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IMPLEMENTATION OF PROPERTY MANAGEMENT SYSTEM IN HOTEL INDUSTRY

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Abstract

Information and Communication Technologies (ICT) influences the development tourism on globally, and its development has changed the practice of business. Any reference ICT in the hotel industry necessarily begins the concept of Property Management System (PMS). PMS as an essential component for hotel management provides tools as are necessary hotel staff in performing daily operations of the reservation, the accommodation capacities management, accounting, etc. This software supports all basic activities involved with process operation accommodation facilities and interconnects systems within it. Hospitality enterprises that are constantly working on innovations in the implementation of hardware, software, and networks can be competitive in the market, which maintain the long term prosperity of the business. This paper is conceptually defined PMS and its application in the context of the impact on the hotel management. The methodology is based on secondary research examing the key dimensions of the PMS systems and their functionality. The aim of this paper is to explore the intensity of the impact on the prosperity implementation of PMS hotel management. The findings show that, despite the availability of a range of PMS software and funcionalities, the European touristic market continues to be led by a handful of providers. The unique contribution of this paper is in secondary research, the issues associated with the critical, core technology for the hotel industry, i.e. PMS.
Keywords: ICT, property management system, hotel industry

1. INTRODUCTION

The requirements of a successful global business which the computer era has brought in every pore of society, certainly must fill out and hotel industry. The classical chain-by–agency–accomodation-entertainment, everyone has their own task and methods for its fulfillment. Within the framework of hotel industry, information technology has gone beyond, especially for large and higher quality facilities, and enabled connection string subsystems in unique system, and also series of hotels into the organizational unit. To use the potential that information technology plays in the hotel industry of crucial importance are the availability and quality of human resources. The basis of successful hotel industry and improving competitive position of each entity in the tourism market includes development and implementation of ICT. Contemporary business model in the hotel industry is characterized by large quantity of information. Processing large quantity of information requires the design of such an information system, which will connect and facilitate the entire hotel business. Hotels, in striving to satisfy the increasingly demanding guests, while maintaining profitability, introduce information systems for managing hotel business. Integral component of a hotel's PMS systems, which play a significant role in leading the management of revenues. PMS covers the administration, planning and operational functions (accounting, marketing research, planning) revenue management, staff management and centralized control of the hotel chain. As an essential component for managing hotel business activities PMS provides tools which are necessary hotel staff in performing everyday activities such as reservations, Check-In/Check-Out, managing accomodation capacities servicing the needs of guests, accounting, etc.

2. THE SIGNIFICANCE OF ICT FOR THE HOTEL INDUSTRY

Information technology is defined as "a term that encompasses all forms of technology utilized to create, capture, manipulate, communicate, exchange, present, and use information in its various forms (business data, voice conversations, still images, motion pictures, multimedia presentations, and other forms, including those not yet conceived)" (Ryssel, et. al., 2004: 198). Sıgnıfıcant as the competitive advantage in the hotel industry's progress in ICT, because the hotels also provide new management capabilities. Since the nineties implementation of ICT in hotels is not considered exclusively in relation to productivity, but also with creating intangible benefits, such as customer service satisfaction (Law & Jogaratnam, 2005), and as an encouragement creation of relationship within hotel, between the hotel, and other tourism entities, and the parties themselves.

Hospitality industry is characterized as a certain specificity. Accordingly, information and communication systems in the hotel industry also have special significance. The hotel sector is characterized by an information intensive area. An abundance of information should be distributed properly,

which is achieved through speed, control and the planning approach. The key role of ICT is to prevent the loss of focus and to create a balance between the amount of information and operational functions at the hotel. Hotels in using ICT improve operations, better quality manage assets and thus increase profitability. ICT facilitate both hotel management, and distribution through electronic media. Hotels in contemporary global conditions must be intensively use the Internet because it allows individual users and agents access to accurate information about the availability and allows them to make easy, fast, reliable and efficent way to make a booking and confirmation without losing funding. (Cooper, C., et. al., 2008: 637)

