Abstract

Purpose: Real estate agents are professionals who need up-to-date and accurate information about their clients in order to maintain profitable and long-lasting relationships with each of them. A satisfied customer can be very valuable and profitable in the long term. This research focuses on solving the problem of the lack of a mobile CRM adapted to the needs of professionals. The importance of solving this problem is related to the importance of optimizing work and resources in a highly abundant information industry.
Design/methodology/approach: It was developed of a Customer Relationship Management (CRM) for mobile devices capable of managing information about the customers and business partners of each user, which provides a set of features well defined by the professionals. These features were collected through 15 face-to-face interviews and validated with six video conference interviews with industry specialists. For the development and evaluation of this artefact was followed the DSR methodology, corresponding each interview to an iteration of this model.
Findings: From this research resulted a selection of functionalities considered essential to the real estate agent's work. These features were successfully implemented in a mobile application that real estate agents appreciate for its simplicity and that they feel adds real value to their daily lives. Using this service, the productivity and performance of real estate agents might be improved.
Originality/value: It was verified that the mobile CRM solution developed is a desired solution by real estate agents in terms of customer portfolio management, enhancing the evolution of their relationships, and monitoring professional's performance.

Keywords: Mobile Customer Relationship Management, Information Systems, Real Estate Mobile Application

1. Introduction

In the last decade commercial real estate (CRE) has shown a great growth (Barwick, 2019) and, in the middle of a global pandemic, it has shown an accelerating pace in following the digital transformation experienced in all industries (Braesemann & Baum, 2020; Starr et al., 2020). With this, CRE competitiveness seems to increase in the same way (D. Zhang et al., 2016). This competitiveness leads CRE agents who traditionally have more information to create a more trustful relationship with customers (Bohling et al., 2006). And, normally, this relationship is synonymous of real estate acquisitions and sales for the professional (Gountas et al., 2014).

Knowing that having valid information constantly updated is a very important competitive factor (Agarwal et al., 2019) and taking into account that the CRE sector is one that generates large volumes of information (Cherif, 2014), the greatest challenge for CRE agents is to be able to store all this information in an organized and easily accessible way (Cherif, 2014; Jin et al., 2018).

This has led to a change in the paradigm of collecting and promoting properties in this sector (Bohling et al., 2006; Gubler & Cooper, 2019). Several complex information systems (IS) began to appear (Warburton, 2016), which allowed storing large amounts of real estate information, such as multiple listing services (MLS) and organized information respective to customers, such as customer relationship management (CRM) (Alrawhani et al., 2016). The different platforms created by each CRE brand encouraged its agents to be able to act without geographic restrictions (Cherif, 2014) creating and sharing business opportunities with different partners around the world (Donner et al., 2017).

With a more extensive portfolio of properties, more clients naturally arise. This way it is increasingly important the adoption of CRM by CRE agents (Haislip & Richardson, 2017; Hou & Wong, 2012). The good use of these IS has proven to be very important in stimulating good relationships between professionals and customers (Tholen et al., 2016). These relationships are translated into a quality service and, in turn, customer loyalty and possible recommendations (Gountas et al., 2014).

There is a need to access the vast information of each client at any time (Awasthi & Sangle, 2013) in order to create good empathic relations and transmit confidence in the service that the professional promotes. Thus, the concept of mobile CRM (m-CRM) arises (Aslam & Latif, 2020), an effective way for the CRE agent to manage all the information and processes of purchase and sale.

Therefore, the motivation for this research is to make CRE agents more competitive through the implementation of an m-CRM. However, before establishing the general objective for this investigation, a set of face-to-face interviews with CRE professionals was carried out to understand their main pains regarding tools like CRMs and their receptivity to the new information technologies, perceiving their background and how they use their smartphones. A total of 15 individual interviews were conducted, each lasting an average of 25 minutes. Table 1 shows the characteristics of the sample.

All the interviewees recognized that not using digital technologies means “giving up competitiveness in the market” (interviewee 8) and confess to be at ease with the handling of technological devices and digital tools. However, it has often been reported that the use of these devices often causes unwanted distractions, quoting one interviewee, "the mobile phone brings with it notifications about other applications such as social networks, that if we are not totally focused, we will not be able to be so productive" (interviewee 2). Professionals in the sector see their mobile phone as an essential tool for the work serving, among other things, the management of their customers and business partners and as an agenda.

Table 1 – First interviewees' data

ID	Gender	Age	Role	Years of Experience
1	Male	54	Collector and Buyer Agent	11 years
2	Male	46	Collector	3 years
3	Male	41	Team Leader	7 years
4	Male	43	Collector	2 years
5	Male	51	Branch Manager	6 years
6	Male	32	Buyer Agent	6 years
7	Female	49	Collector	3 years
8	Male	51	Team Leader	19 years
9	Female	33	Buyer Agent	2 years
10	Female	39	Administrative	7 years
11	Female	29	Marketing Manager	4 years
12	Female	40	Expansion Director	5 years
13	Male	37	Collector and Buyer Agent	7 years
14	Female	24	Collector	2 years
15	Male	52	Collector and Buyer Agent	16 years

Despite knowing the advantages inherent to the transition to digital tools, some of the interviewees are still sceptical, defending the use of a physical notepad where they point out all their commitments and tasks. They justify it because it is thanks to this method of work that they get their results and do not feel the immediate need for change - "if it works, why change?" - some said. However, if a CRM solution emerged for their smartphones tailored to their needs, no interviewee hesitated to state that they would at least like to test the software.

When confronted with some CRM solutions on the market, few were the interviewees who knew the software and even less those who tried it. At the end of the interviews, it was possible to understand that only four interviewees knew at least one of the programs, and only one interviewee had actually had experience with some of the programs. From this CRE agent it was possible to realize that there is still no program capable of managing the sales process with the same quality that can manage contacts and vice-versa, and that is visually appealing. Based on the opinions of the interviewees, it was possible to understand some reasons why these agents do not use the CRMs presented or other tools with the same purpose. The main reasons pointed out for not using these solutions are presented in Figure 1. Although some agents mentioning the CRM provided internally by the brand, none of them presented a positive feedback of the same revealing some flaws and dissatisfactions as well as a non-existent or not very responsive mobile component.

Through these interviews we are now able to realize the research objectives more clearly. Considering all the information gathered it is notable that there is a gap felt related to the inexistence of a complete m-CRM, focused on the CRE agent, able to integrate only the functionalities that they consider essential. Thus, it was established as the main objective of this research the creation of an m-CRM that professionals consider an added value in their daily lives. To achieve this final objective, it is important to outline another intermediate goal. This is related to the questioning of what will really be the fundamental and intended features by CRE agents.

In summary, this research has two main contributions: first, the gathering of the main requirements for the creation of an m-CRM for real estate agents; second, the construction of an m-CRM sustained and validated by constant iterations with professionals using the DSR methodology.

