Available online at www.ijournalse.org

Emerging Science Journal

(ISSN: 2610-9182)

Vol. 8, No. 1, February, 2024

Visitor Experience Map and NFC-Based Scoring for Data-Driven Exhibition Enhancement

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Abstract

In the current exhibition industry, it is crucial for organizers and exhibitors to comprehend and enhance visitor experiences. The objective of this study is to improve the exhibition setting by utilizing Near Field Communication (NFC) technology to capture, monitor, and analyze visitor behavior, engagement, and satisfaction. The main approach entails combining NFC technology with the Visitor Experience Map to fully understand the complexities of the visitor experience. NFC-enabled smartphones facilitate seamless interaction with the system, as users simply need to bring their smartphones close to NFC tags. This enables data collection and triggers the activation of a visitor scoring form for ratings and feedback. The study's findings indicate a mean system usability score of 81.4, which demonstrates successful implementation and great usability. This confirms the effective and easy-to-use nature of the strategy, guaranteeing that visitors can effortlessly provide their ratings and feedback. The originality and enhancement reside in the successful integration of NFC technology with the Visitor Experience Map, providing a strong and user-focused approach for organizers and exhibitors to enhance the exhibition experience. This study creates a favorable situation for both visitors and stakeholders, demonstrating the potential of technological advancements to greatly influence the exhibition industry.

Keywords:

Customer Journey Mapping;
Near Field Communication;
Exhibitions; NFC-tag;
Customer Rating;
Visitor Feedback.

Article History:

Received:	25	October	2023
Revised:	08	January	2024
Accepted:	17	January	2024
Published:	01	February	2024

1- Introduction

Exhibitions have significantly contributed as a pivotal marketing instrument for exhibitors on a global scale. For instance, the European exhibition market has the distinction of being the largest globally, with a total of 496 exhibition venues, which represents approximately 48% of the global exhibition space capacity. In 2019, a total of 13,700 exhibits were staged, attracting around 260 million people [1]. These events are organized for a certain period at regular intervals to acquire new consumers, showcase products or goods, get insights into industry trends, and foster effective communication with existing clients and the public [2]. Exhibitions with thoughtfully designed display booths can attract a substantial volume of visitors. This, in turn, may have a positive impact on the business's reputation and generate more revenue [3]. Moreover, these exhibitions offer exhibitors a great opportunity to present their products and services on a prominent platform, facilitate cultural enrichment and economic advancement within the community, while also enabling companies to generate potential leads [4] to establish connections with prospective consumers and partners. Visitors may also align their interests and preferences with the wide array of offers available at exhibitions, enabling them to discover and actively interact with products, services, and ideas that suit their own requirements and passions [3, 5].

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DOI: http://dx.doi.org/10.28991/ESJ-2024-08-01-015

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Exhibitions have undergone a transformation into dynamic settings that require a comprehensive comprehension of visitor behavior, preferences, and experiences. Visitors use the exhibition as an information source for many purposes, such as acquiring data for potential future purchases, learning about market trends, enhancing job performance, and increasing industry knowledge. Within this setting, the optimization of the exhibition experience has become a strategic need for organizers and exhibitors that aim to effectively connect, enlighten, and captivate their audiences. The conventional methods employed in exhibition design, which rely heavily on assumptions and historical data, are becoming inadequate for addressing the changing demands of visitors. The exhibition's quality can be enhanced by implementing engagement metrics that focus on contributing information to improve the exhibition's quality, such as "We would want to submit feedback on the exhibition's design." [6]. As business partners, exhibitors are prepared to share their exhibit operational skills with the event organizer. Understanding how to strengthen an exhibition's competitive advantage is critical for the continuous improvement of exhibition quality. It is also essential that the organization save visitor information and categorize it based on the purpose of the visit. Prospective customer information can be shared with the sales department, and prospective business partner information can be shared with the purchasing department. Participating in the exhibition is as important as relying on this information [7].

Therefore, obtaining feedback from visitors is of utmost importance for exhibition organizers and serves as a critical factor in maintaining competitiveness within the ever-evolving exhibition industry. This analysis provides valuable insights that empower the organizers to consistently enhance their events, ensuring their ongoing attractiveness and relevance to participants, i.e., exhibitors and visitors [6]. Through gaining knowledge of visitor preferences, event organizers can make precise adjustments to the content, optimize the layout and style, and change marketing techniques to surpass competitors [8]. The provision of positive feedback has the potential to attract a greater number of sponsors and exhibitors, consolidating the event's standing within the market. Conversely, the timely resolution of issues serves to uphold a robust reputation. The perpetual process of enhancing and adapting is vital for maintaining a competitive edge and flourishing within the exhibition industry's challenging environment. Previous studies have applied different theoretical research approaches to address customer experience. This includes the Experiential Design, Service-Dominant Logic, Event Engagement Theory, Experience Economy, Customer Journey Mapping, Social Exchange Theory, and Expectancy-Disconfirmation Theory. Table 1 provides a summary of these approaches.