When designing, building and developing ICT in the hotel industry, and all that business improvement, should be started with the assumption that the hotel business there are many number of evidence that are related to different activities and operational tasks. For their effective functioning are required daily updated information about the changes and conditions in the environment. Is characteristic that there are a large number of operations that are registered, but also repeated in various evidental documents almost the same way. On certain documents, the same data are entered even several times simultaneously. In addition, it is necessary to enable statistical examinations and statements related to the operations of the hotel. At the global level, ICT enables an increased degree in capacity use, continous monitoring of costs, increase operational efficiency and quality control of all business processes based on fast and accurate information; rationalization costs of information; current updates and information; reducing unproductive labor on the formation of data and information easier, more accurate and fastere communication with the environment in submission of statements and increase business efficiency. Various business departments within hotel have specific business requirements, which are executed individual information subsystems. They are particularly adapted to respective business departments and enable them more efficiently; faster; and easier operation. The meaning hotel function can be divided into: basic business function (accomodation, food, drink); purchase, sales, finance, human resources, investments, planning, and research and development.

ICT has contributed to innovation in the hotel industry, so that with the help of it performing the following activities:

- Direct contact to guests: reservations, Check-In/Check-Out, payment;
- Office activities: accounting, payroll, management human resources, marketing of entertainment and services for clients;
- Communication with partners;
- Market Research and Industrial Espionage;
- Flexible and dynamic pricing in revenue management;
- Business process management and staff.

Recent studies have pointed out that the hotel industry is at the top in terms of ICT adoption, compared to companies operating in other industries (eBusiness W@tch, 2006). Many studies identified a large number of ICT facilities in the hotel industry, because they have focused on the analysis of the implementation of solutions by hotels, as well as the advantages arising from the use of technology (e.g. Buick, 2003; Sigala, 2003; Jang et. al. 2006; Daghfous & Barkhi, 2009; Ruiz et. al. 2010). Ruiz et al. (2010) classified them into two major groups: 1) in-house ICT (hotel hardware and software, network connectivity technologies, and business integrated processes), and 2) ICT for external use (e.g. electronic marketing and sales solutions, ICT solutions related to customers, and electronic supply management).

Hotel managers still hardly appreciate the importance of ICT for business development strategies (Law & Jogaratnam, 2005). In fact, managers' doubts about effiency of ICT investments still persist (Luck & Lancaster, 2003). The studies of Frey et al. (2003) and Murphy et al. (2003), carried out in 200 Swiss hotels, revealed that prospects had less than a one in 10 chance of receiving a quick, courteous, and personal reply. In addition, Ruiz et al. (2010) noted that, due to the complexity of CRM solutions, the level of understanding of their possibilities, their value, and the way they work is low (Magnini et al., 2003) and that successful hotels will be those that use the ICT effectively, with the aim of instantly satisfying clients' variable desires and needs (Olsen & Connolly, 2000).

A properly designed database will enable hotels keep track of guests' preferences and provide customized service (Ruiz et al., 2010). Piccoli (2008) found that hotel companies can use information in order to create substantial business value. According to him, this is possible owing to the following characteristics of information: it is costly to produce; it is cheap to reproduce and distribute; and it is not consumed by use. In the hotel industry, a hotel needs to invest considerably in different ICT applications in order to collect a single reservation on the Web. However, once the ICT infrastructure is implemented, incremental reservations can be captured on the Web site at a minimal cost. Moreover, as information can be customized inexpensively and simply, it can be reused multiple times and in many different forms. It should be noted that information management has a valuable role in planning, implementation, and control of both communication.

In terms of ICT infrastructure, Croatia is ranked 24th in Europe and 34th overall, which is well ahead of several EU members. In addition, Croatia's tourism-specific infrastructure is ranked 4th, while its ICT infrastructure is ranked 35th (Šerić, Gil Saura, 2012, pp. 13). The literature review has proved the considerable impact of ICT on hotel industry, prediciting that successful hospitality enterprises will be those that implement new technologies effectively (Olsen, Connally, 2000). According to the results of Baggio's (2004) study the Italian hotel segment is characterized by a generally low usage of technologies. In contrast, the study conducted by Šerić and Gil Saura (2012, 18) the upscale hotels in Italy and Croatia, from the manager perspective, the results revealed a relatively high degree of ICT implementation in upscale hotels located in both

countries, but the Croatian hotels showed a better performance of ICT implementation. However, there are a few studies that examine performance and data sharing/integration that focus on the hotel industry specifically, though Sunny et. al. (2005) establish the relationship between IT investments and performance improvements in the hotel industry at five levels; enhanced annuals sales, reduced operating costs, increased occupancy rates, greater level of repeat business, and enhanced positive word of mouth. They identify a significant positive impact on performance in all but guest-related interface applications. Marchand (2005) confirms that 25% of the business value of IT lies within the deployment and investment whereas 75% of th business value is in fact in factors related to the usage of the information. However, there is little research carried out regarding the successful exploitation of the data shared at property level, in particular, exploiting the data in the PMS.

