SciencePG
Science Publishing Group

A Process Mining Approach for Studying Traveller's Behaviour in Cuba by Means of Customer Journey Analysis

Fidel Pineda Bravo[1, *], Patricia Gonzalez Perez[1], Waldo Perez Garcia[2]

[1]Department of Tourism, Faculty of Economic Sciences, Universidad Central «Marta Abreu» de Las Villas, Santa Clara, Cuba

[2]Department of Industrial Engineering, Faculty of Mechanical and Industrial Engineering, Universidad Central «Marta Abreu» de Las Villas, Santa Clara, Cuba

Email address:
fpineda@uclv.cu (F. P. Bravo), rogperez@uclv.cu (P. G. Perez), waldop@uclv.ecu.cu (W. P. Garcia)
*Corresponding author

To cite this article:
Fidel Pineda Bravo, Patricia Gonzalez Perez, Waldo Perez Garcia. A Process Mining Approach for Studying Traveller's Behaviour in Cuba by Means of Customer Journey Analysis. *American Journal of Theoretical and Applied Business*. Vol. 7, No. 4, 2021, pp. 81-89. doi: 10.11648/j.ajtab.20210704.12

Abstract: Nowadays it is essential for tourism companies to provide increasingly personalized services, and to do so, the quality of the customer experience at an end-to-end level must be improved in every possible way. Customer journey mapping has become one of the most innovative and effective techniques to increase companies' knowledge of their customers. While traditional approaches provide an incomplete view of what actually happens during the journey and the inflection points that determine customer behaviour, a new technique has now been developed that, coupled with CJM, addresses all these limitations: process mining. Process mining techniques use the event logs that store customer decision information and provide a comprehensive map that describes customer behaviour during the stages of the customer lifecycle more effectively than previously employed approaches, not only in terms of the end result, but also in terms of resource savings. This paper shows the application of process mining to analyze a sales web logs to map the customer journey. By means of a case study, in a receptive travel agency, the results of the use of these techniques are presented, discovering the processes that better describe the traveller's behaviour and finding useful insights to improve the customers experiences during they stay in the destination Cuba.

Keywords: Customer Experiences, Customer Journey Map, Process Mining

1. Introduction

Customer journey mapping is a technique that enables tourism sector professionals to better understand customer experiences in their daily interactions with the steps involved in a service. Analyzing how travellers navigate their journey is critical to assess and deliver satisfied needs and it has become a competitive advantage in a market where clients are beginning to demand increasingly personalized experiences, tailored to their exact preferences.

Nowadays, thanks to the data-driven transformation that most of the companies are facing, analyzing the customer journey has become a major issue. For this reason, customer journey maps (CJMs) have become very popular [1].

These diagrams represent graphically the story of the customer, showing all the touch-points he comes into contact with. In particular, they allow tourism companies to have an overall idea of how the traveller behaves, to compare this behaviour with what they expect, and to make the client experience a unique one [2].

The customer journey is defined as the customer's interactions with one or more service providers to achieve a specific goal. It is often used as an intuitive metaphor from a customer's perspective of a service process. A customer journey is modeled as a sequence of consecutive touchpoints; in terms of duration, it can be short (hours) or long (weeks), depending on the service being investigated [3]. Instead of focusing at just a specific part of the journey, the customer journey describes the whole experience. Usually, the customer life cycle begins when the client desires or needs a product or service and it lasts until the product is bought or the service is provided.

Customer journey mapping (CJM) is a well-known

technique that focuses on assessing how customers interact with a tourism company or organization. This allows the gain of a deeper knowledge about the customer's perceptions and becomes an essential tool to improve the overall customer experience. This knowledge can be used to generate competitive advantage and satisfied customers. [4]

Nevertheless, despite the importance of CJMs, traditional approaches to developing this type of analysis are very limited, providing a too simplified overview of what is happening and leading to an incorrect understanding of the traveller's behaviour. They are unable to provide a complete process map that can better describe the user's behaviour through the different stages of the customer life cycle, and finally, they are expensive in time, material and human resources. Process mining techniques are capable of effectively addressing all of the above limitations.

Process mining adds the process perspective to machine learning and data mining, trying to fill the gap between traditional process analysis and data analysis techniques such as machine learning and data mining [5]. Process mining supports the creation of customer journey maps on real time, removing the need of manual intervention, and thus, removing all the consequent biases [6].

On the other hand, process mining can also be used to support recommendations, in particular, the possibility of using process mining to recommend to a client what should be the next step in the process. When a client requires a recommendation, its partial journey is sent to the recommendation service, which compares it to the log and generates a recommendation that optimizes a target function. This concept is particularly useful in the customer journey analysis environment, as mentioned, personalizing the customer experience is essential [7].

The goal of this research is to show the results of the application of process mining to analyses the customer journey based on an event log of a receptive travel agency in the destination Cuba. This paper is organized as follows. Section 2 describes the main components of CJMs. Section 3 gives an overview of what process mining is and its types. Section 4 illustrates the relation between process mining and customer journey maps. Section 5 is about the application of process mining techniques in a CJM and the insights derived from this. Section 6 concludes the article and gives an overlook.