Table 1. Theoretical Approaches in Customer Experience

Theory	Description
Experience Design Research	Focuses on cultivating memorable experiences for customers by creating affective bonds and ensuring customer satisfaction [9]. It is important to integrate different fields of study to investigate the role of emotions in visitor experience [10].
Service-Dominant Logic (SDL)	Considers the interaction between customers and service providers as a collaborative process where both parties actively contribute to the generation of value. It emphasizes the significance of consistent communication to improve mutual comprehension and contentment and acknowledges feedback as an essential component in the dynamic process of value co-creation [11].
Event Engagement Theory	Focuses on the proactive involvement of participants in events. It entails assessing the level of engagement and involvement among participants during the event. The primary focus is on ensuring the satisfaction of attendees and their active participation in the event. The approach acknowledges various ways in which participants may interact and establish connections with the event's content and offerings [12].
Experience Economy	This approach requires creative and innovative experience design to differentiate it from competitors. It values a unique and memorable experience to enhance customer loyalty. It also emphasizes ensuring that customers' time is valued and how effectively companies' offerings fulfil their intended purpose [13].
Customer Journey Mapping	Focuses on understanding the entire customer journey from pre-event awareness to post-event interactions. It identifies pinpoint areas for improvement and aims to enhance overall customer satisfaction [14].
Social Exchange Theory	Focuses on information exchange and mutual benefits between two parties. It also acknowledges the importance of feedback and assumes calculated decision-making as a form of social exchange [15].
Expectancy-Disconfirmation Theory	This approach evaluates customer satisfaction based on the expected gaps to identify areas for improvement. A comparison is made based on customer perceptions of service quality and the actual service quality rating [16].

The exhibition industry involves different exhibition contexts such as the internet and e-commerce, service organizations, science and culture exhibitions, retail environments, education, malls, etc. [17], which maintain a close relationship with technology and its advancement, resulting in a significant transformation in the landscape of exhibits [1]. Furthermore, the success of an exhibition is dependent on the active involvement of a significant number of participants. According to traditional marketing ideology, consumers generally like obtaining significant information to

make informed decisions [9]. It should also be noted that the participants play a significant role in shaping the brand equity of an exhibition, particularly in terms of its long-term worth [18]. Experience design encompasses the deliberate choice, organization, and arrangement of touch points to create a cohesive journey that elicits favorable feelings and thoughts, and ultimately leads to business success [10]. Hence, understanding the visitor path is essential for evaluating how visitors perceive and behave during an interaction. A trip comprises a series of touch points wherein visitors engage with tangible objects, social components, and technology-driven interfaces [9].

A well-designed booth can draw the attention of the audience and impress the exhibits. Exhibitors must maintain their booths, and improper placement may keep visitors dissatisfied and inclined to visit. It is necessary to do a comprehensive evaluation of them to decide which areas have potential and to develop a user-friendly system that considers site visitors' preferences and interests. Hence, conventional approaches to capturing participant feedback, especially from visitors, are no longer sufficient to accommodate their expectations. Their exhibition experiences include a wide range of sensory interactions within the event's physical and social contexts. These encounters engage all five senses and frequently lead to participants sharing their opinions via several evaluations [19]. For example, a study that investigates the digital interpretation and presentation of cultural heritage sites reveals that visitors are willing to actively participate in some co-creation processes and to interact with different digital display settings [20]. Innovative touch points, such as self-service kiosks, mobile devices, and wearable technology, allow organizers to give values, engage with consumers, and deliver experiences in a fundamentally new way, increasing sales and relationship-building opportunities [21].

Therefore, this study intends to employ Near Field Communication (NFC)-based technology in acquiring exhibition visitor feedback by developing a mobile application that is guided by the Visitor Experience Map Framework (VEM). Mobile applications provide extensive data sources for a variety of inputs and concurrent experiences [21]. The application automates all the functions needed and allows real feedback and data-driven insights based on visitors' experiences. It enables stakeholders to effectively enhance visitor experiences, increase engagement, and optimize the value of exhibits for both visitors and exhibitors. The integration of VEM and NFC technology holds the potential to revolutionize the exhibition industry by placing data at the forefront of innovation and prioritizing the visitor experience. In the following sections, we present the methodology, execution, and consequences of this study, offering insights into its potential to transform the exhibition environment and guide future improvements in enhancing exhibitions.

The following sections of this paper are organized as follows: Section 2 provides a view of current visitor experience feedback, the Customer Journey Mapping, and the Near Field Communication technology. Section 3 presents the methodology applied to achieve the outcomes. Section 4 presents the results and analysis of the findings, while in Section 5, we provide the conclusion and suggest potential avenues for future investigation on the subject matter.

2- Related Work

2-1- Visitor Experience Feedback

In the area of survey and feedback gathering, a multitude of approaches and technologies have been devised. The use of feedback boxes, which consist of single-question forms, offered a straightforward and inconspicuous method for gathering input. However, it is worth noting that they may not be as appropriate for extensive feedback collection and the construction of digital records [22]. One of the traditional ways of conducting feedback is through reaching out to the visitors directly. Nevertheless, direct contact requires manpower since it will get more value from a simple conversation instead of from a survey. By contacting through phone calls, emailing as well as scheduling meetings with them are also effective approaches to obtain feedback from customers in person. It opens conversations directly where the customers might provide their experiences with more details even wider impressions as the dialogue evolves. Customers can also provide feedback in a variety of formats including sending emails, tweets, posting online reviews, contacting contact centers, or uploading images to Instagram or vlogs to YouTube [23].

