# Business Intelligence in the Hospitality Industry

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***Abstract*—The hospitality industry is one that has been driven by customer loyalty. Many customers pick their hotel of choice and will stay with that same hotel because of the experiences, service, and even the price. Customers have recently been rewarded through hotel, credit card, and airline points that help drive and maintain this loyalty. Utilizing data to their advantage, the hotel industry has been actively exploring and implementing business intelligence. While many see IT systems as a foundation utility that can be easily imitated, business intelligence can act as a driver to maintain sustained competitive advantage over competitors in the hospitality industry. It can serve means of preserving existing customer loyalty while facing competitive pressures. This paper discusses the importance of BI to the hospitality industry, indicates how BI can serve as a barrier to competitive pressures and discusses future capabilities harnessed through BI that are not yet main stream but are expected to transform the industry.**

***Index Terms*—Business intelligence, hotel industry, sustained competitive advantage, business analytics.**

## I. Introduction

The most critical component for success of the modern enterprise is its ability to take advantage of all available information [1]. This quote represents a lot of the thought behind the increasing emphasize on business intelligence (BI) in all organizations, across the globe, today. Various statistics further prove the importance and growth in business intelligence and its importance to organizations. For instance, the worldwide business intelligence software revenue is forecast to reach $17.1 billion by 2016 [2]. The compound annual growth rate of the business intelligence market is forecast to hit 27.4 percent between 2012 and 2016 [3]. A main reason for the heightened interest in business intelligence stems from massive growth in data created and collected in organizations.

According to Holmes, Smolan and Erwitt, "From the beginning of recorded time until 2003, we created 5 exabytes of data (5 billion gigabytes) [4]. In 2011 the same amount of data was created every two days. By 2013, it's expected that time will shrink to 10 minutes." This trend is not likely to decrease as Gartner technology research is predicting data growth will exceed 650% through the next five years [5]. The speed of the growth is highlighted by the fact that 90 percent of the world's data was created in the last two years [6]. The growth in social media applications along with the expansion of the use of mobile devices have increased the Big Data captured by organizations. Organizations are realizing the importance of capturing and storing Big Data to gain rich insights for decision making. The massive data explosion and the consequent growth in BI has affected every industry. Hospitality, while not among the leading edge industries to embrace business intelligence, has begun to see its value and important to identifying trends and effective decision making.

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## II. History of Business Intelligence in the Hospitality Industry

The history of business intelligence in hospitality industry goes back to the 1980s where revenue management systems were adopted, after being successful in the airline industry. The main purpose of the revenue management system was to help understand length of stays, and discount programs. While these programs worked nicely, the internet becoming a mainstream tool truly launched business intelligence (BI) in the hospitality industry; as key companies began to drive customer data. These companies included Expedia and Travelocity. In the early 1990s the entire hospitality industry became very fragmented with various programs such as Marriott's' One Yield, InterContinental Hotels' HIRO, Hilton's OnQ, and Hyatt's e-Flex. Today, many of these hotels are still on these systems. There were a few players ahead of the game launching BI before the systems were mainstream. However these implementations failed due to common reasons like lack of strategy, technical system, lack of executive support, and finally lack of wide use adoption. In addition, at the time, BI systems were expensive and their success was not as well-known [7].

## III. Current Business Intelligence Trends in the Hospitality Industry

Business intelligence involves the people, processes, and technologies that transform data into insights that drive business decisions and actions [8]. Leaders in the hospitality industry use various components within the business intelligence infrastructure arsenal to increase their effectiveness. For instance, integrated data stores such as data warehouses provide access to massive amounts of real time and historic data for analysis. Online analytical processing (OLAP) cubes provide ease of reporting while advanced analytical tools from forecasting to data mining enable sophisticated data analysis. Fig. 1 presents Rus and Toader's illustration of the basic components of a BI system for the hospitality industry [9].