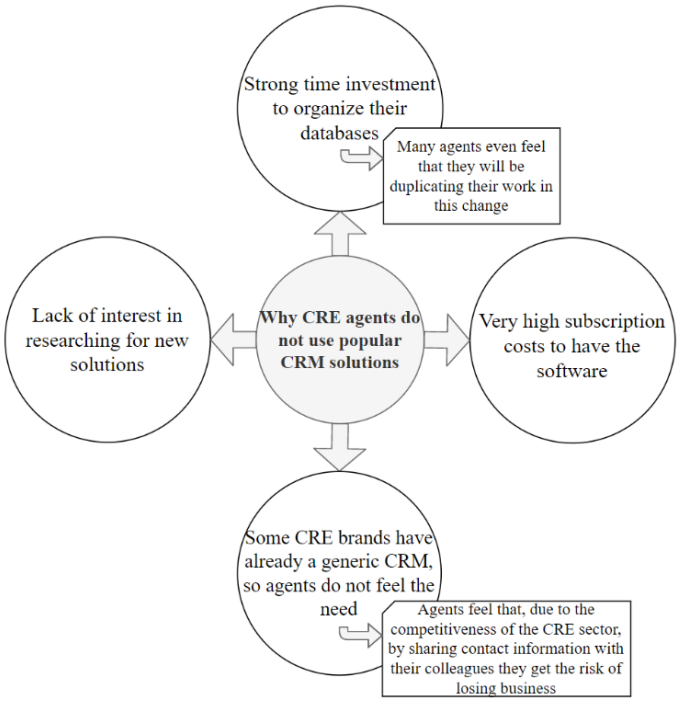

Figure 1 - Reasons why interviewees do not use popular CRM solutions

2. Related Work

In order to explore all the work related to m-CRM in real estate, a Multivocal Literature Review (MLR) was developed. This type of literature review was chosen because it was considered to be a very practical subject, so it would make sense to include publications from websites and white papers, that is, "grey" literature (GL) (Garousi et al., 2016). According to Garousi (Garousi et al., 2019), a MLR is a systematic literature review (SLR) that converges scientific literature with GL. This methodology aims to gain a more comprehensive notion of what is currently being developed and to find possible research gaps. Figure 2 summarizes the phases covered and the information collected in each one.

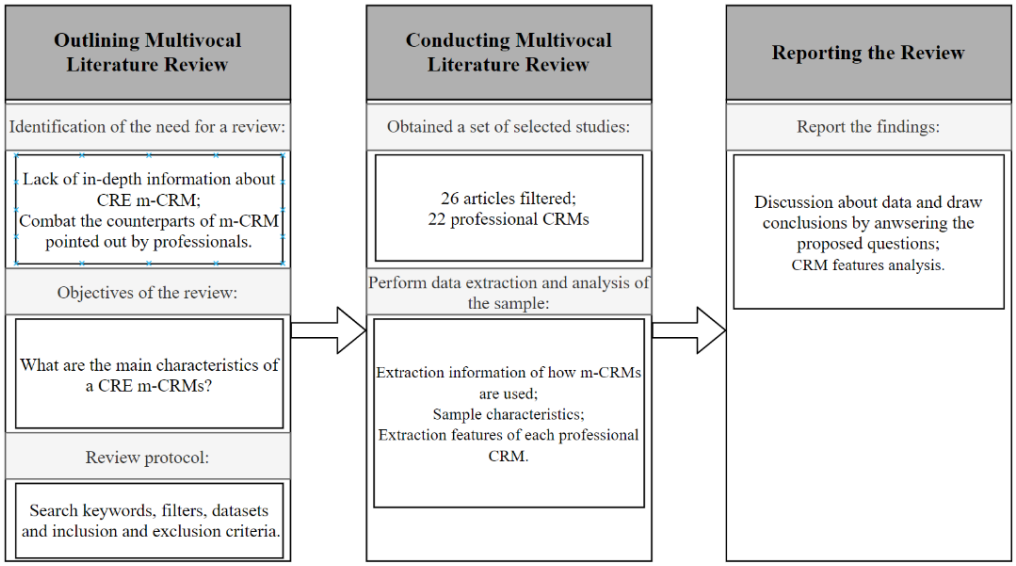

Figure 2 - MLR stages based on SLR ones

2.1. Methodology for MLR

The main goal of this research is to identify the requirements of CRMs in mobile environments and its use by RE agents.

To this end, a set of strings was systematically researched in different online repositories. Four large repositories were used:

1. IEEE Xplore Digital Library (https://ieeexplore.ieee.org/Xplore/home.jsp) - It is a leading repository when it comes to information technology content such as this research;
2. American Real Estate Society (https://www.aresjournals.org/);
3. Emerald (https://www.emerald.com/insight/);
4. Scopus (https://www.scopus.com/home.uri).

It was chosen 1 since it is a leading repository when it comes to information technology content such as this research, 2 was chosen for being a reference when it comes to developments in the real estate sector. 3 and 4 are repositories with aggregator features that allows you to capture different documents from different repositories, which allows you to broaden your research horizons and cover more content.

Regarding GL, a search was made in google search engine (www.google.com) in order to know technological solutions that resemble the artefact we want to develop.

Different keywords (presented next) with different objectives were used to carry out the survey in the different repositories using the AND and OR operators associated with the term "Real Estate" since it is the focus of this research.

Search Strings: *"Real Estate" AND ("CRM" OR "Customer Relationship Management" OR "Mobile CRM" OR "Mobile Application" OR "IT Solutions" OR "Management Systems" OR "Information Systems")*.

At the beginning of the approach of this methodology we started by searching in each repository the keywords chosen without any filter being applied to them. Since the different repositories have different search mechanisms, the keywords were adapted to each reality.

Some selection criteria were considered when selecting scientific literature. These inclusion criteria represented the filters to be applied to the wide selection of scientific documents. The first filtering done use the time as a criterion. Only documents with publication date equal or greater than 2010 were included. This allowed the research to be based on recent data only with ten years old representing what is most recently being developed and studied.Then the next criteria restricted the search of the strings only to the title or abstract of the article. The following step was to eliminate all documents that were not written in English, as well as those that were not possible to obtain a free copy or did not correspond to a scientific paper in conferences or journals and books. The last filter intends to exclude from the 246 documents, 156 that focus the keywords in contexts other than what is the research main goal as well as exclude the 51 duplicate articles found and the 6 written in other languages than english. This filtering results in 26 final articles. The whole filtering process is illustrated through the scheme illustrated in Figure 3.

After applying these filters, it was necessary to realize if the context the document reported was framed within the development of IS for CRE. Strictly following the methodology, selection criteria were used to measure the quality of scientific documents. In this context, two questions were answered: is the description of the article related to the research context? Do the results found in the article add value to the description of concepts?

Since most of CRMs and mobile applications are based in information technology and digital solutions, keywords like "IT Solutions", "Management Systems" and "Information Systems" were used with the exploratory purpose of what has being done in the real estate industry related with new technologies.

To find GL the process was simpler because it was only necessary to find the product that was intended to be compared and analysed. As such the only keywords used were: *"Real Estate" AND ("CRM" OR "Customer Relationship Management")*.

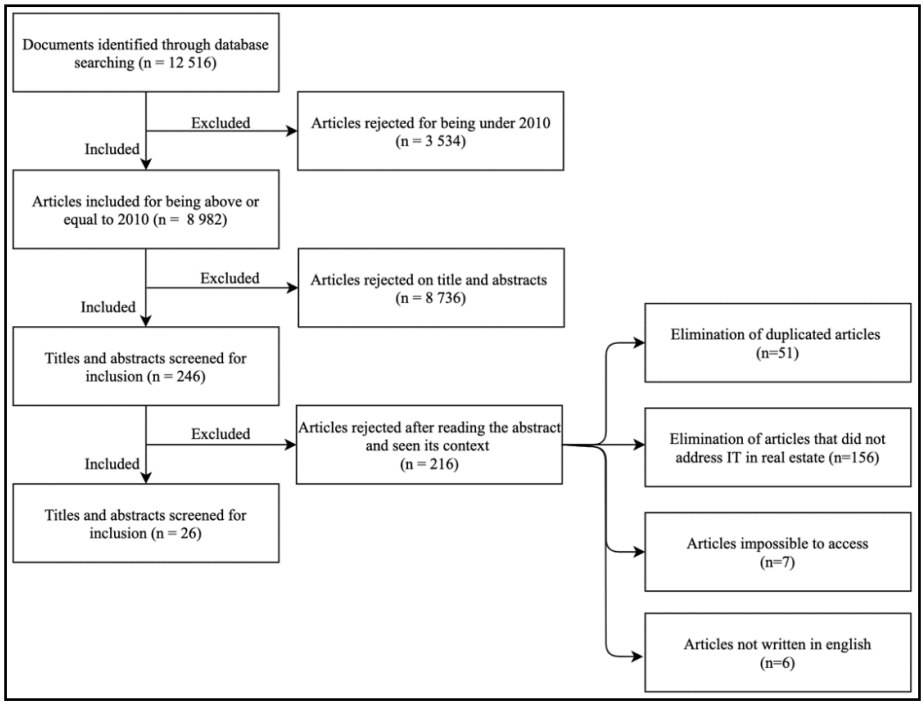

Figure 3 - Flow of all filtration process

In order to broaden the range of research, an internet search of some existing CRMs in the international RE market was performed. The authors found 22 CRMs that are commonly used by RE agents. These are presented in Table 2.