On the other hand, the use of contactless feedback collection methods, exemplified by the implementation of HappyOrNot smiling kiosks, has gained significant traction in recent times. HappyOrNot Smiley kiosks are contactless, which allow customers to press a button to give quick feedback. It is beneficial to answer short and basic questions where these machines are usually placed among people in public. In terms of the number of encounters with different customers, these devices collect more feedback than any other alternative. It was intended to make it incredibly simple for customers to feel comfortable providing anonymous feedback rather than making the process exceedingly lengthy and arduous for them [24]. These methods have proven to be effective in swiftly gathering input from a substantial number of people. However, it is important to consider the associated costs when considering their implementation.

Google Forms, a frequently utilized online survey platform, presented a user-friendly design; nonetheless, it encountered difficulties in terms of user participation. In response to these constraints, the use of QR codes emerged as a prominent alternative strategy. Current visitor analysis uses live survey tools such as SurveyMonkey, which provides cloud-based accessibility but also raises security issues for free accounts. SurveyGizmo, a well-known tool in the field,

had extensive data analysis capabilities, yet there were areas that required enhancements. Additional scalable online survey solutions, such as GoSurvey & Zoho Survey, have emerged to address the varied requirements of different organizations [22, 25]. Rating scale questions and subjects are extensively employed in the social sciences, where online questionnaires are gaining popularity. A rating scale consists of a measurement spectrum extending from one endpoint to the other (e.g., strongly agree–strongly disagree) [26]. Moreover, visitors anticipate an exhibition to be an industry exhibition while also having the opportunity to experience new products and services in addition to swiftly obtaining information. A scoring sheet is useful in the case of exhibition structure. For example, a five-point rating scale was introduced to evaluate a museum's exhibition structure. The rating can assist the museum in effectively communicating its intended messages to the visitors, as it is necessary to advertise modern, innovative, and entertaining exhibitions to enhance the visitor experience [27]. Hence, with the use of a visitor scoring sheet, visitors can express their views and opinions by ranking different services on several behaviors and openly advocating or forbidding the adoption of products and services. Visitors rely on feedback as an essential source of information, which, depending on the quality of the assessments, might influence their decision to acquire a certain product or service [28].

Furthermore, the rating sheet is necessary since it has a substantial impact on visitor satisfaction and recommendation behavior. The goal of gathering and assessing consumer feedback is to discover the pulse of a certain market to assist businesses in improving their products. Thus, it is essential to develop technology that facilitates interactions with real customers and swiftly captures their opinion on the available product-service to obtain the demands of the market and enhance the products and services offered to the market. The acquired data can be sent for further analysis and conducting metrics with advanced software technology, as well as viewing the performance of the visitors' personnel participating in the fair using a feedback management tool [25]. Therefore, an exhibition needs to develop new applications that will benefit visitors.

In addition, the emergence of cross-platform customer satisfaction applications, as exemplified by Review Me, has been designed with the objective of enabling customers to provide genuine evaluations of their encounters with various services and enterprises. This application utilized hybrid frameworks and novel programming languages to guarantee interoperability across diverse operating systems. Nevertheless, there were certain proposed characteristics that were not yet implemented because of project limitations and a scarcity of experience [29]. In addition, strategies for gathering and overseeing input were implemented to tackle prevailing obstacles and assist enterprises in improving their systems for controlling products and services. The methodologies employed mobile applications with 3D animation and visualization, feedback management systems, and text-mining algorithms aimed at obtaining comprehensive insights [25, 30].

Moreover, the incorporation of Near Field Communication (NFC) technology in trade exhibitions represents a noteworthy progression in technical innovation. There are now 2 billion devices that are NFC-enabled, the majority of which are phones. For instance, a service model for O2O (online-to-offline) using NFC (Near Field Communication) technology within an exhibition-space context was proposed [31]. Additionally, Thomson Reuters was reported to have implemented NFC technology for the introduction of an interactive knowledge quiz, which successfully fostered sustained engagement among attendees. The use of NFC chips, which were readily integrated into orange wristbands, played a crucial part in enabling and enhancing this interactive experience. Access to the displays was granted to visitors using NFC technology, which has become essential in the documentation of vital data and monitoring the actions of visitors, encompassing the tally of stations visited and the accrual of points via NFC data collection. The electronic records that were carefully maintained in the master database were afterwards utilized for the purposes of measurement and data analysis [32]. The data has great importance, especially in relation to the improvement of interaction in exhibitions [2].

2-2- Customer Journey Mapping

Customer Journey Mapping is a process-oriented, visual user experience method for structuring and conceptualizing human experiences that has been used in software development, sales and marketing processes, and service engineering to analyze and optimize so-called touch points between the customer and the company [33, 34]. The complexity of the customer experience is break it into separate, chronologically sorted and thus constitute a series, which is analogous to a process [35]. It assists businesses in understanding how consumers utilize and perceive the many channels and touch points with the organization, as well as how they fundamentally envisage that experience. It can be a strategic innovation tool to build the optimal customer experience in terms of important consumer groups' expectations [36].