3. İMPLEMENTATİON PMS's IN HOTEL INDUSTRY

Contemporary hotels, in pursuit to fulfill increasingly demanding guests while sustain profitability, introduce information systems for managing hotel business. One of the two integral components of the hotel's PMS. However, this implementation of PMS has not taken place in all tourism sectors at the same time. The hotel industry was more resistant to its application and it was not until the 1990's that the majority of the hotels were computerised (Van Hoof et al., 1996). PMS represent the most widespread ICT application in the hotel industry. They support reservations, front and back office operations and managerial functions. PMS also operate as a hub for hotel ICT system connectivity, to which entertainment services, in-room refreshments, telecommunications, energy management systems and others can be interfaced for 1 and 2-way communications. Hotels have also been progressively introducing their products in major Global Distribution Systems, in order to increase their market prospects (Buhalis, 2003). Furthermore, hotels have increased the technology that they make available for their guests' self-service and entertainment. Hotels are progressively including access to the Internet and/or printing facilities, by establishing wireless or wired LANs for their guests' usage. In addition, the provision of digital television for entertainment purposes-including games and movies-has become generalised. Moreover, these applications are also being directed to reducing guests' contact with hotels' personnel, reducing costs and automating traditionally irritating processes in hotel lodging: queuing up to check-in and out. Guests' communication with the hotel is progressively becoming mainly supported by these digital devices.

Today, software applications are designed to assist in the development of virtually every business need, including individual packages to support specific business activities, as well as comprehensive systems, which enable businesses to store and manage all the information and share it across departments and even branches. These include general applications, such as word processors, as well as those supporting specific business function, such as financial analysis tools, accounting software, personal productivity applications, contact managers,

diaries, organisation level productivity management, reference software, tax preparation, legal software, online sources of information, workgroups software applications, information sharing between individuals in a network environment, Customer relationship Management (CRM) systems and programming tools and utilities such as antivirus applications (Madura, 1998). Furthermore, constant developments on hardware and software applications, have progressively enabled organisations to process larger amounts of data at higher speed, and to handle more complex algorithms (Beekman, 2003). These developments have enabled organisations to digitally centralise the individual business units that control the entire organisation. There are already many PMS providers available on the markets that provide various solutions with a large number of functionalities based on the changing needs of hotels. The Capterra website evaluates 201 such PMS software providers, and in addition to these PMS software, the JazdHotels website (Jazdhotels, 2010) has 27 more, totaling 228 PMS software evaluated through these two websites. There are many providers for all sizes of hotels, and available all around the world. Daghfous and Barkhi (2009) study is shown that Windows is the most widely used operating system in four and five star hotels in UAE and Fidelio is the overall preferred PMS system and has highest market share worldwide. The leasing of software is not new, albeit only recently a practice adopted by the hotel industry. Till recently, the hotel industry preferred to develop and “own” their PMS software.

According to the study "Hotel Industry in Croatia 2007" by Horwath Consulting Zagreb, that specializes hospitality and tourism, the use of certain technological systems in hotels in Croatia is quite varied. At least the technological systems are global distribution systems (14.4%), and commonly used their own websites (94.4%). Very high, above 80%, is used for Internet access (93.3%), systems for the retail food and beverage outlets - POS (91.1%), accounting system calls (87.8%) and local area network - LAN (83.3%). Mean values of use, from 30% to 70%, occupy USALI (70%), central reservation systems-CRM (67.8%), intranet systems (66.7%), monitoring systems business - MIS (65.6%), network on a broader level - WAN (58.9%), data Warehousing systems - Data Warehousing (43.3%) and energy management systems - EMS (30.0%). In addition to GDS, very low are systems management - PMS used only 28.9% of hotel revenue management systems - Yield Management with a share of only 20%. The reason is that these are complex applications that require the highest level of computerization of business and use them only "the greatest", but also they provide the greatest benefit in the management of the hotel and can be used by those who want to be "the best." These data is different by regions (Istria, Kvarner, North and Central Dalmatia, Southern Dalmatia, interior and Zagreb), among which stands out the Zagreb where most of these technological systems used 100% of hotels, which speaks in favor of the above mentioned factors, investment in information technology business.