Table 2 - Professional CRMs found as GL

CRM	**Reference**
Contactually	https://www.contactually.com/
CINC – Agent	https://www.cincpro.com/
Top Producer CRM	https://www.topproducer.com/top-producer-crm/
Real Geeks	https://www.realgeeks.com/lead-manager-crm/
Market Leader	https://www.marketleader.com/
Rethink CRM	https://rethinkcrm.com/
Realty Juggler	https://www.realtyjuggler.com/
Follow Up Boss	https://www.followupboss.com/
IXACT Contact	https://www.ixactcontact.com/
Lion Desk	https://www.liondesk.com/
Boston Logic	https://www.bostonlogic.com/crm/
Boom Town	https://boomtownroi.com/
Client Look	https://www.clientlook.com/
Property Base	https://www.propertybase.com/
Placester	https://placester.com/real-estate-crm-email-marketing/
Apto	https://www.apto.com/
Pipedrive	https://www.pipedrive.com/
Less Anoying CRM	https://www.lessannoyingcrm.com/
Referral Maker	https://www.buffiniandcompany.com/solutions/referral-maker-crm/
Co Star Brokage"	https://www.costar.com/products/costar-brokerage-applications
Apptivo CRM	https://www.apptivo.com/solutions/crm/
Lease Hawk	https://www.leasehawk.com/products

To understand the needs of one m-CRM a comparative analysis of these GL was made. This benchmark study carried out proved to be quite illustrative of those that could be the main needs of an IS focused on commercial sales. Of the 22 CRMs analysed the contact integration service is the most common. Considering that the function of a CRM is to manage contacts, it is clear why this functionality was adopted. Likewise, although at the other extreme, only two of the CRMs use role differentiation services within a team. In this case, the rarity of this type of services in CRE CRMs can be justified because this is a more autonomous work and there are few teams that take advantage of this differentiation.

2.2. *Literature Review*

In Figure 4 are represented all the functionalities and services found in CRM websites already mentioned in the literature. Still, it is important to clarify the reader about some functionalities. This is the case of reminders and notifications where a distinction was found for representing services with different purposes. In the case of reminders, these are related to the daily tasks and commitments of the user, while notifications are more related to receiving news about clients and/or properties. Another important distinction to mention is the case of feedback support services. In this case, the support services mean the constant support to the professional in case of any problem, while the feedback service only allows the professional to speed up the process of sending feedback on the status of their properties and business prospects.

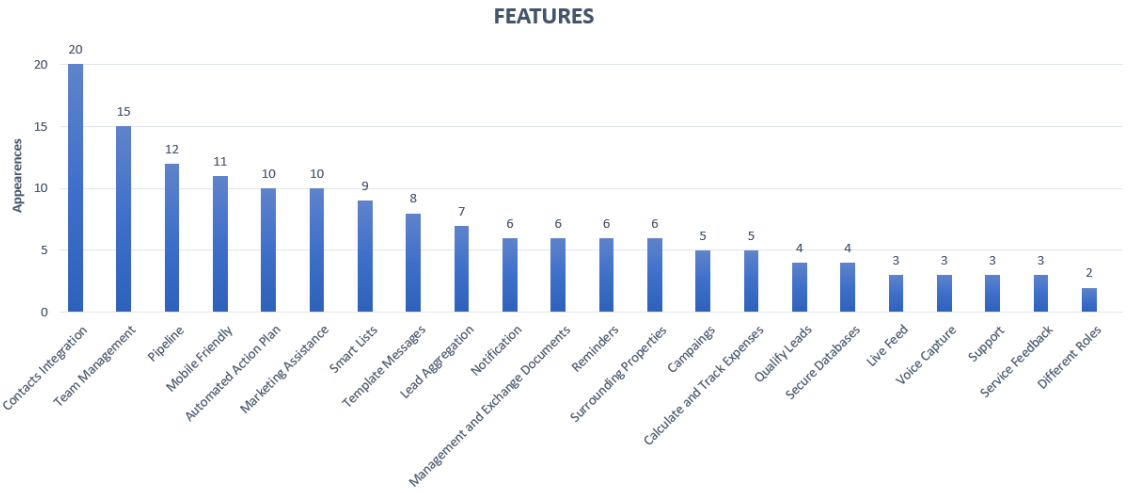

Figure 4 - Professional CRM feature appearance

From this comparative analysis we can also ascertain the relationships between each functionality of the different CRM. With the help of the VOS Viewer program it was possible to see which services are most interconnected in all CRMs. In Figure 5 these relations are represented. We can analyze the figure with three major criteria: the size of the nodes, their positioning and the intensity of the links. The diameter of the nodes of each feature varies according to the number of uses it has, the thickness of the connections varies according to the intensity of the relation between the different features. It is important to analyse the structure of the network presented since at the ends are the less relevant features and near the centre are the ones with more usefulness. The size of the nodes is coherent with the results shown above.

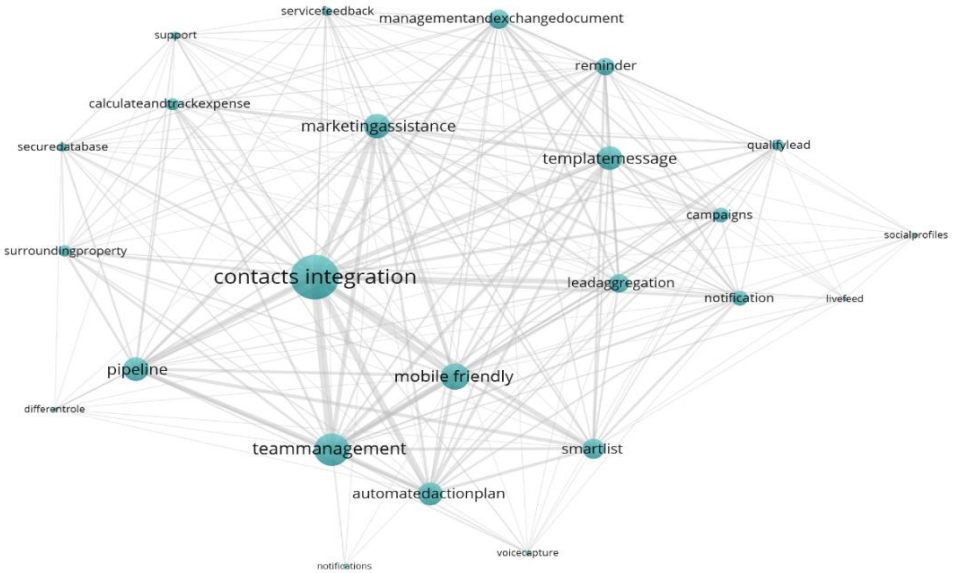

Figure 5 - Relation between different Real Estate CRM features

The objective of this discussion is to divide the articles by main theme and to perceive which are the methodologies approached to each theme. Due to the high specificity of the software and the context to be addressed - m-CRM in the RE sector - it was expected that there would not be a strong scientific basis in the literature.

After analysing all the scientific literature, it was possible to group all its content into six different topics presented in Table 3. These results show that on CRMs applied to CRE and, above all, CRMs in mobile environment, do not have a solid literature base that allows us to survey which are the best practices and main features to be implemented. The authors in (Rockel & Barth, 2019) are the only ones mentioning the benefits that mobile CRM solutions have allowing users to access updated information anywhere and anytime and therefore improves the rapid adaptation of each agent to customer needs.