Customer Journey Mapping (CJM) and Service Blueprinting were employed as realistic methods for measuring and enhancing the customer experience in a library context. Several suggestions were made to improve the user experience, such as increasing digital way finding, making catalog stations more visible, and revising website FAQs [37]. Moreover, the CJM is a tool for understanding the customer's decision-making process and experiences, which are key differentiators in the digital era. The tool is recognized for encouraging innovation by offering upgrades or new services based on client feedback [35]. For example, a study applied CJM to provide useful insights for merchants trying to improve their understanding of consumer behavior in the fashion sector and build better customer-centric experiences.

The study presents a specialized framework for high-participation female fashion customers in an omnichannel setting and investigates risk mitigation measures, emotional experiences, and practical applications [38]. Similarly, another study also contributes to a better understanding of the retail industry by providing insights into various aspects of customer journeys, providing valuable information for retailers to improve their strategies and customer experiences, whether in the context of high-involvement fashion retail or pop-up retail environments. In addition, the study broadens the scope to include all forms of pop-up retail, investigating how Marketplace-Based Pop-Ups (MBPUs) fit into the consumer experience and emphasizing the complexities of these trips across several touchpoints [39].

CJM is also applied for measuring customer service delivery. A process model and a customer journey mapping framework can be used for the identification and execution of acceptable and relevant metrics for monitoring and enhancing customer service experience strategies, as well as the formulation and deployment of such strategies. This is performed by supplying a set of rules to assist in the selection of suitable metrics for assessing customer service performance, which is accomplished via the use of a distinct decision framework [40]. The interactions incorporate social connections, comparative degrees of alternatives, power roles, technology, structural linkages, and collaboration as variables that affect the various phases of relationship evolution [41].

Besides, a method for systematically analyzing assembly processes using CJM was proposed to understand the requirements and experiences of employees who do manual assembly activities. The method aims to find pain areas, opportunities for development, and possible digital assistance solutions that may be efficiently incorporated into the assembly process [34]. Hence, understanding customer behavior, directing consumers through a funnel, selecting marketing tools, identifying the audience, creating targets and Key Performance Indexes (KPIs), and mapping the customer purchasing process are all principles connected to CJM that can be applied in different areas. Integrating CJM into social media marketing tactics may assist marketers in gaining a better knowledge of their consumers and optimizing their efforts to obtain the desired results [42].

2-3- Near Field Communication (NFC) Technology

NFC technology enables communication via short-distance, mobile, and wireless networks. Communication occurs when two NFC-equipped devices are in proximity within centimeters, basically touching an NFC tag, another NFC mobile, or an NFC reader using their NFC mobiles. Following the touching activity, the NFC mobile may use the obtained data further, or alternatively, accessible mobile services such as downloading a web page, initiating a web service connection, and so on [43]. There is a growing number of smart devices being developed for a wide range of applications that can be efficiently controlled by NFC technology since it is already integrated into the user's mobile device [31]. The NFC does not necessitate a special key value, unlike other wireless technologies that rely on such values for device connectivity. Instead, NFC merely requires the user's smartphone to establish a connection. Mobile devices with NFC simultaneously support read/write mode, which allows the device to read and/or write passive NFC tags and stickers, allow data exchange with another NFC-enabled device via P2P mode, and allow the device to act as an NFC card to be accessed by an external NFC reader. This refers to the card emulation mode.

3- Research Methodology

In this study, the research activities were divided into six stages, i.e., defining research objectives, conducting a literature review, formulating research questions, finalizing the research design, implementing NFC technology, and finally, data collection and analysis. Figure 1 illustrates the flow of the research activities.

Figure 1. Research Framework

This study focuses on comprehending the overall visitor experience in exhibition settings. The main objective is to employ Near Field Communication (NFC)-based technology in acquiring exhibition visitors feedback by developing a mobile application that is guided by the Visitor Experience Map framework (VEM). The literature review facilitates a thorough comprehension of current research on visitor experiences, the integration of technology, and data-driven methodologies in exhibitions. This stage is in line with the goal of creating a comprehensive Visitor Experience Map and NFC-Based Scoring system. Related publications in this research area were acquired from scholarly databases including Science Direct and Scopus using keywords like “customer experience”, “exhibitions”, “customer engagement”, “customer feedback” etc. Later, the research question was formulated as “How can the integration of NFC-based technology be utilized to investigate visitor experience in exhibition settings?” and “How can Customer Journey Mapping can be adopted for visitors experience?”. The research design was finalized to implement and assess the integration of the Visitor Experience Map and NFC-Based Scoring system. The NFC technology was chosen to create a seamless data capture infrastructure, contributing to the data-driven exhibition enhancement. Afterwards, data collection and analysis were performed to assess user feedback on the proposed approach.

3-1- Visitor Experience Map

This study applies a customized Customer Journey Mapping (CJM) known as the Visitor Experience Map (VEM) specifically designed for exhibition settings. The selection of this strategy was based on the importance of gaining a thorough grasp of the stakeholders' experience in the context of an exhibition. Exhibitions play a crucial role as significant forums for facilitating contact among organizers, exhibitors, and visitors. Ensuring the optimal visitor experience is of utmost importance for the overall success of these events. The VEM offers a comprehensive depiction of the complete trajectory that participants undertake when engaging in the exhibition. It emphasizes the crucial touchpoints or contact points that exist between visitors and the exhibition. It also depicts the actions that visitors normally take at each touchpoint. Registration, browsing exhibitor displays, interacting with exhibitors, networking with peers, and offering feedback are examples of such activities. Furthermore, an NFC-based visitor scoring mobile application is integrated into the visits to acquire visitor feedback and enhance their experience. This application allows for the gathering of real-time input from visitors, which can then be used by the organizer for continuous improvement and potential areas for enhancement. Figure 2 illustrates the VEM, which consists of five phases, i.e., awareness, action, experience, engagement, and advocacy. These phases collectively illustrate the progression of the visitor's journey throughout the exhibition. The utilization of Near Field Communication (NFC) technology facilitates the gathering and examination of data, hence supporting a more data-centric approach to improving exhibitions. The stages of VEM for exhibitions are described in Table 1.

