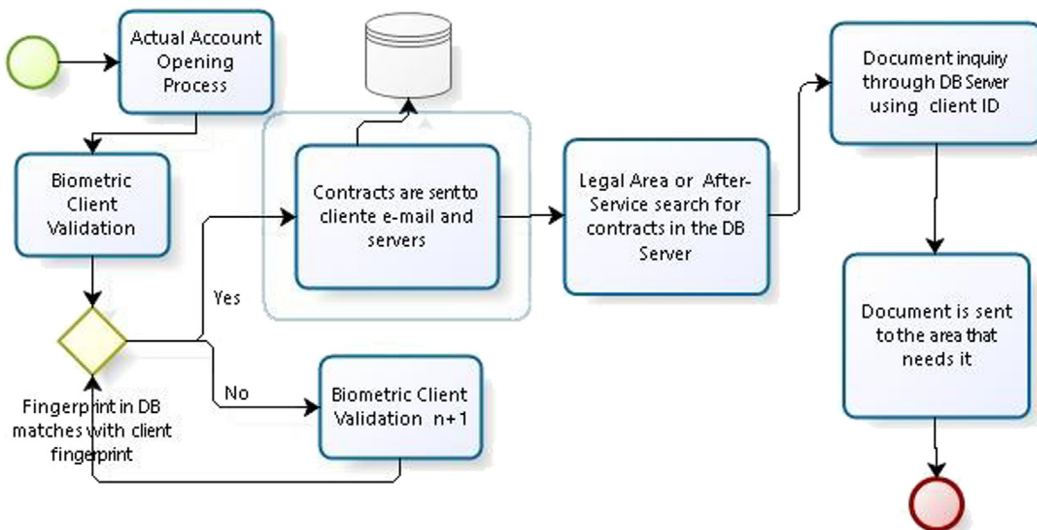


Fig. 5. New process.

with the storage and request of contracts due to the implementation of the digitized process of account openings. The costs associated with the 3 first months starting from October 2018 are related to the implementation of the project (hiring of new personnel for development, training, implementation of new servers, program and licenses). After the implementation is done, the costs in the following 3 months (Jan, Feb, and Mar of 2019) will be reduced only to the maintenance and support of the server, since the ABC Bank will be responsible for the tool management (see Fig. 6).

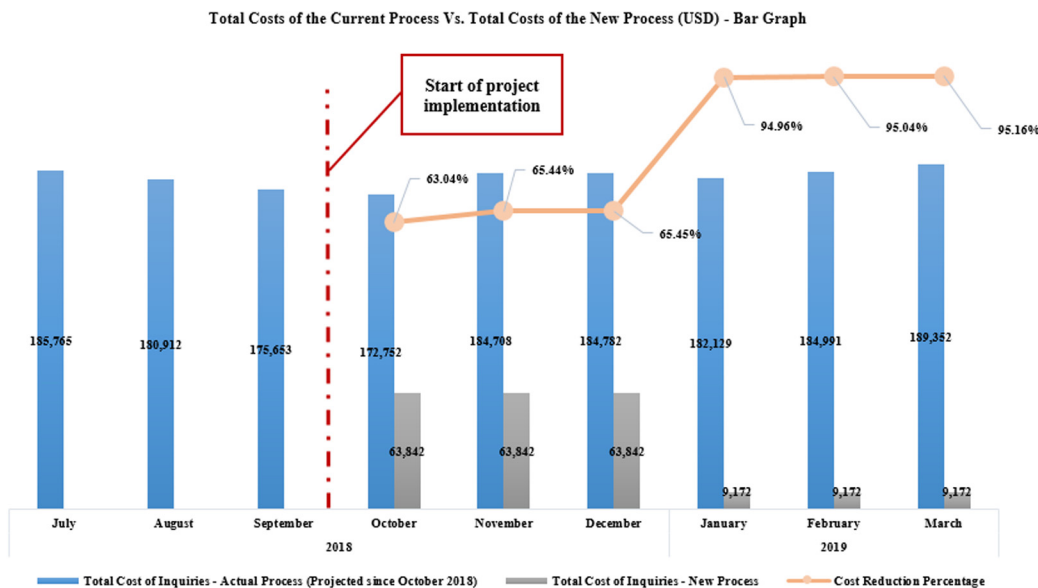


Fig. 6. Total costs of the current process vs. new process (Bar Graph).

Also, after the comparison between the total inquiry time of the actual process (search, scanning and sending via e-mail of the contracts in document storage warehouses used by the bank in Lima and Province to the different units that needs this documentation) and the new implemented process (the bank units that needs this documentation use

the DB server to download the contracts), we could observe a reduction of 80% the first month after the start of project implementation (we are considering a learning curve of the tool the first month) and a reduction of 90% of the inquiry time after the first month, in both cases, Lima and Province (see Figs. 7 and 8).