Table 3 - Papers collected distributed by subjects

Subject	**References**
Support in decision-making	(Bin et al., 2017; Fiaidhi et al., 2014; Fu et al., 2014; Jafari & Akhavian, 2019; T. Q. Li & Wang, 2013; X. Li et al., 2012; Niu & Niu, 2019; Pérez-Rave et al., 2019; Ru, 2013; Tang et al., 2019; Trawinski et al., 2017)
E-commerce Solutions	(Qiu, 2011; Shih & Chen, 2013; W. Zhang et al., 2019)
RE management systems	(Arnold et al., 2014; Gibler et al., 2010; Gross et al., 2014; X. Li et al., 2012)
Other RE IS	(Allen & Benefield, 2012; Kaur & Kaur, 2018; Mani et al., 2014; Ram N. Acharya, Albert Kagan, 2010; Ru, 2013; Wouda & Opdenakker, 2019; Yang, 2018)
Mobile System	(Boyd, 2015; Chiu et al., 2017; Fiaidhi et al., 2014; Rockel & Barth, 2019; Sanford & Oh, 2010; Shih & Chen, 2013)
Mobile CRMs	(Rockel & Barth, 2019).

It is possible to realize that most of the scientific work published is related to the production of tools that facilitate the access of RE information to the final client, so that he can make a more conscious and correct decision. This happens either through improvements in home search systems (T. Q. Li & Wang, 2013) or through the implementation of some machine learning based models, able to predict fluctuations and accurate property price valuations in certain locations (Niu & Niu, 2019).

Some of the work attributed to the category of "Other RE IS" stand out for making reference to the positive aspects that the evolution of IS has from the point of view of the personal marketing of RE agents(Yang, 2018) , in particular by mentioning the influence it has on the personal email of the agent (Ram N. Acharya, Albert Kagan, 2010).

There are some authors who address the reasons for restrictions in the use of mobile applications by users (Sanford & Oh, 2010) and who study the relationship of e-commerce with mobile environments (Shih & Chen, 2013). As most authors study the impact of technologies on the end consumer, we realize that computer systems designed with the agent in mind are practically nonexistent.

Although all these topics allow some understanding of IS in CRE, they are not directly related to m-CRM platforms or features, maintaining the relevance of the topic. Thus, as verified in the comments of the first 15 professionals interviewed (Section 1) there is a research gap related to the lack of contributions that say exactly what functionalities are needed for a real estate m-CRM. Through this literature review we can also identify a second research gap in the same area: the lack of scientific contributions that explain the construction of m-CRM as an IS for CRE agents, since we found a wide variety of contributions at the practical level (22) and only one scientific article on the same topic.

3. Research Methodology

The research methodology used in this research was Design Science Research (DSR). The DSR methodology applied here is based on the principle of design, construction and evaluation of the mobile application we intend to develop. It aims to solve a specific problem and can be defined as the methodical construction of artefacts that intend to meet predefined requirements (Janse Van Rensburg & Vermaak, 2017). This methodology approach includes three elements: conceptual principles, that help establish the DSR, practical rules for implementing the methodology and procedures for conducting and carrying out the research (Peffers et al., 2007). Since this

methodology is based on well-defined iterative processes of development and validation with stakeholders, it represents a scientific approach for developing IS .

Seven iterations of this methodology were performed in this research. Each one corresponded to an interview with a different CRE agent. These iterations allowed to improve the artefact to be developed according to the feedback obtained in the interview of the previous iteration. These iterations only stopped when a point of convergence of opinions was reached. So, when this point was reached at the end of the seventh iteration, one can conclude that the artefact developed was functional and in compliance with what the professionals demanded. Figure 6 presents the DSR methodology stages, and their respective objectives applied to this research. The remaining document follows this structure representing the communication of the whole research.

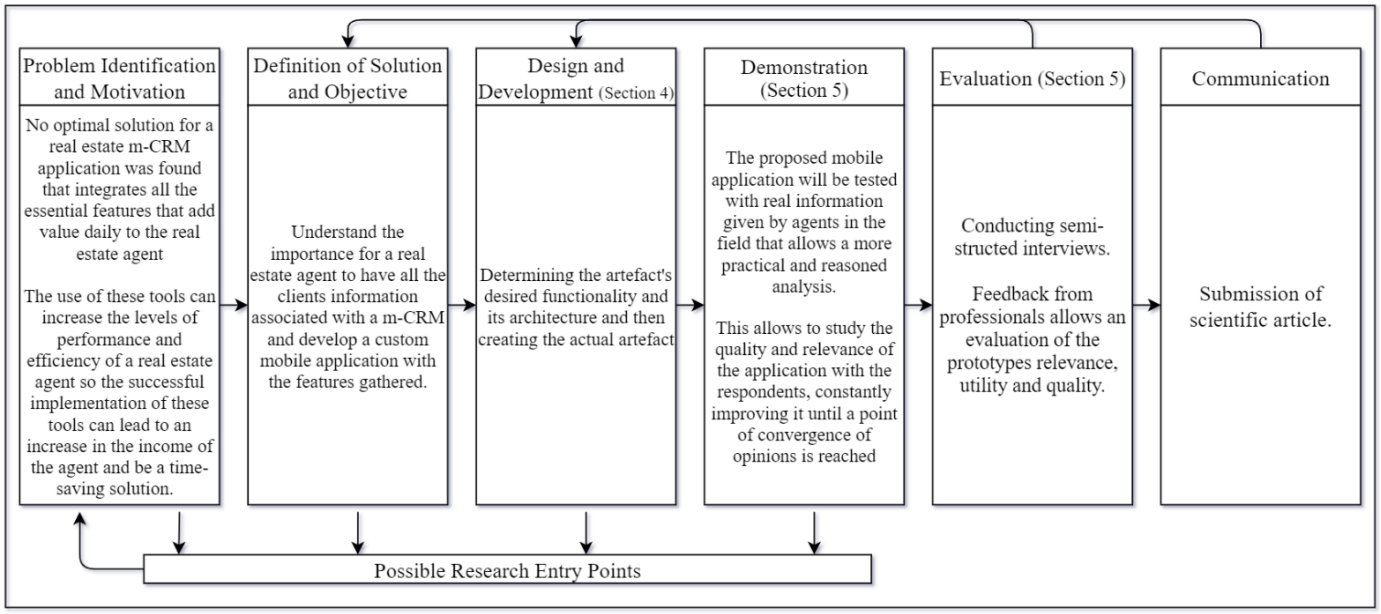

Figure 6 - DSR methodology scheme.

4. Design and Development

To start developing the artefact it was necessary to understand what features it should have. To do so, a comparative analysis was made between the existing functionalities in CRM pointed out in the literature and those pointed out by CRE agents. After that, in order to optimize the agile development, the gathered functionalities have been prioritized.

4.1. Requirements and Prioritization

The search for requirements for the mobile application is divided into two major phases: the realization of a benchmark at the level of existing CRM services identified by the literature; and the validation of these functionalities and collection of other different ones from CRE agents.

After the comparative analysis done in Section 2, the same 15 CRE agents interviewed were used to define the research objectives (Section 1) in order to ensure the relevance of these functionalities and to understand which ones they really wanted and needed. This second wave of interviews took an average of 33 minutes. As a result of these interviews some functionalities were excluded because they were not seen by professionals as essential in an m-CRM. An example of these cases are the functionalities of expense calculation and live feed because they were considered "irrelevant and distracting to the work of a CRE agent". Figure 7 represents the filtering and the respective final list of functionalities that were stated by the interviewees.