One of the main ways business intelligence is assisting the industry is through booking optimization. Often, the lifeblood of hotels is the corporate traveler, and being able to consistently book that traveler is key. Rate optimization is a way the industry is doing this. Because certain days are

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busier than others, business intelligence can help to configure the optimal price that will drive a high occupancy rate [10]. One of the ways that hotels help rate optimize is through data mining. They can put historical booking trends into a formula and model to help understand what will happen if they raise or lower prices. This technique helps the hotels use their past data to make better, more efficient decisions for the future. This can be particularly helpful around the holiday season [11].

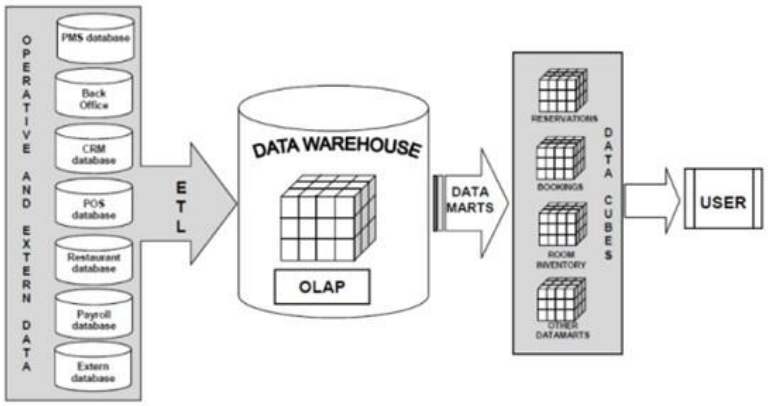


Fig. 1. The components of a hospitality business intelligence system.

Before they can rate optimize, hotels must understand who their customer base is. They must understand if this is a heavy period for corporate or leisure travelers. Hotels have been using a master data management program to determine the correct market. A master data management program results from strong customer data integration [11]. The key to a successful customer data integration is that it is the sole database for all customer data. This helps make loyalty programs for hotels extremely effective; as there is limited conflicting or dirty data. Loyalty programs can be extremely expensive because of the offered rewards, but if hotels utilize their BI effectively, the return on data knowledge is much more valuable than the rewards. For example, hotels can use this data to understand if they gain a return on value form websites such as Priceline.com and Expedia.com. When building a master data management program, there are many ways to organize and capture the data. For example, larger chains can organize data by geography, or sales. Hotels could also organize the data by travel agents, or booking company. It is up to the individual hotel and company to decide the most optimal way to organize the data [11].

Hotels are also using business intelligence to help understand their guests, and how and where they spend their money and time. For example, The Peabody Hotel uses business intelligence to figure out which guests indicate they will never stay again, and dig even further to understand the why. This data mining can link back to a specific issue or employee, and allow management to take corrective actions. The company estimates this use of BI saves them about $120,000 a year in potential lost revenue [12].

Konover Hotel Group uses the system Aptech to help understand their labor and other expenses. They can break this out by region, but also down to the specific hotel. A quote from their executive vice president states, "We're assessing performance on a nearly real-time basis and […] can quickly make and implement informed decisions – whether it's adjusting staffing or implementing a program to recoup lost revenue." This means making adjustments on rates depending on what the weather is going to be [13]!

One of the true benefits of business intelligence in the hospitality industry comes from being an end to end user. One of the major issues with business intelligence is having too much data and not being able properly analyzes it. Some hotels have now been able to avoid this by truly using the data to find cause and effect on information they are analyzing. Ritz Carlton has been able to put in what they call 'internal failure modes and effects analysis (FMEA)' which promotes analyzing data together to understand the cohesion rather than looking at them as individual issues. FMEA works by using data from guest comment cards, feedback surveys, and secret shoppers. The data is then analyzed by the business intelligence group, UniFocus to understand the trends. Each trend has a specific rating that helps the hotel understand the seriousness of the issue as well as the frequency of it. Ritz Carlton has seen the benefits of business intelligence, where their customer service scores rose seven points since 2004. Corporate Director, of Quality Assurances, Sarah Santaella states, "Determining what defects are occurring most frequently, what their impact is on guest loyalty, and how effective our problem detection systems are makes it easy to prioritize our efforts in eliminating the defects that put our hotels at the most risk" [13].