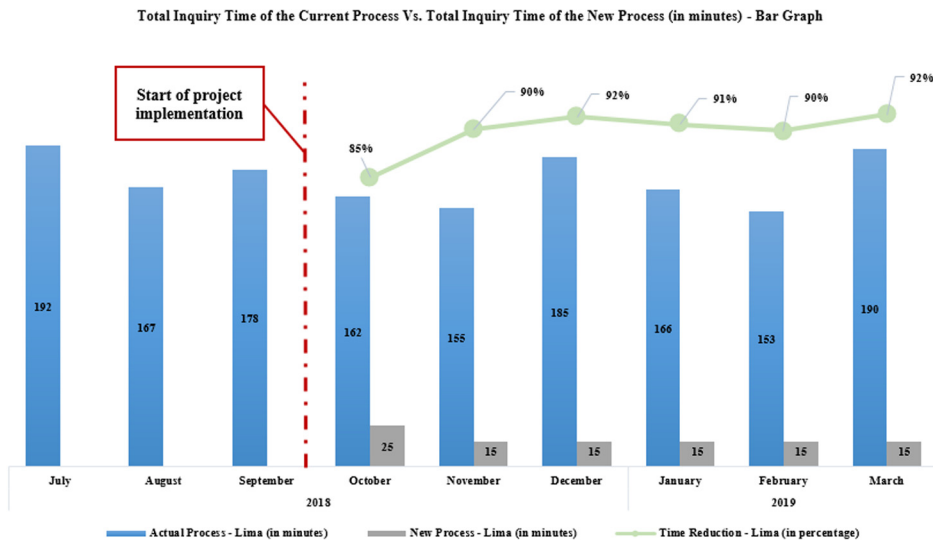


Fig. 7. Total inquiry time of the current process vs. new process — Lima (Bar Graph).

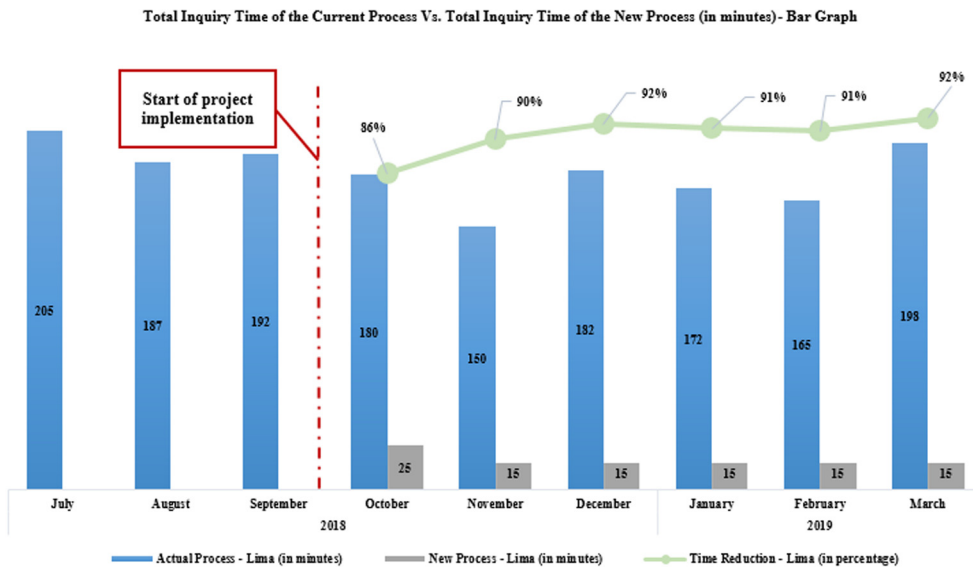


Fig. 8. total inquiry time of the current process vs. new process — Province (Bar Graph).

5. Discussion

5.1. Scenarios vs. results

Our study set out to investigate the multiple benefits of digitally transforming processes in financial entities that require paper, by using our model based on business management, infrastructure, technology and change management. The following discussion will focus on the application, suitability, and usefulness of our model to reduce costs, time and paper consumption for credit application processes and the search for credit documents,

debit card replacements on the Services Platform and the requests and activations of the digital key to carry out operations in the different channels of ABC Bank.

5.1.1. Current situation of the credit application process

The credit application process is based on the delivery of a loan of money to another person and in which the latter commits by means of a contract to return the requested amount plus accrued interest payments, additional insurance, and associated costs in a defined term agreement according to the conditions established by the financial entity prior validation of the credit history and indebtedness capacity of the person requesting the loan.