2. Methodology

2.1. Understanding the CJM

CJM is a visual depiction of the sequence of events through which customers may interact with a service organization during an entire purchase process. CJM lists all possible organizational touchpoints customers may encounter during the service exchange process. By clearly understanding customer touchpoints, senior management can work with cross-functional team members to employ tactics that foster service innovation. The goal of these tactics is to enhance customer-service provider's interactions by improving the customer experience associated with each touchpoint [2].

As Wolny and Charoensuksai [8] pointed out, CJMs are characterized by nonlinear structure, emotional and behavioral drives. The main goal of tracking the customer experience is to comprehend how this experience can be improved [9]. Usually, in a customer journey analysis, companies focus on how customers interact with multiple touchpoints, moving from consideration, search, purchase, post-purchase, consumption, and future engagement or repurchase. The targets of the analysis are to describe this journey and understand the customer's options and choices for touchpoints in multiple purchase phases.

The main CJMs components according to the literature analysis developed by Terragni y Hassani [10] are:

Customer: a customer is the stakeholder that benefits from a service.

Journey: a CJM contains at least one journey, which is a typical path pursued by a customer. It is possible to distinguish between two main types of CJMs: expected journey maps aiming to represent journeys in advance, and actual journey maps which target is to describe how the customers really experienced the journey.

Goal: objective that the company has in mind when it maps the customer journey, i.e., reducing the churn rate.

Touch-point: it is the moment in which customers interact with companies through a product or service, i.e. when a client searches for a flight or contacts the customer service.

Timeline: it describes the length of the journey in a time span that goes from the first touch-point until the last one.

Channel: it is the approach chosen by the customer to interact with the touch-point.

Although sometimes, according to these authors, there are other less representative components such as Stage, Experience, Lens and Multimedia.

2.2. Process Mining Overview

Process Mining, as a key lever to address the complexity challenge, represents perhaps the most exciting technological innovation since the advent of digital transformation. No other technology is able to provide similar process transparency, allows a similar understanding of actual process performance and thus fuels digital transformation of internal processes based on objective insights and facts. It provides wholistic insights into actual processes and complexities, thus allowing to identify inefficiencies and effort driver [11].
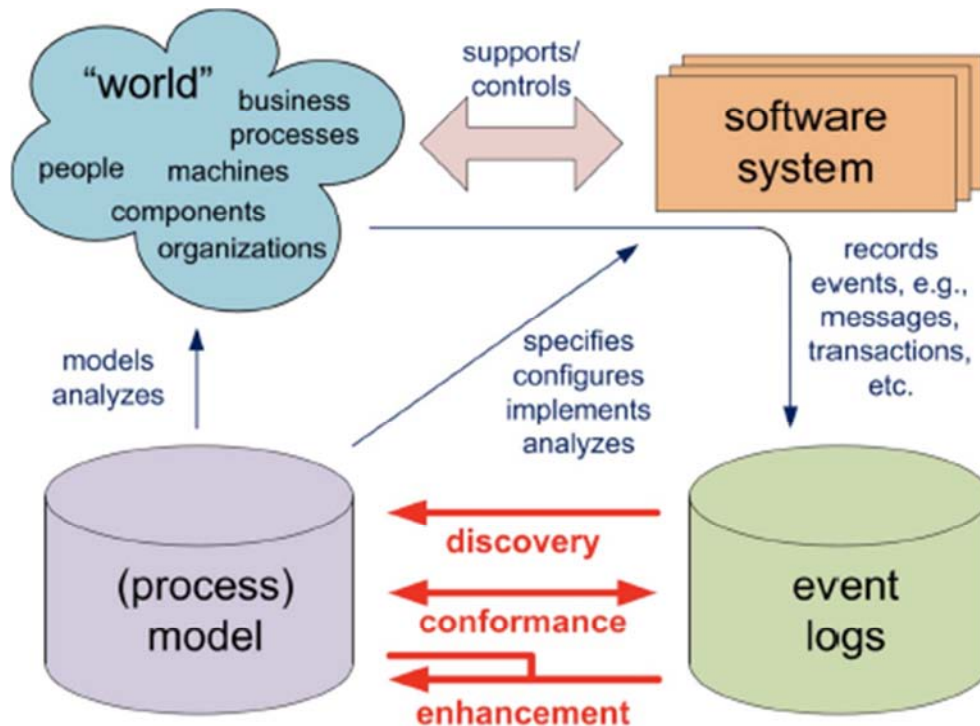
Process mining is a research discipline that bridges the gap between computational intelligence and data mining, on the one hand, and traditional business process analysis, on the other [12]. Process mining techniques use the digital traces contained in information systems to show business processes as they are and as they are being carried out.

The starting point of process mining is an event log. Each event refers to an activity (i.e., a well-defined step in the process) and is related to a particular case (i.e., an instance of the process). The events belonging to a case are logically

ordered and describe an "execution" of the process. Event logs can also store additional information. In fact, whenever possible, process mining techniques use complementary information such as the resource executing the activity, the timestamp associated with the event and other data attributes [13].