Another example of how business intelligence is crucial for success comes from Marriott. With over 3,500 locations and $12 billion in revenue it is one of the largest hotel chains in the world. In a recent interview, Marriott revealed a key strategy as being able to increase the number of distribution channels for their hotels. This strategy is being driven by internet availability. Marriott also revealed that they strive to improve customer service; and plant to do this through the well-respected Marriott Reward program. When Marriott runs a transaction, the business intelligence system is able look up the member status, inventory availability, and possible pricing models. Pricing can be based on length of stay, as well member loyalty status; this analysis takes just seconds. When looking at their IT implementation Marriott considered several factors: (1) its mainframe system would have to continue to meet growing demand and maximize yields on inventory, (2) be consumer friendly

and reward for loyalty, (3) work with internet based business partners to sell Marriott products and their own offerings, (4) real time operations, 24 hours a day, (5) system must be cost efficient.

Marriott has a number of data centers to help support their transactions, and they are supported by the Microsoft Exchange System, UNIX and Linux servers. Marriott recently converted to a service oriented architecture of their software. This helps them deliver on customer value because they can have smarter transactions. For example, the system can recognize a Marriott rewards member and provide better value as they look for room to book [14].

Another example of a successful hotel business intelligence implementation is with La Quinta Inn & Suites. They wanted to know the most up to date information on their 400 owned hotels without using email or a paper-based system. La Quinta used Aptech to implement this system to show real time data on what was happening at the hotels. The system provided specific reports that show key trends, key performance indicators, forecasts and how they relate with the overall strategy. Some of the key performance metrics included revenue across all owned properties, budget variances, occupancy and demand forecasts and, regional booking horizons. These reports were consolidated at night and ready for La Quinta executives in the morning. One of the key things that made this system incredibly effective is that the reports could be customized to meet the needs for each executive. The implementation involved active participation from La Quinta team and Aptech. Aptech developed the reports and then trained the La Quinta team, and then went back and refined further the reports so they met the needs of the business. The key result, as seen in many business intelligence implementations was that La Quinta could continue to develop the system, rather than have to continue to maintain the system [15].

Some of the key metrics stemming from the hotel industry include revenue per available customer, and revenue per available room. These are key drivers to show how well a company, or specific hotel is doing. Before business intelligence was used in the hospitality industry, many data points would be captured via excel to help figure out revenue per available room. Statistics such as maximums and minimums for business for certain days, sales for last year, average cancellations, all would be used to figure out how well the hotel is doing. This process, prone to errors and dirty data, is improved today through the use of business intelligence. With an accurate, complete and integrated data store, the business intelligence solution can use this information to provide snapshots of the data on given time frames whether that is 30 days, 7days, or 1 day. By using a proper business intelligence system, the hotel industry can capture these trends in a more accurate manner. A common analysis in the hotel industry is known as Pace. This is where managers look at a certain historical period and can analyze the same business for this year. Below is an example: Pace analysis for the next 15 days, showing business on the books, along with difference between business on the books and actual sales for the same period last year. The combined totals provide a demand forecast for this time period [7].

Another example of success business intelligence implementation is when Choice Hotels decided to move forward with Business Objects as a main component of their BI infrastructure. Executives desired real time data relating to revenues and occupancy rates. While Business Objects owns the Business Intelligence portion, IBM provided Choice Hotels with the database, which allowed Choice Hotels flexibility in integrating their data. Choice Hotels followed one of the best practices in business intelligence by rolling their program out in phases. They first gave their users reporting information on basics like operations, marketing and locational trends. One of the examples featured in the study said, "Choice Hotels will pull in information from its many hotels via satellite nightly, and then use Business Objects to build and deliver reports the next morning to company executives with the most up-to-date revenue and operational information. The marketing department will rely on Business Objects solution to monitor guests who belong to the hotel's loyalty program, and gear specific promotional and discount campaigns to benefit them." Also, per usual business intelligence implantations, executives had access to dashboards with key information. Another factor that allowed for the roll out to be so successful is Choice Hotels had key executive support with their implantation. Vice President of Marketing, Chris Caren stated, "Business intelligence allows our customers to make their enterprise performance management initiatives truly company-wide initiatives, so that every employee and every department in an organization can work together to reach and exceed corporate goals. Choice Hotels is an excellent example of a company that gets the idea of empowering its employees to improve the overall bottom line of the business. Business Objects EPM solutions help customers like Choice set goals, monitor metrics, analyze their business, decide a course of action, and then act in a timely manner." [16]