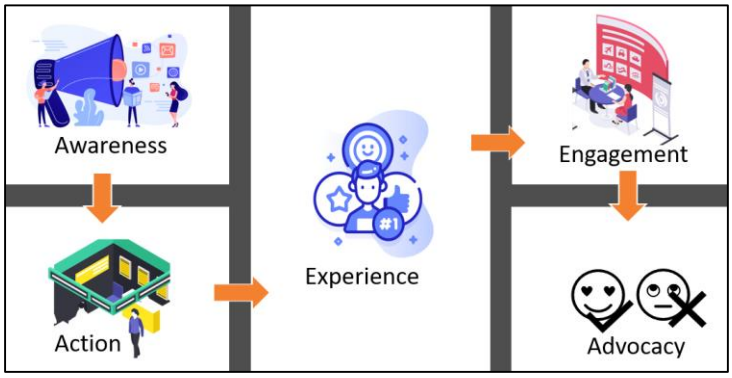

Figure 2. Visitor experience map

Table 1. Visitor experience map for exhibitions

Stage	Touchpoints	Actions
1. Awareness	Marketing campaigns (online and offline); Social media presence; Email invitations.	• Potential visitors become aware of the exhibition. • Potential visitors explore event details, the agenda, and exhibitor information. • Potential visitors plan their visit and set expectations.
2. Action	Exhibition website; Registration site/portal.	• A potential visitor indicates their intention to attend the exhibition by registering. • Organizers receive notifications and send reminders to potential visitors and exhibitors. • Exhibitors receive event logistics and guidelines.
3. Experience	Registration/check-in desk; Booth setup for exhibitors includes placement of NFC tags.	• Visitors check in, receive badges, and enter the exhibition. • Exhibitors set up their booths and promotional materials.
4. Engagement	On-site staff assistance; Interactive displays and demonstrations; NFC-based Visitor Scoring App.	• Exhibitors interact with visitors. • Visitors gather information, make connections, and engage in activities. • Visitors provide real-time feedback via the mobile app.
5. Advocacy	Post-event surveys; Thank you emails; Organizer dashboard.	• Visitors reflect on their experience and provide recommendations to the community. • Exhibitors provide feedback to the organizer and follow up with leads. • Organizer analyze feedback received, reflect, and provide an action plan for the next event.

3-2- NFC-based Visitor Scoring App

The visitor scoring application proposed uses NFC technology to facilitate interaction between the application and visitors. The system architecture (Figure 3) offers a visual representation of the solution, showcasing the key components involved and their interconnections. It illustrates the flow of processes and highlights the role of NFC technology in enabling seamless communication between the visitor scoring application and NFC-enabled devices, such as smartphones. By leveraging NFC, visitors can conveniently interact with the application and provide their ratings and feedback.

Figure 3. System architecture

The system provides ease of interaction between the organizer, exhibitors, and visitors. Considering the requirements, design, functionality, and structure of the application, the front-end components were developed using HTML, CSS, and JavaScript programming languages. The purpose of this feature is to acquire feedback about the exhibitors/booths being visited. It is assumed that each visitor will have their own NFC-built Android device that enables him/her to tap on the NFC sticker that is placed at the booth to obtain the scoring form. Then, the visitor's smartphone will instantly run a web browser and generate a rating form for the visitor to provide statistical information through a structured set of questions. Visitors must rate their level of satisfaction as either 1-totally disagree, 2-disagree, 3-neither disagree or agree, 4-agree, or 5-totally agree based on the statements. The obtained data will subsequently be stored in Firebase, which served as the backend system. The acquired data will be visualized on a dashboard and may be further analyzed into meaningful information. Exhibitors and organizers will be provided access to the dashboard to view the generated reports based on the acquired information.

3-3- Visitor Scoring Instrument

Figure 4 presents the questions or statements included in the Visitor Scoring form. Visitors are required to rate their level of satisfaction based on their engagement with the exhibitors at specific booths. The 5-point Likert scale applied are 1- totally disagree, 2- disagree, 3-neither disagree or agree, 4-agree, and 5-totally agree.