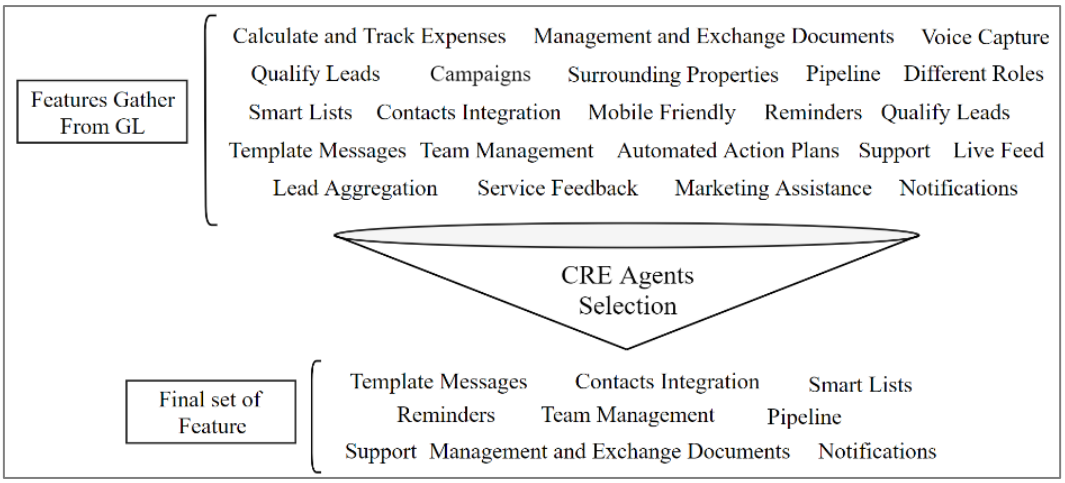

Figure 7 - Features filtered by CRE agents

After being collected, a new comparison was made with the functionalities collected in the benchmark study carried out and it was discovered that no other CRM analysed aggregates the same information as the one intended to be developed. It is important to note that since the goal is to develop an m-CRM, this functionality will be inherent to the artefact itself and was not considered in the list presented.

Once the requirements gathering process was finished, it was important to assign a priority to each feature. This prioritization allowed an agile mobile development process in which the most important features would be the first to be implemented. Priority values were assigned from 1 to 10 where the value 1 meant maximum priority and 10 minimum priority. The values to be assigned to each functionality were defined based on the comparison of the various feedbacks obtained by CRE agents and the comparative analysis performed in the previous section. The distribution of the priorities is defined in Table 4.

Table 4 - Artefact features ordered by priority

ID	Features	Priority
F1	Contacts integration	1
F2	Smart lists	2
F3	Notifications and reminders	3
F4	Individual performance management and statistical information	4
F5	Client qualification	5
F6	Clients documentation management	6
F7	Clients pipeline	7
F8	Customizable template messages	8
F9	Support Settings	9

4.2. Artefact Architecture

Designing the architecture of the system was a constant challenge since any iteration performed the system could be changed to meet stakeholders' expectations. In order to synthesize the investigation, only the final design of the system will be demonstrated, both in terms of activities and screens of different features.

4.2.1. Use Case Diagrams

The use case diagrams are graphic representations of the functionalities that a system should have. The functionalities are modeled using actors and sets of actions, services and functions that the system needs to perform (Russell & Esep, 2019). Their importance for software development is related to their simplified way of representing a system. This way any stakeholder can understand how the system works and validate it before being developed, allowing the creation of a more robust system. Given the iterative methodology used, only the final use case diagrams will be represented.

Given the variety of features needed to build the application, the use case diagrams were made according to the main ones pointed out. Figure 8 represents the home screen, designed to be presented in a simple and minimalist way. On this screen, the user should be able to access his personal information, a range of options representing the general functionalities and should also display the notifications that are sent by the web services.

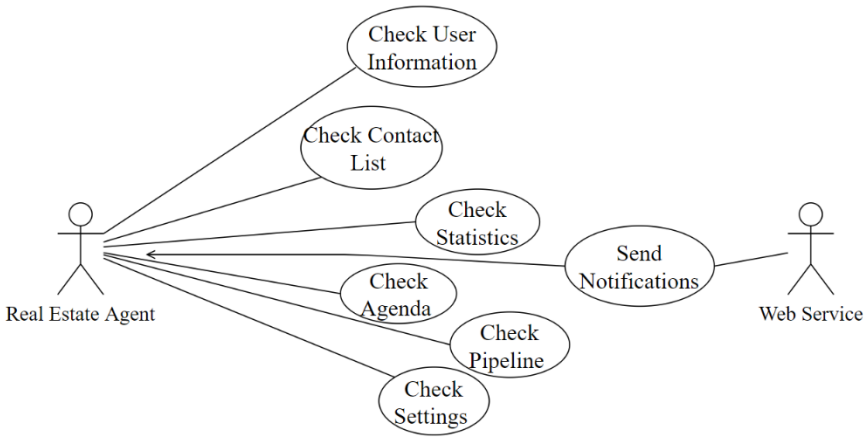

Figure 8 - Main screen use case

As far as the contact integration service is concerned, the diagram becomes more complex. Represented in Figure 9, this diagram shows that the user can have access to several features such as the ability to filter and contact customers directly through his contact list. There are also features inherent to each client such as access to their documents and history.

In Figure 10 you can see the characteristics of the performance management and statistical information functionality. A functionality designed to provide the user with the ability to see its evolution through relevant metrics and illustrative graphics.

Figure 11 represents the functionality of the pipeline service in the application. The operation of this service was inspired by the CRMs previously analyzed. This means that the user can organize the different stages of the sales hopper at his taste and with his individual criteria. The CRE agent, when using this functionality, should be able to move his customers to the different stages depending on the moment of purchase/sale.

Finally, the last diagram of use cases was regarding the settings (Figure 12). This system functionality allowed the user to register and change at any time his personal and professional information as well as his profile picture. Through these simple changes the CRE agent is able to make his tool custom and unique to his work.