Process mining allows process owners to gain knowledge and insights in business processes by analyzing the event data stored during execution of the process. There are three main sub-fields of process mining (see Figure 1) [14]:

Figure 1. Process mining scenario: Relationship amongst real data, actual processes and process models. Source: Adapted from [15].

Discovery is the most attended area within process mining, with several techniques being developed, with different approaches. The aim of these techniques is to create a process model, without using any a priori information, that is able to explain most of the observed behaviours, without undervaluing or overvaluing the event log [15]. Many tourism companies are surprised to find that existing techniques are actually capable of discovering real processes merely based on the execution samples in digital records.

Conformance verification consists of comparing the existing process model with its event log and thus checking whether the reality, as stored in the event log, is equivalent to the model and vice versa [15]. Conformance checking can be applied to procedural models, organizational models, declarative process models, business rules, policies and regulations [16].

Model improvement aims to extend or improve an existing process model using information about the actual process stored in some event log. While conformance checking measures the alignment between the model and reality, this third type of process mining seeks to change or extend the a-priori model [15].

2.3. Process Mining and Customer Journey Map

The Customer Journey has become an emerging focus topic. The majority of the participants at the first global Process Mining Conference, ICPM 2019, considered this a focus area for Process Mining. Customer centricity and customer obsession are strategic priorities and require a thorough understanding and continuous optimization of customer interactions [11].

Bernard & Andritsos [17] are pioneers in considering process mining as an approach to analyzing the consumer life cycle. They point out that expected journey maps and actual journey maps correspond with two of the types of process mining: discovery and conformance checking. They show correspondence between the components of a customer journey map and the XES format, in which event logs are stored, the starting point for the application of process mining techniques.

Thus, these authors lay the foundations for a new field of application of process mining. In further research, Bernard & Andritsos [6] develop CJM-ex as the approach to output the journeys in a CJM by applying discovery mining techniques.

In 2018, Terragni & Hassani [10] apply process mining techniques to the analysis of customer journeys in web logs, demonstrating that it is possible to discover the process model that best describes customer behavior and find valuable related insights. Moreover, this research makes a second contribution: it provides personalized recommendations through a nexus between process mining techniques and recommender systems.
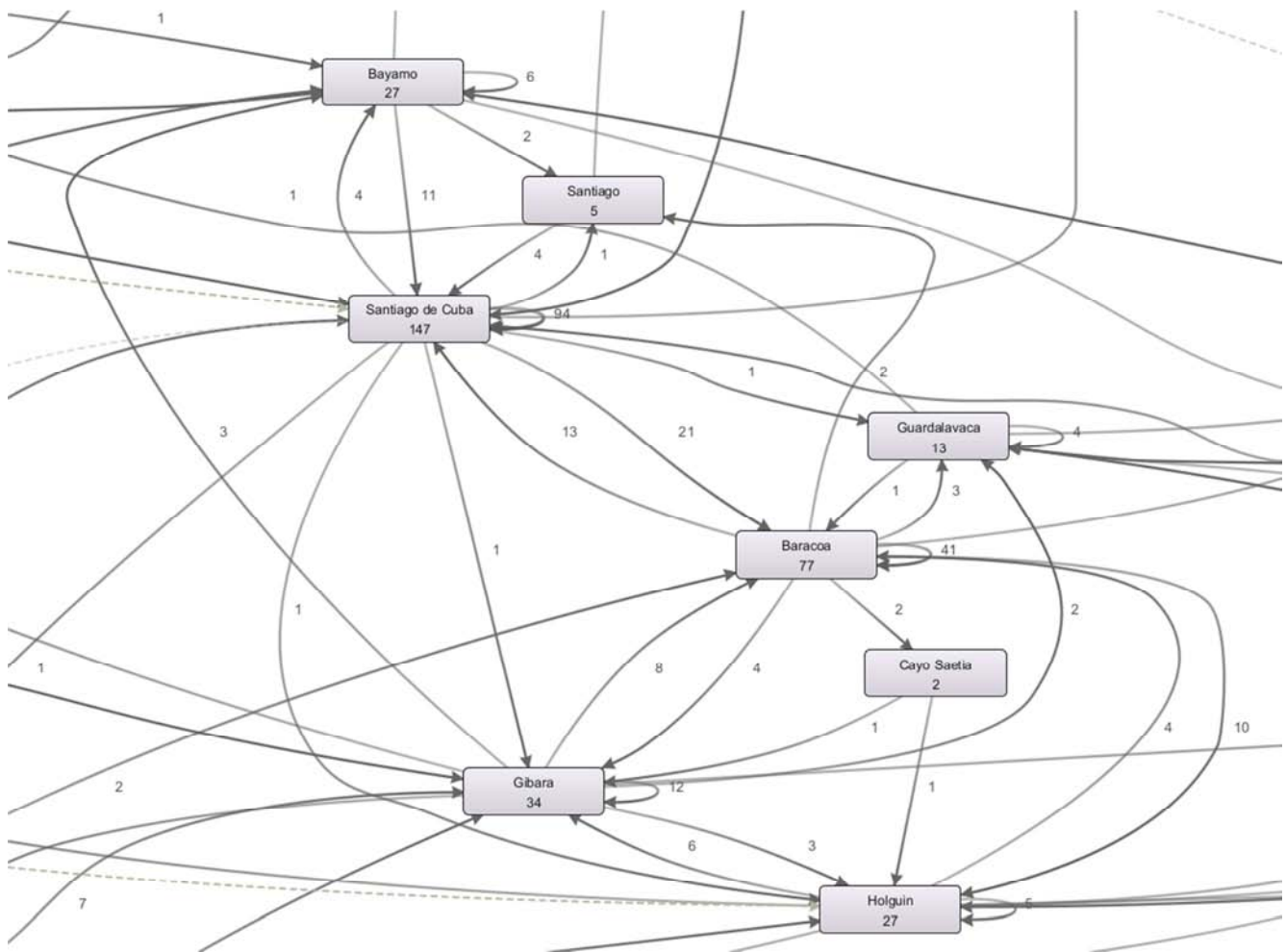
3. Results of Customer Journey Analysis with Process Mining