The other study by Kokaz Pucciani and Murphy (2011) conducted by 95 European hotels belonging to 4 to 5 star category is shown that the market seems to be dominated by Micros for PMS systems with 54 hotels mention having a

version of Opera or Fidelio. Protel follows with 6 hotels, Medialog and Amadeus each was listed by 2 hotels and 12 hotels report that they do not have a PMS, while others use manual systems created by them for this purpose as they were "too small to invest in a PMS system". According to their study it seems that hotels stay with their current PMS system until it is imperative to change. It appears that many hotels stay loyal to a PMS provider's software for an extended time (5 to 20 years). The hotels are aware of mainly the following PMS system: Micros Opera (75%), Micros Suite 8 (57%), Protel PMS (27%), Rezware XP7 (11%), ONE Property Management System (7%), MyPMS (6%), and Barefoot Agent (3%). The functionalities used more (i.e. more hotels have them) are the ones that rated more. The Rooms Management department has access to all software held by the hotel, however, this is less so far Sales&Marketing and Accounting departments. F&B Management have the most access to the POS and PMS but rarely to the CRS. HRM is the department that has the least access to the software and therefore any data held by the hotel. The bigger the hotel, the more PMS functionalities they have and the higher RevPar they reported. Chain hotels appear to have PMS software with more functionality. More than 90% of hotels collect both customer-related and operational data on real time or daily basis for all functions of Rooms Management. Most of the data is collected in real time or on a daily basis with some functions like the Credit System/Accounts Receivable and Financial Control also collected weekly. The costs of a "good" PMS are high (Kokaz Pucciani, Murphy, 2011, pp. 111), these systems are too technical and only IT people can use/understand them.

4. PMS's SPECIFIC CHALLENGES FOR THE HOTEL INDUSTRY

The PMS is one of the key ICT systems supporting the operations of hotels businesses. Although Front-Office features such as reservation, registration, housekeeping, billing and report generation are common to all the PMS solutions in the market, the concept of PMS and its boundaries are not consistent across suppliers, solutions and properties. These systems are normally provided in modules, and therefore additional features, suiting the specific requirements of the establishment, can be adopted. These additional features can support sector-specific activities such as revenue management at a basic level; general business activities such as business intelligence applications, accounting, human resource, etc; and/or the management of additional facilities which are offered by the establishment, including bar, restaurant, conference center, spa and golf courses. These features can be supported by obtaining additional modules which are then integrated to the PMS, facilitating, in this way, the flow of information throughout departments. On the other side, there is a wide variety of ancillary ICT systems, including both additional systems for running the property (such as Electronic Door Locking and Energy Management Systems), as well as Guest Service Systems, such as In-Room Entertainment, In-Room Telephone, Electronic Minibar, etc. These systems are non-modular solutions, however, they can be operated standalone or interfaced with the PMS through a network-

enabling devices such for seamless connectivity between the devices and the PMS, enabling charges to be tracked and posted directly to the guest's billing account, the service to be shut down when the room is not allocated and/or to enable further automated features. This type of communication between additional systems and PMS enables the improvement of controls, employee productivity and internal communication, translating in turn into a reduction of the operational costs. PMS can also be interfaced to the electronic distribution systems for the automatic update on the room inventory available for sale. To support the PMS there has to be processes and procedures that integrate data into a more holistic picture for supporting competitive decisions, at strategic, tactical and operational level. Unfortunately, "no common integration methods allows the installed systems to work together to effectively create, store, retrieve, and present information that may exist across them" (HTNG, 2010, pp.7). There is however, recent movement towards harmonization in data standards and integration. Hotel Technology Next Generation (HTNG) was conceived 10 years ago to facilitate the provision of industry standards in data interfaces and provide certification to suppliers who comply with HTNG standards. In the wider context of travel, the Open Travel Alliance has worked for over decade to produce a platform that software and hardware suppliers can adhere to in order to facilitate data integration. However, not all stakeholders participate in these voluntary initiatives, nor comply with the standards and guidelines that emanate from the workshops and agreements (HTNG, 2010). Tiedemann et al. (2008) confirmed in their sample of 50 Spanish hotels that reluctance to invest in full integration of IT systems and the lack of inter-sharing is no good, and also state that 3-4 star hotels are less likely to share information than the upscale hotels.