## IV. Challenges to Business Intelligence in the Hospitality Industry

Organizations in hospitality have greatly benefitted from BI and have much more to gain. BI and IT in general can provide firms in the hospitality industry with competitive advantage. However, most organizations strive to gain and maintain a *sustained* competitive advantage from IT [17]. There are several drivers to response lag, or in other terms key barriers that enable organizations maintain a competitive advantage resulting from IT based strategic initiatives [18]. They are IT resources such as existing IT infrastructure and data repositories, complementary resources such as physical and tangible assets, the nature of IT projects implemented and preemption that increases competitor switching costs [19]. Many past information technology innovations have failed to meet expectations of sustained competitive advantage.

BI, a key IT priority among executives in recent years [5], and a major complex IT system has enabled major organizations gain competitive advantage when faced with business failure as well as bankruptcy. Case studies highlighting organizations in the banking industry [20] and the airlines industry [21] attest to how BI implementations enable organizations to go from dire straits to marked

success. Numerous organizations across industries have obtained varying levels of payoff from BI, from new insights in standard reports and process to complete organizational transformation [22]. Business intelligence is among the few complex IT initiatives that can provide firms in the hospitality industry the opportunity to erect barriers to the erosion of sustained competitive advantage. In other words, the IT drivers to response lag in the hospitality industry [17], that were introduced previously, can be accomplished through BI implementations. The manner in which BI can bring about IT dependent sustained competitive advantage and act as a response lag driver that contributes to sustained competitive advantage is presented below in Table I using the framework described by Piccoli [17].

TABLE I: FRAMEWORK FOR BI BARRIERS THAT HELP MAINTAIN SUSTAINED COMPETITIVE ADVANTAGE

| General IT Barrier | Business Intelligence Barrier |
|---|---|
| **IT resources:** An initiative becomes increasingly difficult to copy as it becomes more reliant on preexisting IT resources such as data management infrastructure [23]. | BI infrastructure such as an integrated enterprise data warehouses can be challenging to implement. However, once in place, can provide sustained advantage through its uniqueness within the organization. |
| **Complementary resources**: As an initiative becomes more reliant on distinctive complementary resources, the complimentary resource barrier to imitation strengthens. | BI implementations are often supported by complementary resources within the organizations such as upper management support and corporate culture. Successful BI implementations result from strong upper management support that often leads to the creation of a corporate culture that is open to embracing a single version of the truth as well as business analytics. |
| IT projects: The technology and the implementation process of an initiative in terms of its complexity, uniqueness and visibility to competitors can create barriers to copying. | BI projects can be complex depending on the nature of the legacy operational data environment, the need to incorporate Big Data to existing data stores and the advanced analytical needs of the requested solution, to name a few. The complexity inherent in BI projects can stand as a barrier to competitors. |
| Preemption: It is not enough for competitors to imitate the leader's strategy, they need to provide additional value or compensate switching costs to attract customers. | The initial advantage gained by acting upon the key insights gained though BI solutions will give hospitality firms with BI solutions an opportunity to attract customers that new entrants would find difficult to provide added value to customers by using similar BI solutions. |

## V. FUTURE BUSINESS INTELLIGENCE INNOVATION IN THE HOSPITALITY INDUSTRY

The future of business intelligence innovation in the hospitality industry is bright. New business intelligence systems have generated a lot of buzz in the industry. They have features that promise to help hotels look at both the future and past data to better understand trends and maximize profit. Some of the trends includes a customized dashboard, reservation system, and offers alerts sent to users' mobile devices. Newer systems offer solutions that help hotels reach new markets, and quickly identify positive or negative trends. The new systems also promise highly visual data with maps, charges, as well as alerts, filters and analytics [24].