The analysis was developed based on an event log generated from the data stored in the Odoo suite regarding customer travel itineraries in Cuba. Each of these itineraries or custom-made tour packages include several services or products which are presented to customers for them to choose according to their particularities. This "à la carte" tourism package approach results in a more personalized experience for clients given their role as producers-consumers [18].

The record of events analyzed was limited to the time period from November 1st, 2015 to April 10th, 2017; covering a total of 4192 events, 318 sales orders and 125 different tourism services or products. The average duration of these tourism packages was 12 days.

To discover the process model capable of capturing the general behaviour of consumers during their trips the Disco process mining tool was used. This tool uses an enhanced version of the Fuzzy Miner discovery algorithm to easily and intuitively visualize the map corresponding to the imported event log. Figure 2 shows the spaghetti-like model produced from the whole event log.

Figure 2. Excerpt of row model discovered. Source: Study data (2015-2017), Odoo Suite (2017).

As can be seen, the discovered model is barely comprehensible and little or no insights can be extracted from it. It becomes necessary to handle filters to eliminate, for example, generic activities. In this way it is possible to manage the levels of abstraction and to focus the analysis. From this adjustment, a much clearer model is achieved as shown in Figure 3.

The resulting model is an accurate description of the actual customer behavior during the trip. Both, the number next to the arrows and the thickness of the arrows, indicate the number of sales orders that elapse from the product or service

where the arrow starts to the product or service to which the arrow goes. Here are some insights that were discovered from the model of Figure 3.

1. Main starting point of the CJM is destination Havana specifically with the transfer service.
2. The best-selling tourism product was the one involving the destinations of Havana, Viñales, Cienfuegos, Trinidad, Varadero and then back to Havana.
3. There is a significant percentage of the analyzed cases that go directly from some destinations to others without reflecting a transfer service. This can be result of several

reasons: the client rented a car; they purchase the transfer service directly with the local provider or they are part of a tourism circuit.

4. The Havana transfer service reflects both the inbound and outbound transfers.
5. Preference for lodging in private homes rather than hotel facilities.

Thanks to the stakeholders involve with this business process and adjusting activities and paths parameters was possible to discover some more insights.

Firstly, the travel itineraries or tour packages most in demand (see Figure 4) by customers were identified. 1,500 to 3,000 euros with a relative frequency of 22.8% (770 package tours), followed by 3,000 to 4,500 euros (724 package tours) for 21.47% and 4,500 to 6,000 euros with 17.6% (593 package tours) respectively. There was a total of 49 package tours (1.45%) priced between 55,500 and 57,000 euros, which shows the great purchasing power.

Subsequently, to analyze the travel motivation variable the tour packages were grouped according to the client purchasing power (Figure 5): up to 7,500 (bronze clients); 7,500 to 13,500 (silver clients) and from 13,500 and upwards (gold clients).

In the case of bronze clients (Figure 6) the most visited destinations were: Havana, Viñales, Trinidad and Cienfuegos in that order. Other destinations of lower demand are identified as Varadero, Cayo Santa María, Las Terrazas and Remedios. In this market segment, there is a clear inclination to multi motivation due to the different types of activities purchased in the destinations of interest.