The room inventory in individual hotels can be sitting at the property level, and accessible through the basic reservation module offered by any of the PMS solutions, enabling the visualisation of room inventory and the input, storage and retrieval of reservations. Since reservations can normally still be taken at the property level in many hotels, inventories need to be synchronised for maximising bookings without over-booking.Therefore, most software suppliers offer solutions specially designed to host the inventory in one of the sites and to provide seamless communication between the Central Reservation Systems (CRS) hosted at the central reservation offices and the reservations system hosted at the property level. In terms of distribution, opportunities can be maximised by enabling direct booking and their automatic confirmation, through the seamless connectivity of hotel inventory to major GDS (such as SABRE and Galileo), to major Alternative Distribution Systems –ADS (such as Expedia, Travelocity, HotelFactory, BookDirect and iHotelier), CRS powered by external partners (such as Best Western and Reserve America) or through the hotel's own website. A direct interfaces can be set up to provide this connectivity. However, developing direct interfaces for each individual channels can become expensive.

In order to maximise the revenue generated through their sales, revenue management systems can be implemented. This functionality can be included by default or as a modular feature in many PMS, enabling establishments to set up

special configurations such as rates for selected dates which will be automatically displayed at the reservation stage. The basic features relate to the facilitation of data analysis for marketing purpose, supporting decision making, which can be translated into revenue generation. These systems can be interconnected to PMS and to other systems, such as those supporting restaurant management, in which case, the guest history information can be shared across systems. When connected to the PMS, labour productivity and internal communication are enhanced and controls and customer service can improve.

In terms of the Business Administration Systems applications, these can be integrated into the PMS or they can be run as standalone systems. Some of PMS providers offer specific modules to be integrated into their PMS solutions or they offer connectivity to other software solutions. The benefits of systems' integration in back and Front-Office applications are mainly related to the increased labour productivity and internal information accuracy by sharing the same database among departments. This category includes Procurement, Accounting and Human Resources solutions.

The basic facilities offered by a hotel relate to the accommodation services, therefore, the ICT systems in place will be mainly focused on covering the operations involved in providing these type of services, however, many hotels generate a substantial part of their revenue from additional facilities which also require specific ICT systems for their effective operation. These ICT systems can be set up as standalone systems or they can be integrated seamlessly with the PMS, supporting information share between restaurant, bar areas, spa, golf courses, time share facilities, conference and events and the front and back office areas of the hotel. One of these additional facilities can relate to a variety of leisure activities. Those establishment which offer leisure activities, such as spa or golf can implement a Leisure Management System/Activity Scheduler for supporting the scheduling and billing operations, which can be designed to be fully integrated with the PMS, enabling guests to book and close their bills also from the front desk. These systems enable guests to set up their appointments, and when integrated with the Maestro PMS, to develop promotional packages including some of these activities.

Restaurant Management Systems refer to the software applications which are specially designed for supporting the management of restaurant and/or catering facilities. In accomodation establishments, they can operate individually or they can be interconnected to the PMS systems for information flow across departments. They can include special features such as labour management, kitchen display systems, they can enable the input, storage and retrieval of customer preferences and also can include an alarm system which can be set up for different incidents.

When Conference and/or Banqueting Management Systems are connected to the PMS, they enable the sales agent to seamlessly book bedrooms matched to conference dates and stored guest preferences.

The Time Share Management module is offered by PMS providers to assist in the management of this type of unit. It supports the visualisation of the

space for easy identification and management. Additionally, it provides reports, possibility to lock owner's account, tracking billable services such as housekeeping, and the storage of inventory. Enhanced features include the provision of a web interface enabling owners to access their profile information and to include reservations for their own use. Similar features are offered by the Vacation Ownership System developed by Micros-Fidelio (Micros-Fidelio, 2008).

Whether these systems have the basic or more advance features, from the accommodation facility perspective, their contribution to business performance is mainly related to control improvement. If these systems are interconnected to the PMS, then they support internal communication, customer service and labour productivity.