Mobile devices will also begin to be highly used as a part of BI data gathering. As guests expect more customized service, hotels must meet these expectations. Many hotels see mobile phones as a way to deliver on this. There is still some deep investigation on what the return on investment will be [25]. MiscroStrategy [26] recently launched an iPhone app that is aimed at the hotel industry for business intelligence. This app serves to hotel managers and executives so they can see current P&L, budget information and recent guests reviews. The goal is to allow management to make decisions regardless of where they are located. CTO of Alloso Technologies states, "Our new iPhone app is the first of its kind for the hospitality industry, and we are delighted to offer our clients advanced tools to help them enhance their business performance. Our clients see real value in having the ability to access their business data anywhere in the world, and at any time." The company is now working on the creation of an iPad app (Fig. 2) [27].

Business intelligence is considered a survival tool more than a nice to have, especially with the recent economic downturn. Hotels are finding that business intelligence serves as a differentiation for their customers. A recent Gartner study concluded that 65% of large hotel companies are leveraging customer data in business intelligence tools to help improve decision making. Many hotels believe business intelligence to be a tool that can identify new revenue streams, and test strategies [28]. Also, with the proliferation of social media, hotels are expected to be on top of any reviews (positive or negative) that involve their particular location. By being able to monitor their brand online using business intelligence, hotels are better able to own their own brand [29]. newBrandAnalytics is a company that uses social business intelligence. It has provided services for many industries including, restaurants, hotels, and retail. The company's strategic differentiator is its ability to mine user reviews from sites such as Yelp, and Facebook, and then provide detailed analysis on these reviews. newBrandAnalytics uses algorithms to decide the importance and impact each social media review has on the company's brand [30]. newBrandAnayltics partner, Harry Weller states, "nBA has transcended the listening platform category and is pioneering a new arena of social business intelligence. Their technology goes beyond simple social metrics and generates industry specific customer insight through operational categories that really matter to business, like service performance, employee feedback, and product quality. This type of insight is million-critical for any business, especially service providers" [31].

Another future trend of business intelligence in the

hospitality industry includes outsourcing the work to experts. Orbitz has recently adopted a cloud warehousing system for Kognitio. They stated that Kognitio fit with their strategy because maintaining the infrastructure is Kognitio's competitive advantage. This let Orbitz do analysis and not has to worry about maintaining their infrastructure. When Orbitz was managing the data, it would take hours, even days to run queries. Now with the help of Kognito, Orbitz can run queries in minutes; which allows for faster decisions. A recent article stated, "By using Kognitio WX2, Orbitz can now take information from web channels, demographic and psychographic data, customer segmentation and modeling scores and turn it into actionable intelligence, allowing them to think of new ways of offering the right products and services to its current and prospective client base." [32]

Fig. 2. the iPad app created by Alloso.

Another future innovation coming to fruition is from a startup of Exepdia employees called Hopper. The core belief of this startup is that the core data that the hospitality industry uses is not accurate and it needs to be repaired. Hopper is using a number of databases to help web pages more accurately capture guest information; and allow the customers to search better. Hopper prides itself on not having rigid data, their data is built on NoSQL technology; this allows them to better deliver search results to its customers. This allows Hopper to make better links to the keywords [29].

A final trend is coming from SaS in customer analytics. SaS states their system of customer analytics can help hotels have successful revenue models. This program tracks guest information and uses them so management can make thoughtful and choice decision per customer, rather than target market. SaS claims to help increase retention rates, get a 360 degree view of the guest experiences, as well as increase loyalty and profitability among guests [32]. SaS claims they can do all of this and more through their superior analytics system as well as their ability to properly manage the data input. This allows for hotels to plan on what their next strategic move is, rather than how they are going maintaining the current system. Among their customers include intercontinental Hotels, Venetian, and RCI Global Vacation Network.

The hospitality industry is quickly becoming a leader when it comes to business intelligence. Optimizing customer data has led to higher profits, and occupancy rate. Business intelligence has also helped improve the customer experience by being able to quickly react to negative experiences. In the future, mobile phones, and social media will quickly become key parts of business intelligence systems. Overall business intelligence serves as a differentiator for those in the hospitality industry.

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