No	Questions	Scale				
1	How would you rate the booth on a scale of 1 to 5?	1	2	3	4	5
2	I am happy with the number of activities in this booth.	1	2	3	4	5
3	I have the opportunity to ask questions and engage in the booth.	1	2	3	4	5
4	I am clear with the booth information.	1	2	3	4	5
5	I am satisfied with the quality of the booth's content.	1	2	3	4	5
6	I'm satisfied with the networking opportunities offered by the exhibition staff.	1	2	3	4	5
7	I would recommend similar events in the future to my friends.	1	2	3	4	5
8	The exhibition staff were helpful and knowledgeable.	1	2	3	4	5
9	I have met the expectations in the exhibition booth.	1	2	3	4	5
10	I am likely to participate in one of the events in this booth in the future.	1	2	3	4	5
11	How satisfied were you with the speakers and sessions at the booth?	1	2	3	4	5
12	The duration of the event booth was just right. (Not too long or not too short)	1	2	3	4	5
13	I wish to attend to exhibitions again in the future.	1	2	3	4	5

Figure 4. Visitor scoring questions

4- Results and Discussions

During the awareness phase, potential visitors to the exhibition commonly get information about the exhibition through many channels, such as advertisements, social media platforms, and public relations endeavors that were initiated by the organizer. This includes promotional materials on various digital platforms, such as social media feeds and websites, as well as getting recommendations from their acquaintances and professional networks. The exhibition will be appealing to potential visitors based on several factors, including the event's distinct value offer, notable speakers or performers, captivating themes or topics, and the potential for important networking prospects. To cultivate and enhance the individual's interest, it is imperative to deliver a concise and captivating message that effectively emphasizes the significant advantages of the exhibition while also addressing any concerns or areas of interest that may be of relevance to the possible visitor. The venue of the exhibition also plays an important role in the likelihood of people becoming aware of its presence.

The action phase is characterized by individuals making a deliberate choice to officially enroll, get tickets, or take other tangible actions to participate in the event. At this point in time, it is important for the organizer to assist the individuals, and efforts should be made to optimize the registration process by implementing streamlined procedures, offering online platforms that are user-friendly, and ensuring the provision of clear and concise instructions. The primary factors that draw participants during this stage are the convenience of registration, early-bird discounts, and the opportunity for unique access to the exhibition booths. The conveyed message should prioritize highlighting the ease of the registration procedure and the concrete advantages of participating, such as acquiring useful knowledge or networking prospects. Efficient communication between the event organizer and the participant includes timely replies to inquiries, customized registration confirmations, and unambiguous event logistics. A smooth and effective experience at this juncture cultivates a feeling of dedication and expectation, reinforcing the attendee's intention to partake. Considering the NFC-based Visitor Scoring App design, each booth is equipped with an NFC sticker that contains a unique ID specifically assigned to that booth.

During the experience phase, the primary objective is to investigate the spatial arrangement of exhibitor booths and analyze the booths visited by the visitors. During this pivotal phase, visitors proceed towards the designated exhibition area, where they actively interact with exhibitors and a wide range of exhibits, products, and services. The effective use of pathfinding elements, clear signage, and easily accessible informational resources facilitates individuals in exploring designated booths that align with their preferences. Moreover, during the engagement phase, the physical setting serves as the central point for their immersive experiences, as NFC technology effortlessly gathers data on their interactions and behaviors. Visitors may express their viewpoints and observations via the NFC-based Visitor Scoring App, offering important evaluations and comments on specific exhibitors. Figure 5 presents the visitor scoring form for a booth, i.e., Booth B.

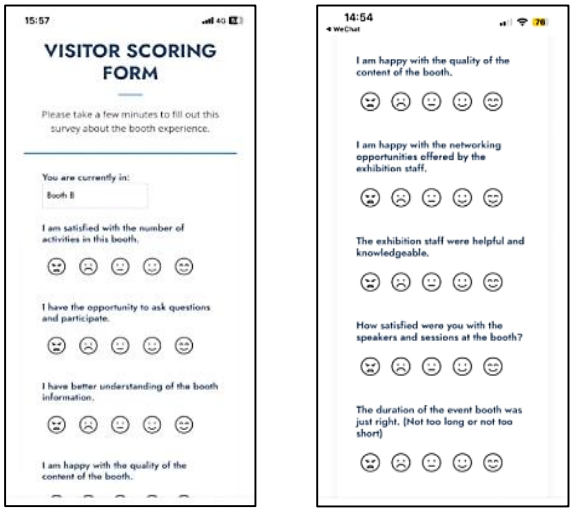

Figure 5. Visitor scoring form for exhibitor

The presented data possesses substantial importance for exhibitors and organizers, as it allows them to evaluate visitor satisfaction and implement specific improvements. Due to the non-linear characteristics of visitor footprints, visitors have the freedom to either revisit booths they have previously visited or proceed directly to their desired booths or exhibitors, guided by their own preferences and interests.

The advocacy phase plays a crucial role in cultivating a devoted community of visitors who not only exhibit repeat attendance at forthcoming events but also assume the role of advocates, disseminating information, and attracting new visitors. The NFC-based Scoring App serves to collect data and feedback from visitors to gain a comprehensive

understanding of the successful aspects of the event while also identifying potential areas for improvement in subsequent events. The inquiry pertains to the visitors' general satisfaction, their advocacy or recommendations, and any comments they may have. Figure 6 presents the visitor scoring form for the organizer.