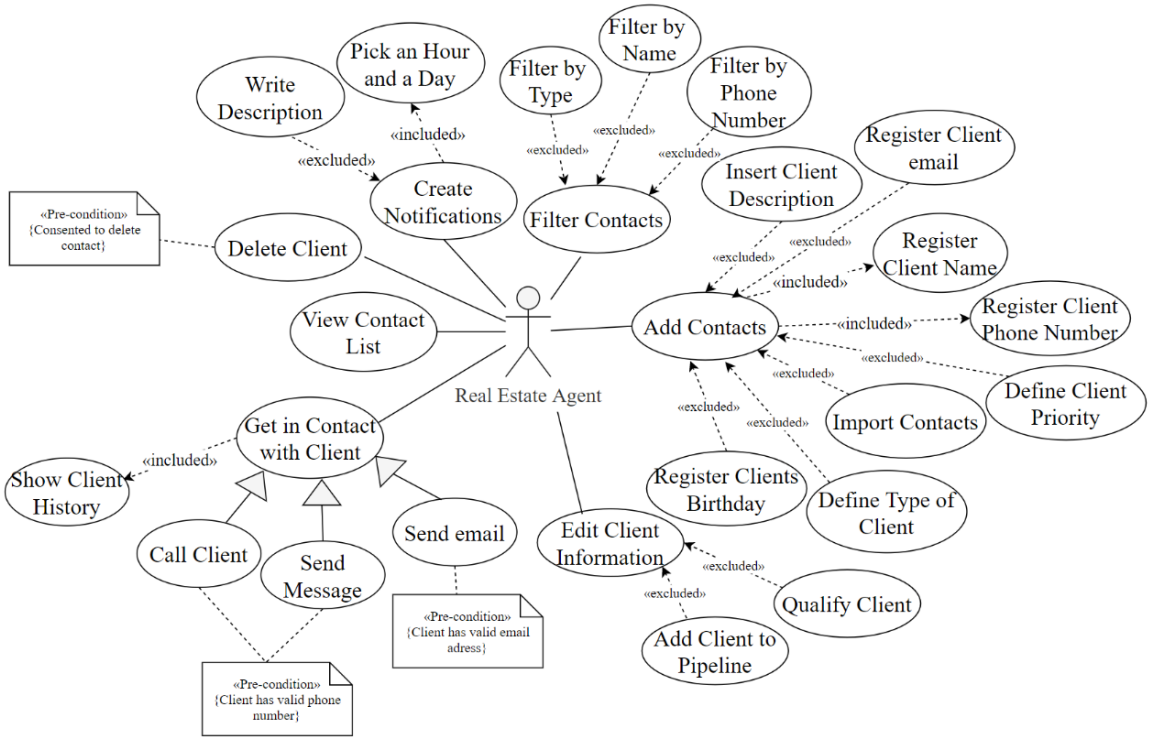

Figure 9 - Contact list features use case

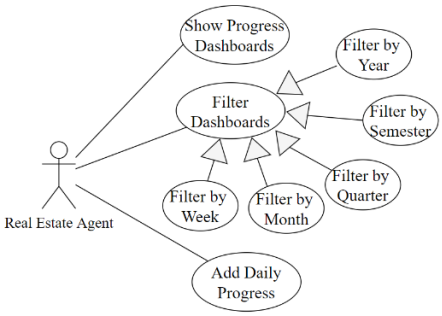

Figure 10 - Dashboards feature use case

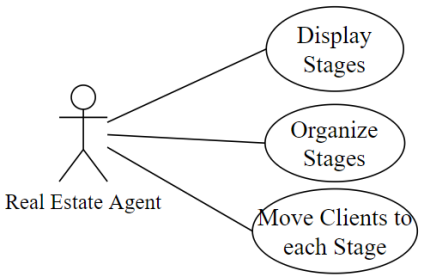

Figure 11 - Pipeline feature use case

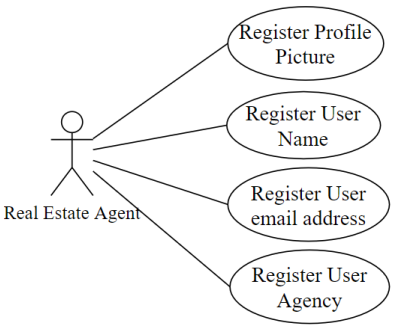

Figure 12 - Settings use case

4.2.2.Mock-ups

Mock-ups are essential in the process of software creation because they allow you to gain a more refined notion of what you want to develop, improving the themes inherent to IS such as user interface (UI) and user experience (UX) (Aslam & Latif, 2020). For a better understanding, the mock-ups have been created individually for each feature to be implemented, together with an authentication screen and another that functions as the main menu.

These sketches were designed taking into account the system interface. Each structure presented in each mock-up represents a well-defined widget in order to facilitate the implementation of the application.

Describing each screen succinctly, the main screen (Figure 13) was designed as a screen that allowed a very accessible and intuitive UI. As such, the screen was divided into three parts: at the top of the screen would be the user information part; in the body of the screen would be clickable cards with the main features implemented; and in the end, it was created in the bottom app bar navigation, settings and system output buttons. The statistics screen is intended to provide the user with an organized way of displaying and adding information. Given the statistical nature of this data, it makes sense to present bar, line and pie charts combined with a time filter for future analysis. As for the screen properties of the Pipeline, each column should correspond to its specific stage. To ensure the customization of this service both individual stages and customers were designed to work in a drag and drop way with each element moving in a very agile way, similar to a Kanban board. In the settings screen it was intended to enable in a very simple and practical way the CRE agent to change his personal information and profile image, customizing his experience as a user.

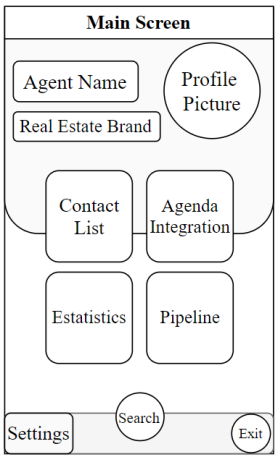

Figure 13 – Mock-up of main menu to access the features

Regarding the contact integration service, it becomes more complex because it is interlinked with different functionalities. For the stakeholders this is a service of greater importance as it stores and handles their most sensitive information. Usually, a CRE agent's client portfolio represents thousands of clients. Therefore, it is imperative to organize and filter it for quick access by the user. It was in response to this situation that a search bar and a client list with expandable client information lines were devised – facilitating access to each client's basic functionalities in a few steps. The mock-ups designed for this service are illustrated in Figure 14.

It is from this list of clients that it is given a kick access to the customer's documents; create personalized reminders regarding each customer; access the history of conversations with the customer, facilitating the direct

sending of emails, messages and making voice calls; it is possible to edit the customer's base information and also qualify the customer according to its characteristics.

Finally, they can add, edit and delete as many contacts as they want. To ensure efficient contact addition, the system is designed to be able to import the agent's own contacts into the cloud.

4.3. Artefact Development

At the beginning of this development process, the programming language and its database were chosen. Dart was chosen as the programming language, using its most recent framework: Flutter. The use of Flutter allowed the development in multiplatform, meaning that the application is compatible with Android and iOS operating systems. The data was stored using Firebase as back-end. The use of this free cloud service from Google, besides being very compatible with Flutter, facilitates the authentication process with email and password; allows cloud storage through Cloud Firestore, its Storage features allows us to store images and files; enhanced the sending of push notifications through Firebase Cloud Messaging; and, among other things, also allows the creation of automatic processes through Firebase Functions.

It was also defined a primary graphical package of the application in order to enable the coherence of the software, a better UX and facilitate the creation of the UI. A functional authentication screen was developed capable of registering each user and an initial dashboard containing an image of the CRE agent, his name and agency. This was the starting point of the development of the first and most important features of the artefact.

In each iteration of the DSR methodology, in addition to the implementations the interviewees considered appropriate, the functionalities were also added according to their order of importance. Table 5 intends to illustrate all stages of the development of this artefact.

Table 5 - Software development plan according to different iterations

DSR Iteration	Feature	Feature ID
First Iteration	Contacts integration; Smart lists.	F1; F2
Second Iteration	First iteration feature improvement; Notifications and reminders; Individual performance management and statistical information.	F3; F4
Third Iteration	Second iteration feature improvement; Client qualification; Clients documentation management.	F5; F6;
Fourth Iteration	Third iteration feature improvement; Clients pipeline.	F7
Fifth Iteration	Fourth iteration feature improvement; Customizable template messages.	F8
Sixth Iteration	Fifth iteration feature improvement; Support Settings.	F9
Seventh Iteration	Sixth iteration feature improvement.	--

The last iteration served mainly to verify and validate if all the implemented suggestions were in accordance with the opinion of a bigger number of professionals, which allowed us to reach a saturation point and validate the artefact created.

5. Demonstration and Evaluation

As mentioned, seven iterations of the DSR methodology were performed in order to validate the implemented functionalities with different stakeholders. In each demonstration of the artefact there were positive points and negative aspects to be improved. At the end of each iteration a set of issues was established and then resolved before the next iteration.

In the first demonstration some irregularities and lack of responsiveness of the application were detected. The CRE agent also left an alert for the vast number of contacts that a professional has – which in some cases can reach tens of thousands – and that therefore, the inexistence of a filtering option was a negative point of the application. In addition, the interviewee left a positive feedback regarding the start-up process and initial adaptation to the application characterizing it as "simple, fast and intuitive" and recognized the value of the project showing interest in testing it professionally after completion.

After the implementation of the new improvements and functionalities, in the second iteration, the interviewee's feedback was very positive and constructive. As main positive feedbacks the agent praised the integration of the personal agenda of the agent, for being "an essential tool in time management and organization of professionals"; the intuitive interface of the dashboards and their segmented way of showing the analytical information of the progress of the agent; and also recognized the value and importance of the customized reminders for the professionals of the sector, because it allows them to be reminded of all the important information demonstrating

confidence in their service. On the other hand, the agent pointed out as negative aspects the lack of interaction, confirmation messages and UX that still existed in the application and felt that in an application based on CRM it would be very important to have a field that recorded the customers' birthdays and alert them to these events on a daily basis.