In spite of the similarity with the previous group in terms of main destinations visited (Havana, Viñales, Trinidad, Cienfuegos), silver clients, (see Figure 7) have a marked inclination towards the historical-cultural and nature modalities, with a tendency to carry out activities linked to these tourism modalities. Among the rest, the visited destinations are Varadero, Santiago de Cuba, Cayo Santa María, Las Terrazas, Remedios and Cienega de Zapata, in that order. For this range, Trinidad is consolidated as the main destination in the middle of the country and the development of sea, sun and sand (SSS) related activities is less frequent.
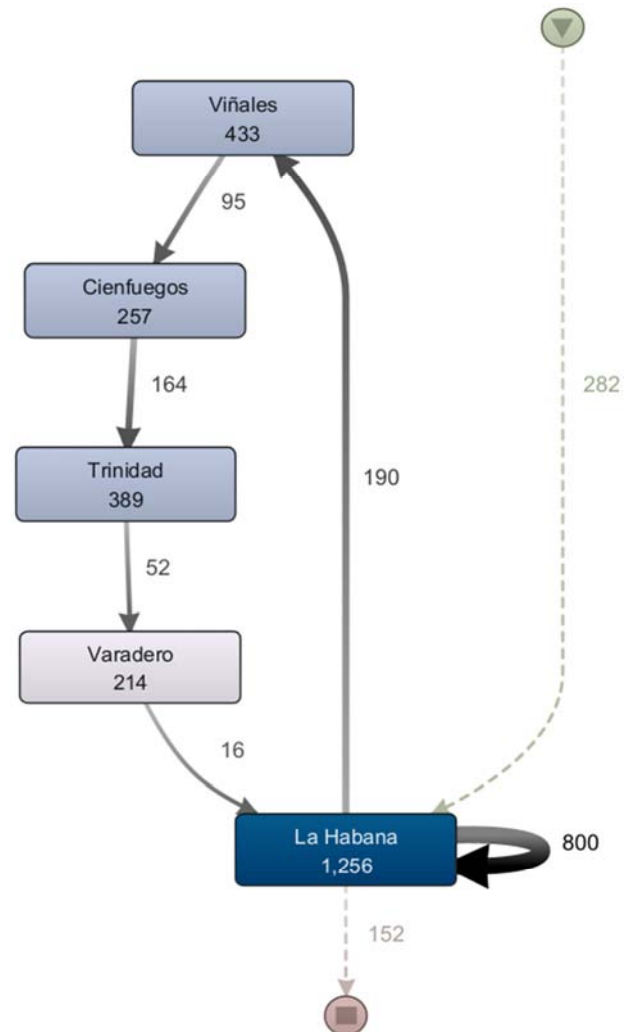

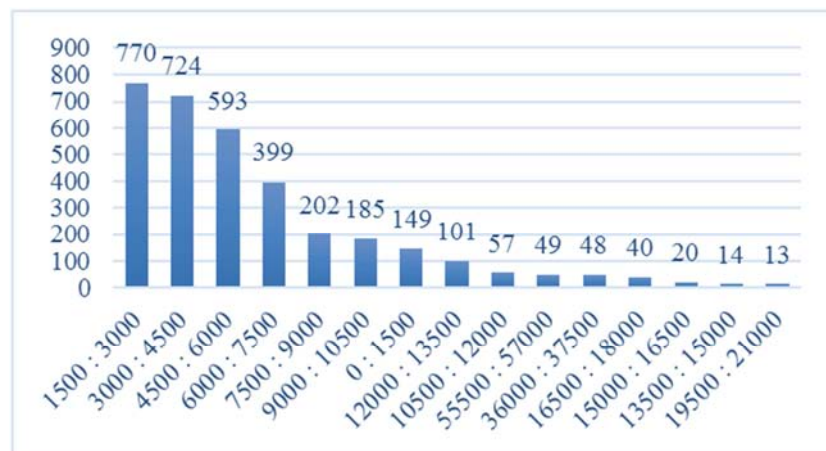*Figure 3. CJM. Main paths and activities. Source: Study data (2015-2017).*