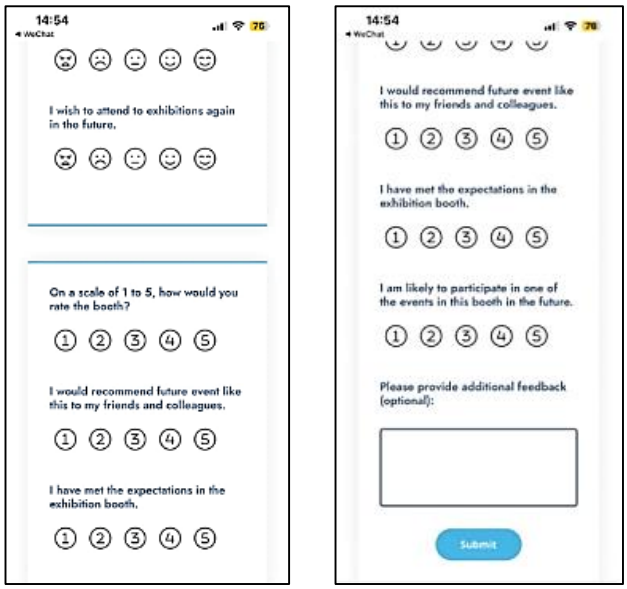

Figure 6. Visitor scoring form for organizer

Moreover, for the long-term maintenance and growth of the success of future exhibitions, the NFC-based Scoring App is linked to a dashboard that aims to provide information and insights into the success and effectiveness of an exhibition. The exhibitors and organizers may access the dashboard using their credentials. To obtain the credentials, a registration process needs to be completed during the action phase of the VEM. This ensures that each exhibitor is associated with a specific booth, granting exclusive access to its information. On the contrary, the organizer will have privileges to oversee the entire exhibition event. At any point of the exhibition, both the organizer and the exhibitor may access the dashboard, which presents key metrics, including the total number of visitors per booth and the overall number of booths at the exhibition. It includes the timestamp graph, which shows the timestamp when visitors submit their ratings in the booths. This allows exhibitors and organizers to track the timing of visitor engagement and identify peak periods of activity. The dashboard ensures privacy and access control by limiting exhibitors' views to their respective booths. Each exhibitor can only access detailed information and analytics for their own booth, and other options are disabled to prevent unauthorized access. Exhibitors can also view average scores for each question to understand visitor feedback and opinions on different aspects of the booth or exhibition. Figure 7 shows a few snapshots of the dashboard.

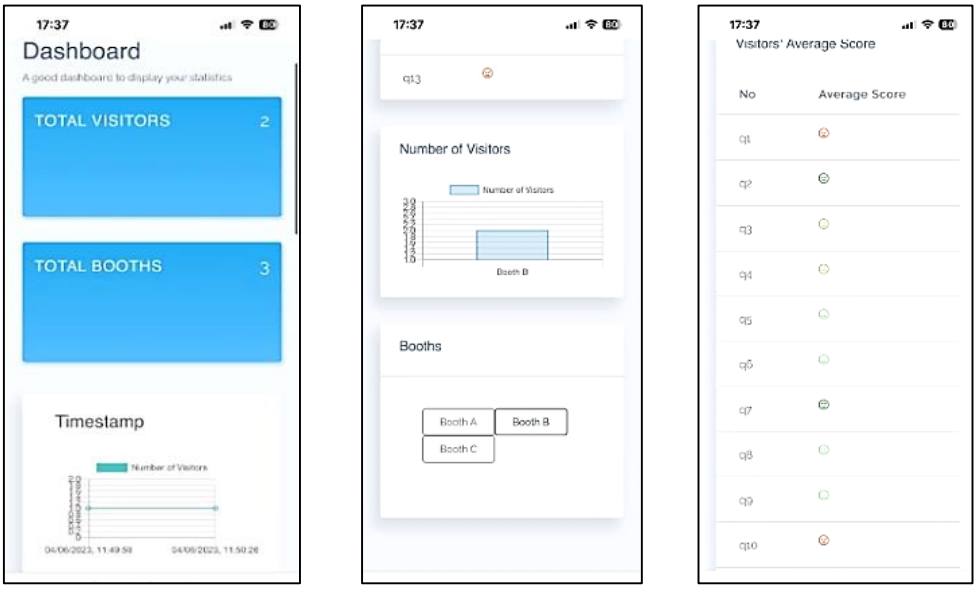

Figure 7. Snapshots of NFC-based visitor scoring app dashboard

Overall, the NFC-based Visitor Scoring App was tested by 20 volunteers in a closed environment. Each booth is equipped with an NFC sticker that contains a unique ID specifically assigned to that booth. The participants used their own NFC-enabled Android or iOS devices to tap the corresponding NFC stickers at each booth. At the end of the testing, the volunteers were asked to fill up a System Usability Scale (SUS) survey. The SUS survey is a standardized questionnaire-based method for assessing the perceived usability of a system. The SUS questionnaire is prepared using a Google Form, which consists of a series of ten statements, and respondents rate their level of agreement on a scale from 1 to 5, ranging from strongly disagree to strongly agree. The statements cover aspects such as ease of use, learnability, efficiency, and overall user satisfaction. By administering the SUS survey, feedback regarding the usability and satisfaction with the proposed NFC-based Visitor Scoring App was collected and analyzed. The result revealed that the volunteers found that the app has good usability and provides a positive user experience, with an average SUS score of 81.375. The system's design, NFC technology integration, user interface, and functionality contributed to its effectiveness in enhancing visitor engagement and booth evaluation at exhibitions.

