The Influence of Table Top Technology in Full-service Restaurants

by Alex M. Susskind and Benjamin Curry

EXECUTIVE SUMMARY

The use of tabletop technology continues to grow in the restaurant industry, and this study identifies the strengths and weakness of the technology, how it influences customers, and how it can improve the bottom line for managers and business owners. Results from two studies involving a full-service casual dining chain show that dining time was significantly reduced among patrons who used the tabletop hardware to order or pay for their meals, as was the time required for servers to meet the needs of customers. Also, those who used the devices to order a meal tended to spend more than those who did not. Patrons across the industry have embraced guest-facing technology, such as online reservation systems, mobile apps, payment apps, and tablet-based systems, and may in fact look for such technology when deciding where to dine. Guests' reactions have been overwhelmingly positive, with 70 to 80 percent of consumers citing the benefits of guest-facing technology and applications. The introduction of tabletop technology in the full-service segment has been slower than in quick-service restaurants (QSRs), and guests cite online reservation systems, online ordering, and tableside payment as preferred technologies. Restaurant operators have also cited benefits of guest-facing technology, for example, the use of electronic ordering, which led to increased sales as such systems can induce the purchase of more expensive menu items and side dishes while allowing managers to store order and payment information for future transactions. Researchers have also noted the cost of the technology and potential problems with integration into other systems as two main factors blocking adoption.

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From an operational perspective, tabletop technology affects several elements of a restaurant experience that can benefit both the operator and the guest. First, the ability to limit meal duration has two main benefits: the ability to turn tables more quickly for operators and the ability of guests to finish their meals at their discretion. Because restaurants essentially have a fixed capacity, reducing table turnover time increases the number of guests served each day, assuming a demand for the additional seats. For example, using a conservative estimate of a restaurant achieving $2.5 million in sales, and achieving a 15-percent reduction in table-turn time, there is the potential for an additional $375,000 in sales from unmet demand.[1] Irrespective of potential sales gains from improved table turnover, research has shown that restaurant consumers value more control over the payment process and the service elements afforded by customer-facing technology during their meal.[2]

[1] Printz, Kelsey (2014). Presto by E la Carte improves lunchtime Table Turn at Genghis Grill by over 30 Percent. Downloaded from: www.businesswire.com/news/home/20141202005140/en/Presto%E2%84%A2-la-Carte-Improves-Lunchtime-Table-Turn#.VeCEjU3JCos on August 27, 2015.

[2] Collier, J. E., & Kimes, S. E. (2013). Only if it is convenient, understanding how convenience influences self-service technology evaluation. *Journal of Service Research*, 16(1): 39-51.Susskind, A.M., & Curry, B. (in press). An examination of customers' attitudes about tabletop technology in full-service restaurants, Service Science.White, M. Lawrence, B.C., & Verma, R. "Consumer Preferences for U.S. Restaurant-based Technology." *Cornell Hospitality Report* 15 (18), Ithaca, NY: Cornell Center for Hospitality Research.

The next benefit for operators is potential labor savings. If the tabletop technology reduces the amount of time servers need to attend to their guests, operators can use that "excess" service labor to improve service delivery by giving guests more attention or make each server responsible for a larger number of guests. This presents a choice to each operator on how to use the potential labor savings per guest or table. The last benefit from customer-facing technology in full-service restaurants is the potential for higher guest checks, through the sale of add-ons to the customers' meals.[3] Additionally, guests who use the tabletop technology do not need to wait for a server to place orders for additional beverages, refills, or food, such as appetizers and desserts. To put this in perspective, if the tabletop technology can improve the average guest check by just $3, that would result in a 20-percent improvement considering a restaurant average check of $15. From a theoretical perspective, the addition of technology into the service experience for restaurant guests affects the traditional interaction between servers and their customers.[4] As all participants in the service process adjust to these changes, research has shown how and why individuals gravitate toward or away from new tech-nologies. Specific studies have shown that socio-demographic characteristics, usage characteristics, and usage outcomes are key influences in decisions for adoption, use, and enjoyment of a new technology.[5]

With these findings in mind, we seek to quantify the value of using tabletop technology for restaurant operators through two studies. The first study involved observations using a single restaurant in a chain operation before and after tabletop technology was added to their restaurants. The second study used point-of-sale (POS) data from a larger sample of restaurants within the same chain to confirm the results from Study 1 after the tabletop devices had been fully implemented. Through Study 1 we investigate how the introduction of tabletop technology influences table-turn time in the restaurants and how the tabletop technology influences front-of-house labor usage. Through Study 2 we confirm the relationship between tabletop device use and table-turn time, and also examine the relationship between the tabletop device use and consumer purchasing behavior.

To frame our analyses we present the following two research questions for Study 1:

- *Study 1, Research Question 1*: Does the introduction of a tabletop device in full-service restaurants affect the overall efficiency of the restaurant as measured by average table-turn time for all tables in the restaurant (not just the tables using the technology)?
- *Study 1, Research Question 2*: Does the guests' use of tabletop devices reduce front-of-house labor needs measured as server time spent serving guests with or without the technology?