Figure 4. Tour packages most in demand by customers. Source: Study data (2015-2017) CJM. Main paths and activities. Source: Study data (2015-2017).
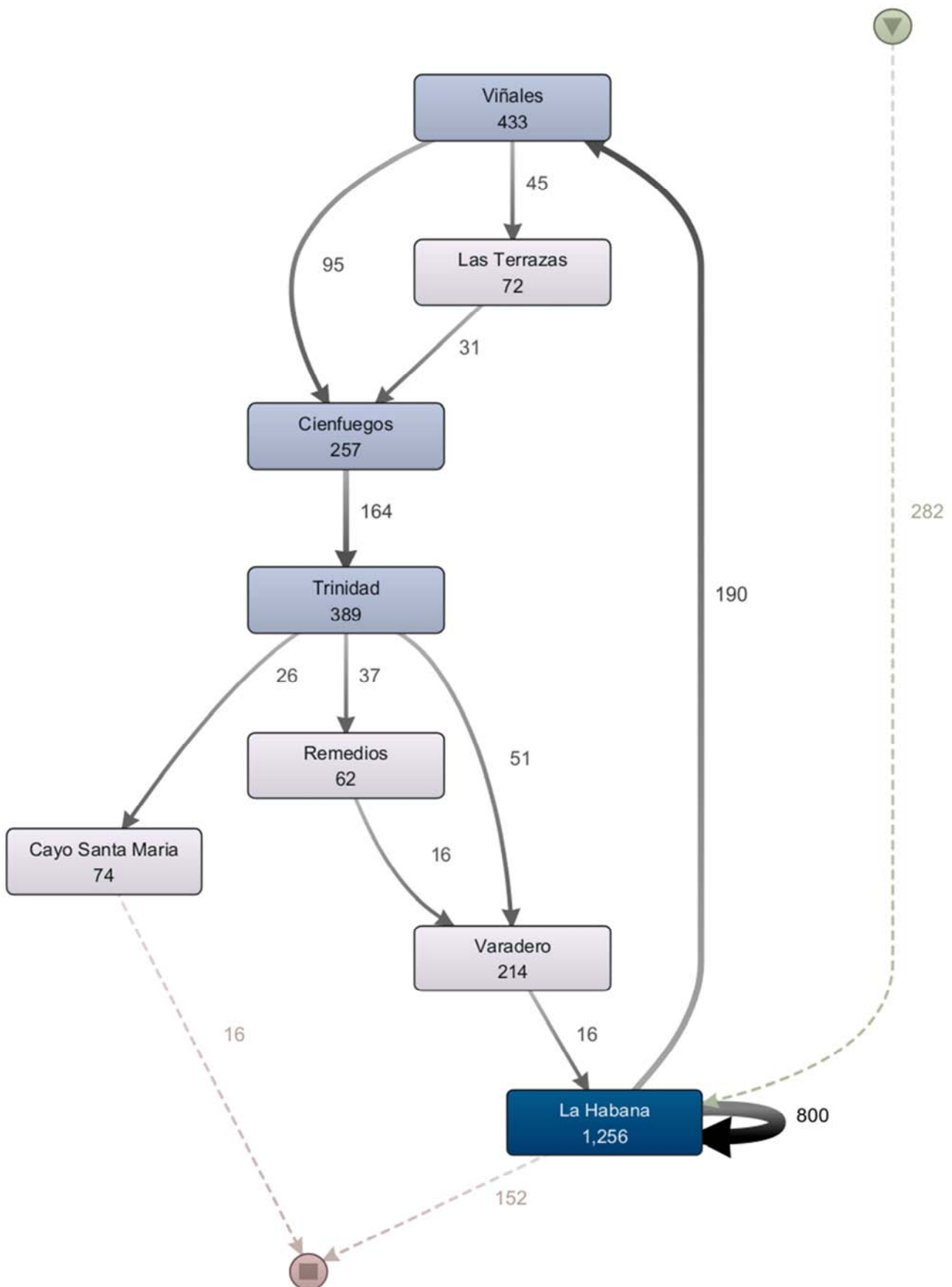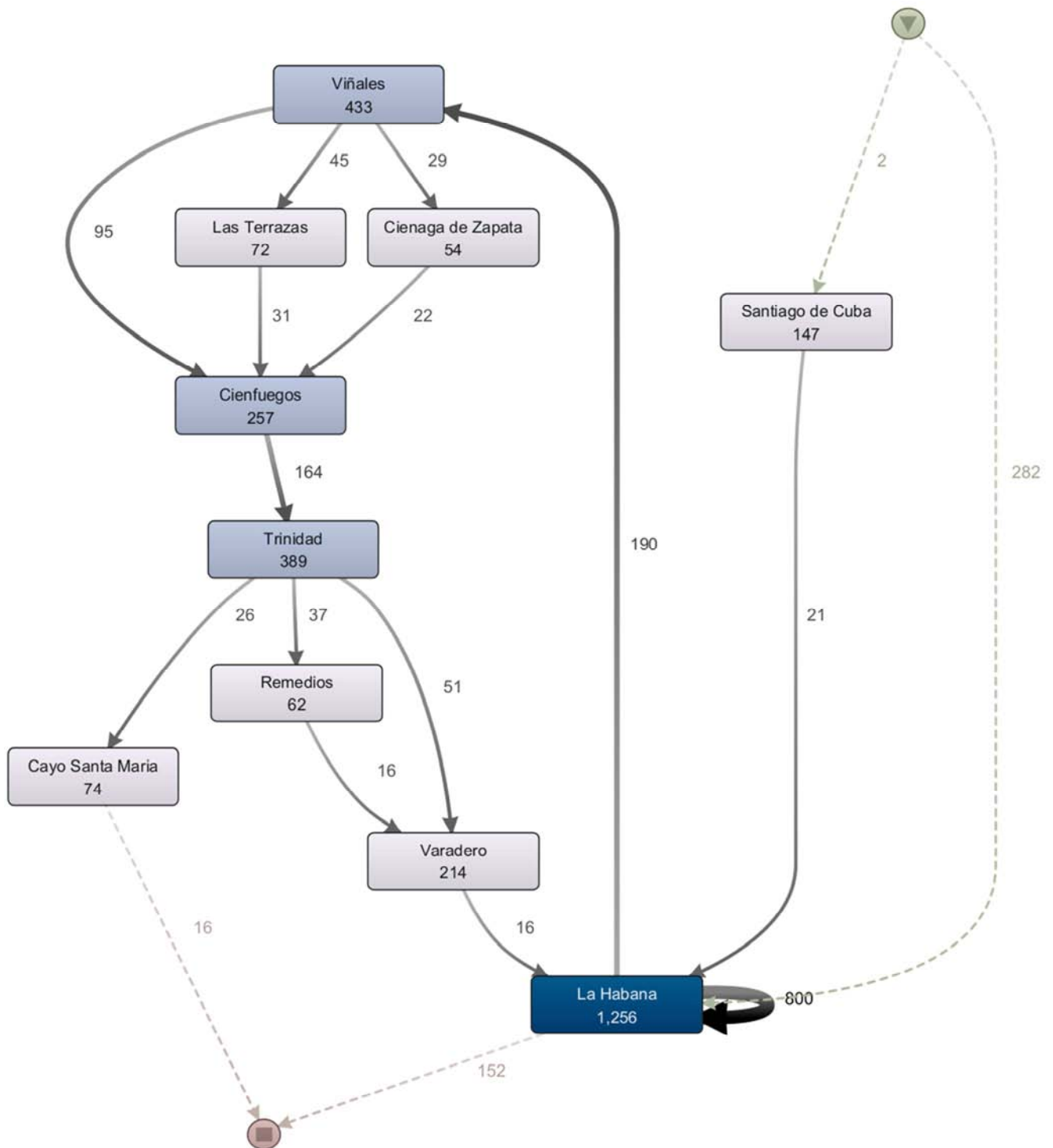
Figure 5. *CJM for bronze clients. Source: Study data (2015-2017).*