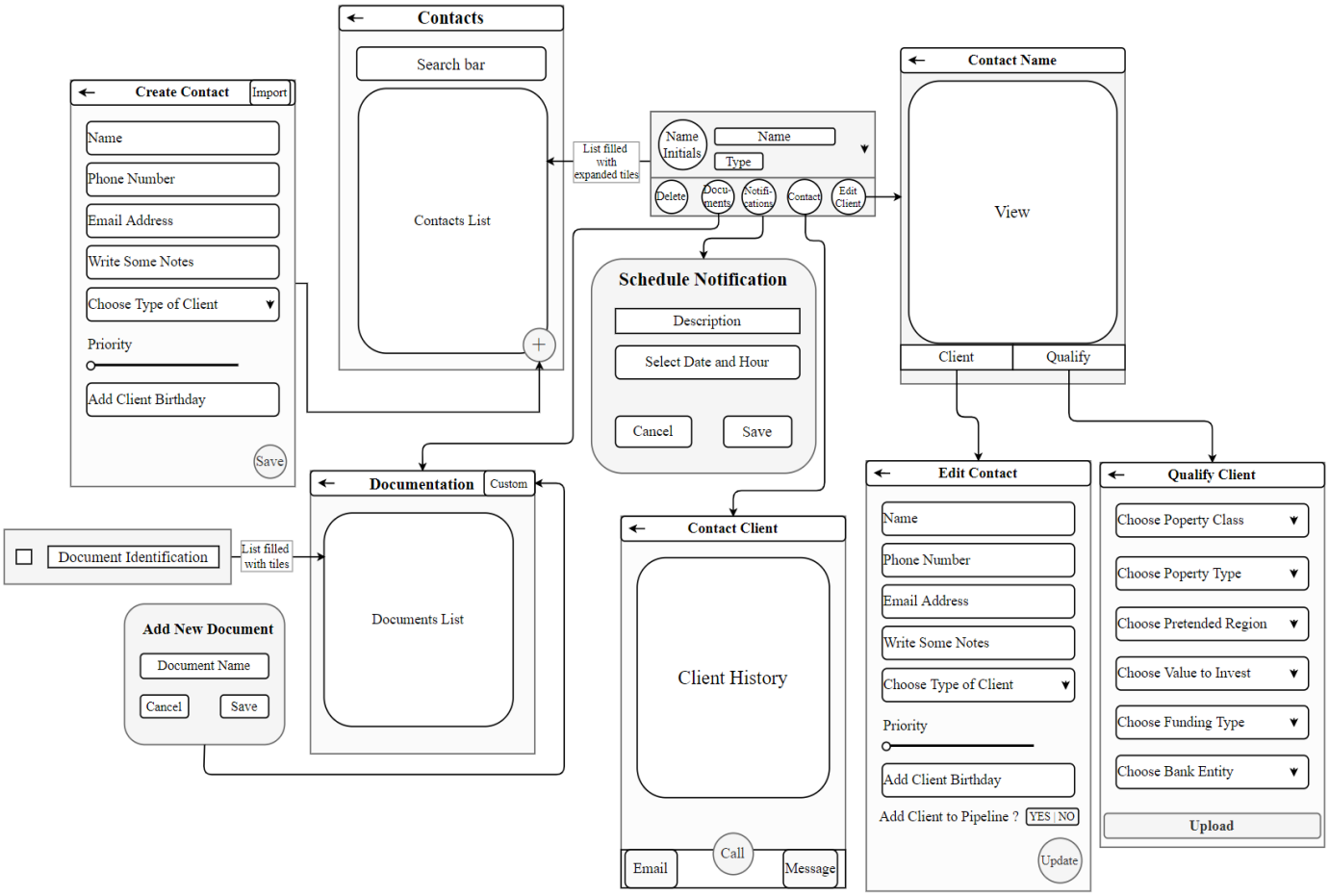

Figure 14 - Contact list features mock-up

In the third iteration, the interviewee mentioned how important the notifications are for the CRE agent: "it is impossible to memorize all the daily appointments and to have a tool that helps us and reminds us of each task is fantastic" - said the CRE agent. The fact that this comment is repeated already by more than one agent, makes us interpret that the functionality of notifications is important for professionals and should be taken into account when building m-CRM.

The segmentation and relevance of the dashboard screen and statistical information was praised again, however, this time the CRE agent said that the metrics used were not yet the correct ones, leaving his suggestion of how to improve them. As a last main positive aspect, the interviewee considered that the screen of the registration of all contacts was extremely important considering that it is this registered information that really allows the creation of fruitful and lasting relationships. In this iteration the need to change customer qualification metrics was felt and several suggestions for improvement were also made.

At the end of the fourth demonstration a repetitive feedback about the implementation of the contact integration functionality started to be felt. The CRE agent himself was very pleased with the usefulness of the smart lists through the definition of priorities because "it allows in a few seconds to see who the hottest contacts are and ready to do business so we can focus on them". On the other hand, the interviewee considered that for this feature to be excellent it was important to synchronize the phone contacts with the application. He also left the criticism that in the statistical information screen it could be enough to present the professional's annual billing objectives because he considers that the agent's performance levels are only possible to be completed after 12 months.

After five experts interviewed, it was noted that most of the feedback given by the agents was positive and with intentions to re-test and even implement the artefact in their working methods when it was completed. In this fifth interaction, praise was mainly given to how to qualify clients and how to organize their documents within the application. The ability to record birthdays was again praised and the interviewee also showed a lot of enthusiasm in integrating his personal agenda. On the other hand, as the most negative aspect pointed out problems of UI and UX considering that the artefact should be more appealing and simpler in order to captivate and attract more professionals.

From the sixth demonstration the interviewed agent mentioned that "the functionalities present were the essentials" and once more the interviewee praised the integration of contacts and the intuitive and simple adaptation to the application, it meant that one was close to the optimal solution. As main criticism, some flaws in the interaction with the user were again pointed out in some actions to the application logo. It was also left the note that often each client needs specific documentation and, although the list was quite complete it would be important to have the option of adding documents specifically for each case and each client. Finally, this expert also considered that in a general way it was a well achieved application and that the implemented functionalities could generate real impact on the CRE agents.

After the interviews were completed, it was possible to realize that the opinions of the CRE agents converged to a common point and the implemented features were the main ones. In order to show the final result produced in the seventh iteration, the images of the screens were grouped together with their corresponding functionalities (Figure 15 to 20).