Energy Management Systems refer to those solutions which enable hotels to reduce unneeded energy consumption, normally related to lighting and/or heating. They refer both to Software and Switches, and include a wide range of devices and operate in various areas of the hotel, however, they are mainly focused on the energy management of guest room. This can be operated from a PC terminal, which in turn can be interfaced with the PMS, and provide additional features. This might include a thermostat which enables the property to setback the room temperature when this is unoccupied, and handles the temperature control to the guest when the room is used. Further energy control is provided through their centralised version, which connects the system to the PMS and enables further functionalities such as automatically illuminating the room when the guest checks-in in order to generate a welcoming atmosphere.

Electronic Minibars can be an important source of revenue to many hotels. In busy hotels, where customers want to check-out promptly, housekeepers cannot always check the items consumed from the Electronic Minibar. In this case, Electronic Minibar can be interfaced to the PMS systems, identifying the removal of items and automatically posting charges to the guest account. Since guest tend to move items and then place them back again without consuming them, these devices normally allow some time for guest to place it back again before reporting the item as consumed.

In-Room Internet Access can be provided directly to the guest computer or through the television system. Furthermore, depending on the business model of the establishment and whether this service is intended to support revenue generation or only customer satisfaction, it can be for free or charged per time of usage. The Internet connection can be dial-up through the telephone line, in which case, it will be charged through the call accounting system. On the other hand, Internet providers offer high speed Internet with unlimited Internet connection per room/for the entire hotel which can be payable at once/per day/per month. Establishment have then the choice to account for the Internet usage, charging their guests or offering this service for free. An interface to the PMS will easily enable posting charges to the guest account.

Guest Service Systems are mainly available to improve customer service, however, when these are provided upon additional payment, they can

become a main source of revenue for accommodation providers. The communication between these systems and the PMS enables the improvement of control, internal communication and labour productivity, by facilitating the accessibility to billing information throughout one system only.

Therefore, there are an entire range of industry-specific and general business applications, which can operate standalone or be integrated in a networked system environment for supporting the hotel business operations, contributing to business performance, by improving labour productivity, supporting decision making, reducing operational costs, improving internal communication, communication with partners, communication with suppliers, increasing revenue, and customer satisfaction and improving controls.

5. CONCLUSION

Hotels to link and to facilitate overall hotel business, which is characterized by a large quantity of information, have to implement information and communication systems for managing the hotel business. ICT implementation hotels improve business activities, higher quality assets management and human resources, rationalizing costs and thereby maintained profitability. The integration of information and business systems within the hotel is realized direct cost savings in the necessary resources, in the time required for performing individual business operations, providing a higher quality of hotel services and increased flexibility, which results in an additional competitive advantage and higher earnings. ICT implementation working process is faster and simpler, resulting to improved performance. In addition to efficient management, trained and professional work force the hotels are doing successful business forced to implement ICT.

One of the major components of ICT is a Property Management Systems. PMS make the highest contribution to hotel business performance. PMS, which by nature presents an integrative functionality of key activities within the hotel establishment, was rated as one of the highest contributors to business performance. This suggests that overall the integrative requirements of the hotel industry are fulfilled by PMS.

It is clear that not all functionalities of the PMS are used by the properties It seems original, core functionality i.e. that of room allocation and accounting/guest billing continues to be dominant. A property level is a large under-utilisation of the range of the PMS functionalities. This may be explained by the lack of training or could be explained by lack of access to other data/functionalities or the complexity, albeit “perceived complexity”, in extracting cross-functional/departmental data. The frequency of the data collection, which is daily, also may suggest a mostly operational utilisation of the data.

A lack of awareness and exploitation in the full range of PMS functionality is reported in this paper, which is exacerbated by lack of

interoperability, training and the perception that data management is more of an IT function due to the perceived high technical nature of these systems.

There are obvious limitations in this paper and may not be representative of all hotel properties. Nonetheless, the complex nature of hotel departments and data structures does not easily lend itself to investigation and this is the secondary research of this subject and hopefully, future researchers will be able to build on the methodology, methods and results.

It is recommended that managers should promote availability and awareness of data, invest in tools and processes that promote cross functional optimisation of data and link business objectives to data resources. Training is crucial to the successful of all these recommendations. To explore this further, this secondary research will proceed to a qualitative stage of research using focus groups, to determine the prevailing barriers and issues in more depth that hinder the profitable exploitation of data sources at property level.

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