After the granting of the credit, the documents are sent by courier to the warehouse where all types of documents sent by the bank are kept and filed by date of shipment.

5.1.2. Current situation of the debit card replacement process

The Debit Card Replacement process consists of the delivery of a new card that replaces one of the client's cards that has been blocked for different reasons. This leads to the use of paper because the client signs a written contract of General Conditions for the use of the card, where rates and fees related to the card are also stated.

5.1.3. Current situation of the digital key activation process

Digital key activation requests entail the signing of a 4-page contract indicating the General Terms and Conditions for the use of the product itself.

5.2. Result analysis

After implementing the new established process in this investigation into the 3 processes from the “ABC Bank”, the analysis of each scenario was carried out for each indicator, thus obtaining different statistics ([Table 6](#)) (see [Table 7](#)):

Table 6. Document inquiry times (from October 2018 to March 2019).

Average documentation inquiry time (Per days) As March 31st, 2019						
	Oct-18	Nov-18	Dec-18	Jan-19	Feb-19	Mar-19
Lima	2–3 days	2–3 days	2–3 days	2–3 days	2–3 days	2–3 days
Provinces	4–6-days	4–6-days	4–6-days	4–6-days	4–6-days	4–6-days
Total per month	6–9 days	6–9 days	6–9 days	6–9 days	6–9 days	6–9 days

- On average, the document inquiry cost was reduced to US\$20.74.
- On average, document transportation time was reduced by 96.04%.
- On average, the document inquiry time was reduced by 96.18%.
- With a confidence level of 98%, the cost per document inquiry after the implementation of the model ranges between US\$21.62 and US\$19.86.
- With a confidence of 98%, the document inquiry time after the implementation of the model ranges between 3 min, two seconds and 3 min, 8 s.
- With a confidence level of 98%, the percentage decrease in document transportation time after the implementation of the model ranges between 96.15% and 95.92%.
- With a confidence level of 98%, the percentage decrease in document inquiry time after the implementation of the model ranges between 96.34% and 96.01%.

6. Conclusions

This research aimed to construct a digitization model for Peruvian Banks that seeks to reduce their costs and inquiry time. Based on a quantitative analysis of a paper-based process, and its late modification using the digitization model into a paperless process, it can be concluded that the change management is necessary to

Table 7. Analysis of scenario results and statistical analysis.

	Total cost of paper consumption (in USD)	Total cost of paper inquiry (in USD)	Paper consumption (unit)	Inquiry time (min)	Transportation time decrease in %	Inquiry time decrease in %
Formula	$CTC = (CP/QH) \times (QHo \times Qo)$	$CTCo = CC \times TC$	$QTH = QHo \times Qo$	–	$\%DT (t) = 1 - (TNP (s)/TPA (s))$	$\%DT (c) = 1 - (TNP (s)/TPA (s))$
Scenario 0 (Account opening)	0	US\$ 21.81	0	3	95.87%	96.39%
Scenario 1 (Credit application)	0	US\$ 21.28	0	3.04	96.18%	95.95%
Scenario 2 (Card replacement)	0	US\$ 20.38	0	3.09	96.09%	96.24%
Scenario 3 (Activation of digital key)	0	US\$ 19.50	0	3.06	96.00%	96.15%
Mean	0	US\$ 20.74	–	3.05	96.04%	96.18%
Variance	–	US\$ 0.78	–	0	0.00013%	0.00028%
Standard deviation	–	US\$ 0.88	–	0.03	0.11%	0.17%
Coefficient of variation	–	US\$ 0.043	–	0.011	0.001	0.002

generate a better organizational culture oriented towards a digital culture without being rejected by any member of the organization, in addition to providing the ability to adapt to changes in the company. Also, the organization and infrastructure management are necessary to achieve a digital transformation since they complement one each other, covering certain limitations that each one cannot achieve independently, something that must be taken into consideration in other models that only focus on the organization, infrastructure or change management, but not consider this three axis in one model. Transforming a paper-based process into a paperless process, also, could achieve a considerable reduction in document's storage and inquiry time/costs, as the case of study demonstrates that implementing the model could achieve a reduction of approximately 90% in both metrics.

To better understand the implications of these results, future studies could address the implementation of this digitization model in other enterprises that offers a different type of service than banks (Public Health, Consulting, Education, etc.) or a different economic sector (Quaternary Sector, Quinary Sector, etc.).

Declaration of competing interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Data availability

The data that has been used is confidential.