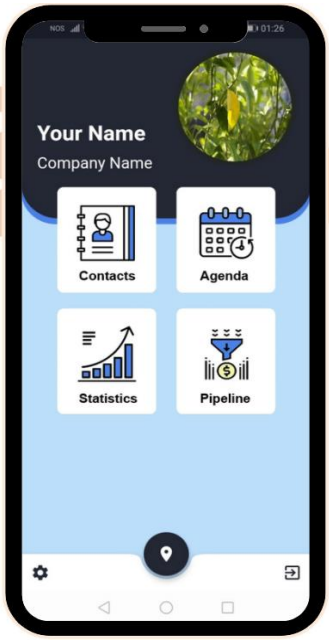

Figure 15 - Main screen

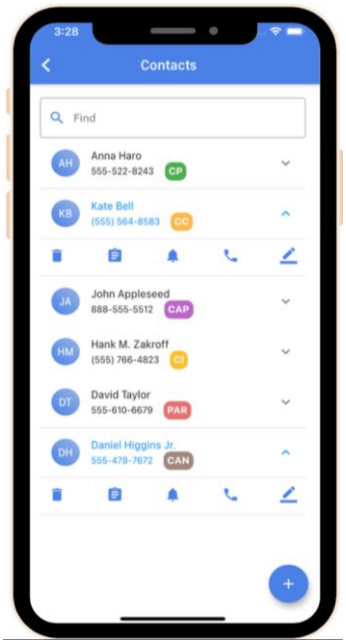

Figure 16 - Contact list screen

Figure 17 - Dashboard screen

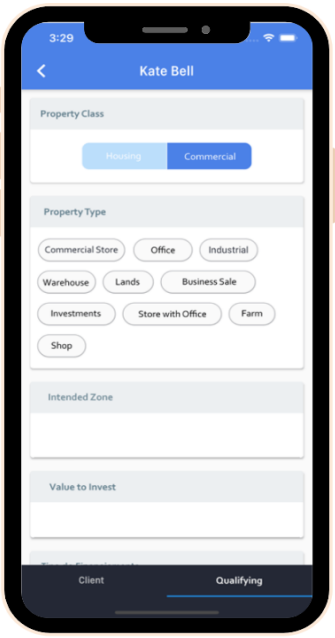

Figure 18 - Client qualification screen

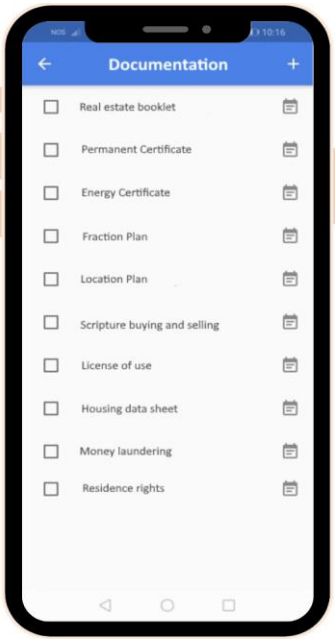

Figure 19 - Documentation screen

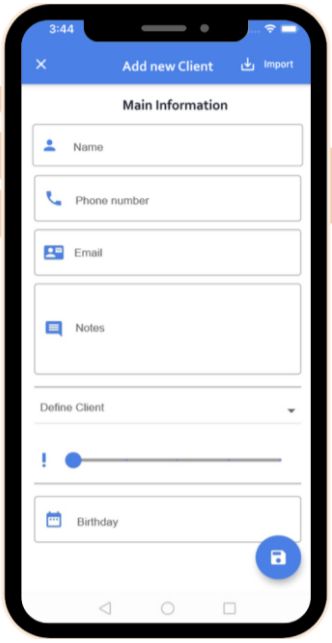

Figure 20 - Add client screen

All proposals for improvement left by interviewees are summarized and organized by iterations in Table 6. This table shows that not all functionalities have been implemented. This is justified by the fact that some suggestions were considered specific to the working method of the interviewed agents and that it would not make sense to replicate them for other contexts. Nevertheless, there were situations where the suggestions made no sense at an early stage and that with the continuity of the interviews it was verified that the suggestion of one CRE agent was the suggestion of others. As an example of this situation is the improvement PI1.2 which although not made because of the first iteration was implemented as a consequence of the third in PI2.3.

Table 6 - Synthesis of all CRE agents' feedback

First Iteration					
ID	**Proposed Improvement**	**Type**	**Implemented?**	**Suggested by**	**Figure**
PI1.1	"Adjust the formatting of the cards on the dashboard."	Visual	Yes	Interviewee	15
PI1.2	"Decrease priority levels."	Information	No	Interviewee	-
PI1.3	"Client search implementation."	Information	Yes	Interviewee	16
Second Iteration					
PI2.1	"Separation of the contact list according to the various types of clients."	Information	Yes	Interviewee	16
PI2.2	"Creation in the customer profile of a field to record the anniversary date with notification associated with that event."	Information	Yes	Interviewee	20
PI2.3	"Priority allocation do not need to be so extensive."	Information	Yes	Interviewee	20
PI2.4	"Follow-up notifications following the 1-30-90 method. "	Information	No	Interviewee	-
PI2.5	"Creation of a screen with a record of calls and notes taken by the agent at the end of each customer interaction."	Information	Yes	Author	-
Third Iteration					
PI3.1	"Add a checklist with the necessary documentation."	Visual	Yes	Interviewee	19
PI3.2	"Improvement of statistical analysis metrics."	Information	Yes	Interviewee	17
PI3.3	"Definition of customer qualification metrics."	Information	Yes	Interviewee	18
Fourth Iteration					
PI4.1	"Change the scale of the dashboards."	Visual	Yes	Author	17
PI4.2	"Add business partner contacts."	Information	Yes	Interviewee	16
PI4.3	"Establish only the professional's annual goal and from that set their daily, weekly and monthly goals automatically."	Information	No	Interviewee	-
PI4.4	"Synchronization of contacts with the user's mobile phone."	Information	Yes	Interviewee	20
Fifth Iteration					
PI5.1	"Add some types of property that are missing."	Information	Yes	Author	20
PI5.2	"Add information about the client's relatives."	Information	Yes	Interviewee	20
PI5.3	"Add a calendar focused only on contact information."	Information	No	Interviewee	-
PI5.4	"Changing customer type nomenclature"	Visual	Yes	Interviewee	16
Sixth Iteration					
PI6.1	"Creating a date picker to select the birthday."	Visual	Yes	Author	20
PI6.2	"Creating a field to record personalized documents."	Information	Yes	Interviewee	19
PI6.3	"Creation of toast messages to accompany the user."	Information	Yes	Interviewee	-

6. Conclusions

This research aimed to gather the main features and to build a more complete m-CRM based on experts' (CRE agents) feedback. DSR was selected as the main research methodology for representing an iterative scientific methodology of constant evolution and validation. This methodological approach to IS development allows for regular contact with stakeholders, thus creating an artefact based on their opinion that can be generalized to all professionals in the same industry. Besides, several interviews were performed to elicit requirements and to validate the proposed artefact.

This tool allows the user to avoid an early large time investment and integrates several services that were ascertained and valued by the experts revealing that it has a practical contribution. The m-CRM was assessed by professionals, receiving positive comments from those wishing to use it in their work as CRE agents. The willingness to adopt to this tool reflects the quality and relevance of the mobile application created.

Through the interviews conducted to gather requirements, it was possible to determine what the main and unavoidable features in order to achieve a high-quality and valuable m-CRM. Some of the core features are contacts and agenda integration, dashboards and charts showing the agent progress and clients qualification features. Were through these features that the artefact was developed, and the project was structured until the application was completed.

It was possible to conclude that the implementation of an application of this nature can allow a controlled growth of contact lists, qualified customers, and portfolio customers. This IS can strengthen the relationship between the CRE agent and their clients, which in turn drives sales and may impact CRE recovery in a post-pandemic scenario. The interviewees also considered that the developed artefact is able to save the CRE agents' time, allowing them to focus on the growth of the emotional and empathic relationship with the client.

They also pointed out that the features that stood out the most were notifications and reminders as they allowed them to keep track of appointments and important dates, ensuring that the user can stay focused on their daily tasks of high profitability. In addition, the qualification feature also received many compliments for its detail, effectiveness, and simplicity. All other features were also successfully implemented and had great feedback from the CRE agents. All feedback can be found in a summarized form in Table 6.

As future work is suggested to study how impactful can this m-CRM be, by analysing sales activities cycles and customer retention. The functionalities found in the interviews that were not implemented because they left the scope of a m-CRM would now be timely. Moreover, given the feedback constantly collected during the interviews for UI/UX improvements, the existence of a study that understands the design and good practices to have in the realization of an m-CRM for CRE agents can be necessary for the real implementation of the artefact created. Taking also into account the comments of the interviewees regarding the graphics created, they should also be the object of study in order to understand with scientific rigor what makes the statistical graphics appealing, both in terms of the type of graphic used and what are the best colours for them, in order to optimize their use.

The automation of some processes concerning the management and qualification of contacts and properties is seen as having a lot of potential for association with ML and AI, in general, technologies. The existence of CRE suggestions compatible with what your clients are looking for and chat bots capable of assisting the CRE agent in any task, serving as an intelligent assistant, are also other timely suggestions that could create a positive impact on the work of the CRE agent, affecting the entire industry.

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