Figure 6. *CMJ for silver clients. Source: Study data (2015-2017).*

In the market segment with the highest expenditure, the gold clients (see Figure 7), the historical-cultural modality is consolidating as predominant. Although the main destinations remain the same (their order varies), the activities carried out in them are predominantly of a historical-cultural nature. Havana also stands out as the main starting point in this CJM. Other destinations visited were Baracoa, Santiago de Cuba, Remedios and Holguin.
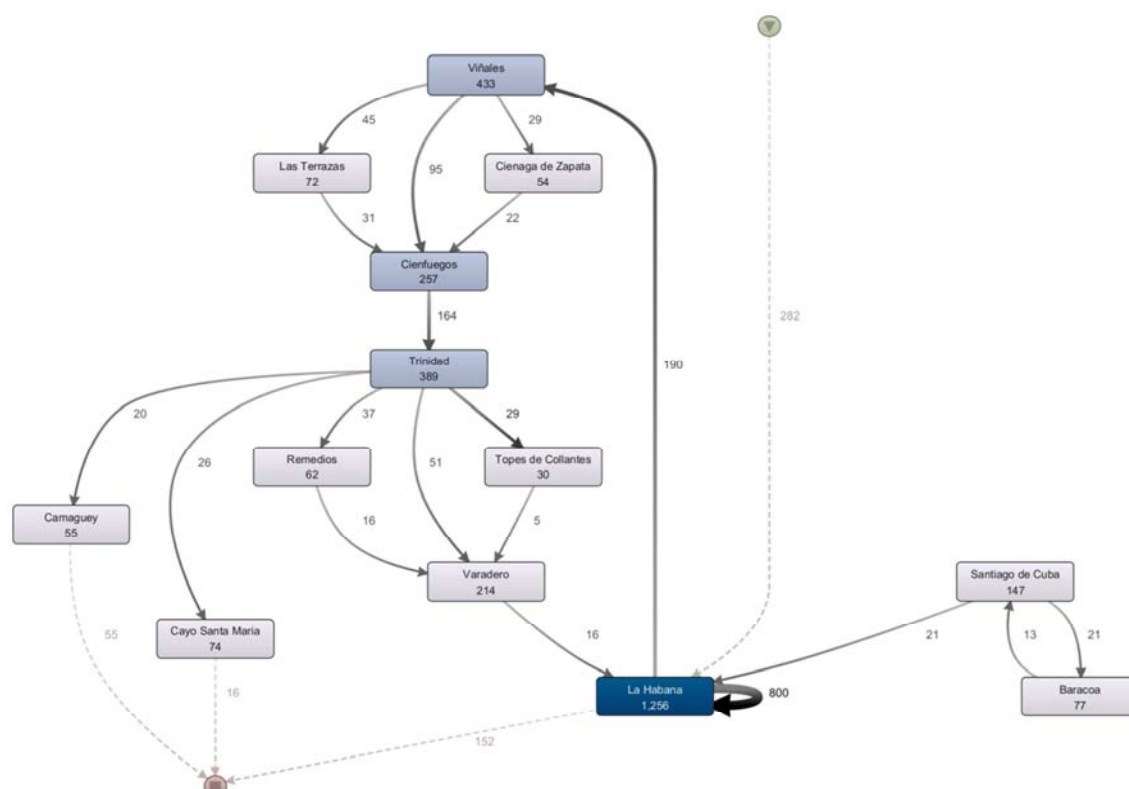
Figure 7. CMJ for golden clients. Source: Study data (2015-2017).