References

- [1] Liu DY, Chen SW, Chou TC. Resource fit in digital transformation: Lessons learned from the CBC bank global e-banking project. *Manage Decis* 2011;49(10):1728–42. <http://dx.doi.org/10.1108/00251741111183852>.
- [2] Pourebrahimi N, Kordnaeij A, Hosseini HK, Azar A. Developing a digital banking framework in the Iranian banks. *Int J e-Bus Res* 2018;14(4):65–77. <http://dx.doi.org/10.4018/IJEBR.2018100104>.
- [3] Yablonsky S. A multidimensional framework for digital platform innovation and management: From business to technological platforms. *Syst Res Behav Sci* 2018;35(4):485–501. <http://dx.doi.org/10.1002/sres.2544>.
- [4] Chanas S, Myers MD, Hess T. Journal of strategic information systems digital transformation strategy making in pre-digital organizations: The case of a financial services provider. *J Strateg Inf Syst* 2018;(November):1–17. <http://dx.doi.org/10.1016/j.jsis.2018.11.003>.
- [5] Obonyo ES, Kerongo F. Factors affecting strategic change management and the performance of commercial banks in Kenya: A case study of Kenya commercial bank in Nairobi region. *Eur J Bus Manage* 2015;7(15):109–18.

- [6] Chatarina Skogland Mari Anna. A spatial approach to transformational change: Strategic alignment of the spatial and cultural environment. *J Corp Real Estate* <http://dx.doi.org/10.1108/JCRE-09-2016-0030>.
- [7] Hechanova MRM, Caringal-go JF, Magsaysay JF, Hechanova MRM, Caringal-go JF, Magsaysay JF. Implicit change leadership, change management, and affective commitment to change comparing academic institutions vs business enterprises. 2018, <http://dx.doi.org/10.1108/LODJ-01-2018-0013>.
- [8] Tara K, Singh S, Kumar R. Green banking for environmental management: A paradigm shift. *Curr World Environ* 2015;10(3):1029–38, Retrieved January 17, 2018.
- [9] Islam S, Das PC. Green banking practices in Bangladesh. *IOSR J Bus Manage (IOSR-JBM)* 2015;8(3):39–44, Retrieved January 24, 2018.
- [10] Chandra S, Pandey B. Green banking in India. *J Econ Int Finance* 2015;7(1):1–17, Retrieved February 7, 2018.
- [11] Giridhar VK, Sudhakar GK. Green banking: Issues and challenges in India. *Int J Latest Technol Eng Manage Appl Sci (IJLTEMAS)* 2017;6(7):2278–540, Retrieved February 7, 2018.
- [12] Michal Demecko JK. *Procedia economics and finance* [abstract]. *Procedia Econ Finance* 2015;2:12–7, Retrieved January 17, 2018.
- [13] Hallam Cory, Contreras Carolina. Integrating lean and green management. *Manage Decis* 2016;54(9):2157–87. <http://dx.doi.org/10.1108/MD-04-2016-0259>.
- [14] dos Santos JX, do Rosário Cabrita M. Lean banking: Application of lean concepts and tools to the banking industry. In: *The 2016 international conference on systematic innovation*. 2016.
- [15] Netland TH, Schloetzer JD, Ferdows K. Implementing corporate lean programs: The effect of management control practices. *J Oper Manage* 2015;36:90–102. <http://dx.doi.org/10.1016/j.jom.2015.03.005>.
- [16] Jin E, Choonjong Y. Service development using fuzzy QFD in the banking industry. *J Korean Soc Qual Manage* 2015;43(1):103–23, Vol. 43.
- [17] Shahin A, Bagheri Iraj E, Vaez Shahrestani H. Developing house of quality by integrating top roof and side roof matrices and service TRIZ with a case study in banking services. *TQM J* 2016;28(4):597–612. <http://dx.doi.org/10.1108/TQM-10-2012-0075>.
- [18] Shahin A, Bagheri Iraj E, Vaez Shahrestani H. Developing the C-shaped QFD 3D matrix for service applications with a case study in banking services. *Int J Qual Reliab Manage* 2018;35(1). <http://dx.doi.org/10.1108/IJQRM-02-2016-0018>.
- [19] Zanjirani DM. Introduction to process planning of service by using quality function development case study: Electronic banking services. *J Internet Bank Commer* 2016;21:1–25, Retrieved February 14, 2018.
- [20] Morteza Ghayour RH. The effect of using QFD technique on improving the quality of services in bank branches (case study: Kashmar, Gonabad and torbat-e-heydarieh bank sedate). *Sci J (CSJ)* 2015;36(6). Retrieved February 14, 2018.
- [21] Bryson D, Atwal G, Chaudhuri A, Dave K. Antecedents of intention to use green banking services in India. *Strategic Change* 2016;25(5):551–67.