5- Conclusions

In the exhibition landscape, it is crucial to comprehend the trajectory of visitors and augment their whole experience to achieve success. The absence of a systematic methodology for comprehending visitor journeys hampers the capacity to make well-informed judgments pertaining to event planning, marketing strategies, and overall exhibition administration. Understanding the visitor experience will potentially boost the probability of visitors becoming advocates and attending subsequent events. Exhibition organizers and exhibitors who lack strategic mapping and optimization of the customer journey may face difficulties in distinguishing themselves and attracting repeat visitors. Hence, this study introduced a Visitor Experience Map (VEM) for exhibitions with five phases, i.e., awareness, action, experience, engagement, and advocacy, that considers the Customer Journey Mapping approach and an NFC-based Visitor Scoring App for the purpose of collecting data from the visitors. Our study considers significant touchpoints and interactions among visitors, exhibitors, and organizers to obtain a comprehensive viewpoint on the progression of individuals from potential visitors to advocates of the exhibition.

During the experience and engagement phases, the NFC-based Visitor Scoring App serves as an instrument that facilitates the collection of real-time data from visitors. The scores are characterized by significant interactions and assessments of visitors' satisfaction, which offer exhibitors and organizers vital data to facilitate further enhancements. The satisfaction of the visitors may informally lead them to assume the role of advocates and ambassadors of the exhibition, which could be recognized as a deliberate approach aimed at cultivating a dynamic and enduring community. The findings from the data collected via the NFC-based Visitor Scoring App enable organizers and exhibitors to enhance their plans, customize visitor experiences, and optimize the effectiveness of their events. The data-driven approach holds significant potential for shaping the future of visitor engagement and event success within the evolving exhibition landscape. The convergence of technology and a focus on visitor experience is highly encouraged to fully harness the potential of exhibitions and offer visitors impactful and enlightening experiences.

The synchronization of VEM with the NFC-based Visitor Scoring App ensures a comprehensive understanding by capturing the entire journey. This is crucial in exhibitions where visitor experiences unfold across multiple phases. It specifically explores the emotional journey, which is well-suited for the purpose of improving visitor satisfaction in the context of exhibitions. Since VEM is based on Customer Journey Mapping (CJM), it is fundamentally characterized by its dynamic and iterative nature, which enables the ability for adjustment and refinement in response to the evolving behaviors and expectations of visitors and enables continuous enhancement. Other frameworks may possess a more rigid or inflexible structure, which could potentially restrict their ability to adapt to changes in the display landscape. Moreover, VEM incorporates visual depictions, such as maps or diagrams, to enhance accessibility and facilitate effective communication with stakeholders. Conversely, many theoretical frameworks may significantly depend on quantitative data while lacking a visual narrative. The shared visualization also allows for collective understanding and decision-making among exhibitors, organizers, and visitors. In general, the app's functionality and usability were validated through testing, and it demonstrated its ability to facilitate the feedback collection process and enhance visitor engagement. However, the system's limitations include its limited testing environment, which may not fully represent real-world exhibition settings. Hence, it is proposed to conduct testing in real-world exhibition centers under different scenarios.

Moreover, the lack of previous research related to CJM not only highlights the importance of this study but also urges a more profound examination of the potential ramifications of these gaps. This acknowledgement provides a chance to contribute not just to the academic discussion but also to tackle practical difficulties in the exhibition sector. Further investigations can be conducted to compare the exhibition industry with other industries that have effectively utilized CJM. Transferable insights and recommendations from other industries may be implemented to improve the visitor journey at exhibitions. Evaluations of whether visitors who had a favorable, directed experience are more inclined to become recurring attendees and proponents of exhibitions or organizers may also be investigated. It is recommended for future researchers to analyze the incorporation of technology to improve visitor interaction in exhibitions, especially the integration of emerging technologies, such as augmented reality (AR) or virtual reality (VR), into a CJM framework to generate immersive and interactive experiences. Additionally, integrating advanced analytics techniques, such as sentiment analysis, would provide deeper insights into visitor feedback and emotions towards specific booths or exhibition aspects.

6- Declarations

6-1- Author Contributions

Conceptualization, S.F.A.R. and S.Y.; methodology, S.F.A.R. and R.A.; validation, M.S.S. and S.Y.; investigation, J.H.P.S.; writing—original draft preparation, S.F.A.R., J.H.P.S., and R.A.; writing—review and editing, S.F.A.R. and S.Y.; visualization, M.S.S.; supervision, S.F.A.R. All authors have read and agreed to the published version of the manuscript.

6-2- Data Availability Statement

No new data were created or analyzed in this study. Data sharing is not applicable to this article.

6-3- Funding

The authors received no financial support for the research, authorship, and/or publication of this article.

6-4- Acknowledgements

The authors would like to thank everyone who has contributed to this research, either directly or indirectly. The authors would also like to thank members of the Center for Intelligent Cloud Computing for their support in this study.

6-5- Institutional Review Board Statement

Not applicable.

6-6- Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

6-7- Conflicts of Interest

The authors declare that there is no conflict of interest regarding the publication of this manuscript. In addition, the ethical issues, including plagiarism, informed consent, misconduct, data fabrication and/or falsification, double publication and/or submission, and redundancies have been completely observed by the authors.

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