4. Conclusions

With process mining techniques, a real Costumer Journey Map can be discovered in an automated way, in less time and with less expenditure of material and human resources, thus moving from the traditional analysis based on perception to one based on facts.

The process mining approach allows the creation of a complete process map that leads to a better understanding of the customer journey, identifying starting points, main destinations visited, best-selling tourism products and preferences.

Main destinations visited were Havana, Viñales, Cienfuegos and Trinidad, which varied in order depending on the client purchasing power and travel motivation. Trinidad is consolidated as the main issuer to the rest of destinations in the country. To analyze the travel motivation variable, tour packages were grouped according to the client's purchasing power: bronze, silver and gold clients. In the market segment with the highest expenditure, gold clients, the historical-cultural modality is consolidated as predominant, unlike the rest of the groups where there is a marked tendency towards multi-motivation.

References

[1]   Micheaux y B. Bosio, «Customer journey mapping as a new way to teach data-driven marketing as a service», *Journal of Marketing Education*, vol. 41, n.°2, pp. 127-140, 2019.

[2]   M. S. Rosenbaum, M. L. Otalora, y G. C. Ramírez, «How to create a realistic customer journey map», *Business Horizons*, vol. 60, n.°1, pp. 143-150, 2017.

[3]   R. Halvorsrud, K. Kvale, y A. Følstad, «Improving service quality through customer journey analysis», *Journal of service theory and practice*, 2016.

[4]   M. Arias *et al.*, «Mapping the patient's journey in healthcare through process mining», *International Journal of Environmental Research and Public Health*, vol. 17, n.°18, p. 6586, 2020.

[5]   F. M. Santoro, K. C. Revoredo, R. M. Costa, y T. M. Barboza, «Process Mining Techniques in Internal Auditing: A Stepwise Case Study», *iSys-Revista Brasileira de Sistemas de Informação*, vol. 13, n.°4, pp. 48-76, 2020.

[6]   G. Bernard y P. Andritsos, «CJM-ex: Goal-oriented Exploration of Customer Journey Maps using Event Logs and Data Analytics», 2017.

[7]   Terragni y M. Hassani, «Optimizing customer journey using process mining and sequence-aware recommendation», en *Proceedings of the 34th ACM/SIGAPP Symposium on Applied Computing*, 2019, pp. 57-65.

[8]   J. Wolny y N. Charoensuksai, «Mapping customer journeys in multichannel decision-making», *Journal of Direct, Data and Digital Marketing Practice*, vol. 15, n.°4, pp. 317-326, 2014.

[9]   K. N. Lemon y P. C. Verhoef, «Understanding customer experience throughout the customer journey», *Journal of marketing*, vol. 80, n.°6, pp. 69-96, 2016.

[10]   Terragni y M. Hassani, «Analyzing customer journey with process mining: From discovery to recommendations», en *2018 IEEE 6th International Conference on Future Internet of Things and Cloud (FiCloud)*, 2018, pp. 224-229.

[11] L. Reinkemeyer, *Process Mining in Action*. Springer, 2020.

[12] G. Flores y J. R. Riquenes, «AUDIT 2.0, A PERSPECTIVE FOR ITS EXECUTION IN THE BUSINESS ENVIRONMENT USING PROCESS MINING TECHNIQUES/Auditoria 2.0, una perspectiva para su ejecucion en el entorno empresarial utilizando tecnicas de mineria de procesos/AUDITORIA NUMERO 2.0, UMA PERSPECTIVA PARA SUA EXECUCAO EM UM ENTORNO EMPRESARIAL UTILIZANDO TECNICAS DE EXPLORACAO DE DADOS», *Vivat Academia*, n.°150, pp. 47-58, 2020.

[13] M. Montali, «Process mining manifesto», en *Business Process Management Workshops: BPM 2011 International Workshops, Clermont-Ferrand, France, August 29, 2011, Revised Selected Papers, Part I*, 2011, vol. 99, pp. 169-194.

[14] W. Van Der Aalst *et al.*, «Process mining manifesto», en *International Conference on Business Process Management*, 2011, pp. 169-194

[19]

[15] W. Van Der Aalst, «Data science in action», en *Process mining*, Springer, 2016, pp. 3-23.

[16] D. Dakic, D. Stefanovic, I. Cosic, T. Lolic, y M. Medojevic, «BUSINESS PROCESS MINING APPLICATION: A LITERATURE REVIEW.», *Annals of DAAAM & Proceedings*, vol. 29, 2018.

[17] G. Bernard y P. Andritsos, «A process mining based model for customer journey mapping», en *Forum and Doctoral Consortium Papers Presented at the 29th International Conference on Advanced Information Systems Engineering (CAiSE 2017)*, 2017, vol. 1848, pp. 49-56.

[18] P. Kotler, H. Kartajaya, y A. Alaydrus, «Megamarketing in The Post-Pandemic Era: Rebalancing Political and Social Power», *Journal of Macromarketing*, p. 0276146721996433, 2021.