To frame our analyses for Study 2 we present the following two research questions:

- *Study 2, Research Question 1*: Does the introduction of a tabletop device affect the overall efficiency of the restaurant as measured by average table-turn time for all tables in the restaurant (not just the tables using the technology).
- *Study 2, Research Question 2*: Does use of a tabletop device influence guest spending?

Study 1 Data, Methods, and Findings

In a pre- and post-adoption research design, we collected data with the cooperation of a restaurant chain one month before and one month after the company installed tabletop devices in their restaurants. At the time of installation, the tabletop devices allowed guests to view food and beverage menus, order food and beverage items, summon their server, and pay for their meal.

All observations were recorded at a single location from a chain restaurant over two Fridays and two Saturdays (one each pre-adoption and post-adoption) between the hours of noon and 10:00 p.m., when the restaurant operated at or near capacity. To collect the observational data, the researcher was positioned near the POS terminal, where he could accurately observe server time spent on the terminal and where he could view two sections of the restaurant that had 15 tables that we selected to observe. The average number of guests at the table in the pre-adoption condition was 2.80 (SD = 1.08) and in the post-adoption condition it was 2.83 (SD = 1.15).

During each of the four observation sessions we measured and recorded key dining moments during the meal: start time, ordering, food delivery, payment, and check closing, along with the amount of time spent by the server doing specific activities, such as taking orders, using the POS system, delivering food, and consulting with guests. The dining time for each table was recorded as starting once the guest was seated and considered closed when the guest left the table. In the pre-adoption session we observed 115 table-turns and in the post-adoption session, 103 table-turns.

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[3] Kimes, S. E., & Laque, P. (2011). Online, mobile, and text food ordering in the U.S. restaurant industry. *Cornell Hospitality Report*, 11(7), Ithaca, NY: Cornell Center for Hospitality Research.

[4] Giebelhausen, M., Robinson, S. G., Sirianni, N. J., & Brady, M. K. (2014). Touch versus tech: When technology functions as a barrier or a benefit to service encounters. *Journal of Marketing*, 78(4): 113-124.

[5] Venkatesh, V., Thong, J. Y., & Xu, X. (2012). Consumer acceptance and use of information technology: Extending the unified theory of acceptance and use of technology. *MIS Quarterly*, 36(1): 157-178; and Susskind and Curry, *op cit.*

Exhibit 1

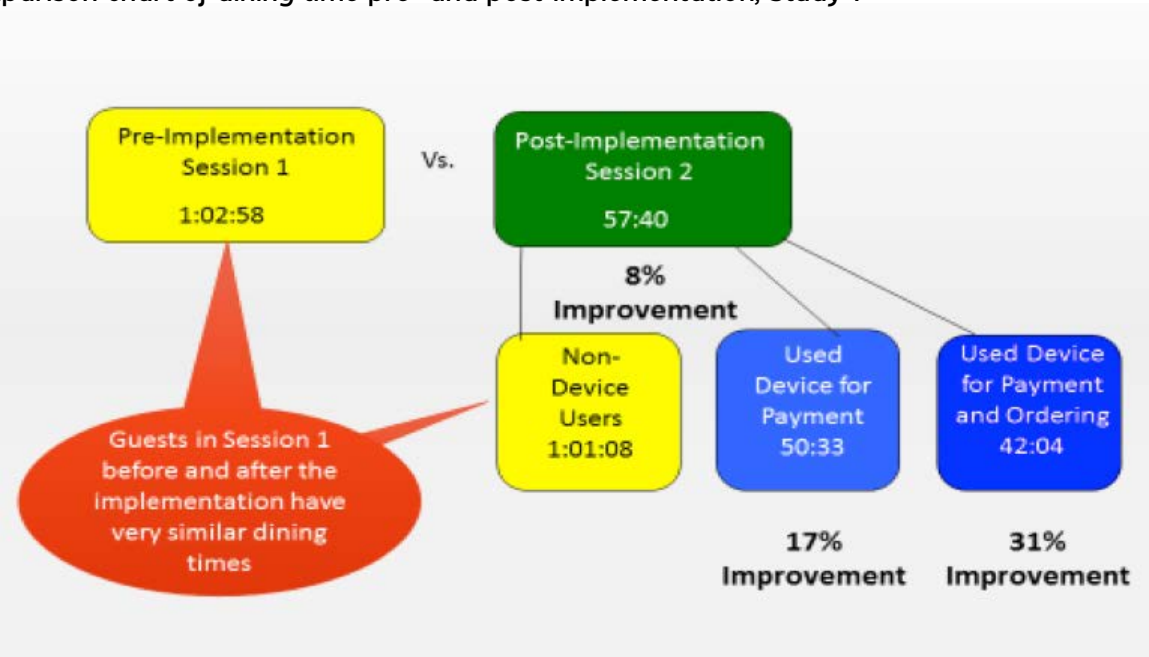
Average meal duration, Study 1

	Pre-Adoption	Post-Adoption	Post-Adoption	Post-Adoption	Post-Adoption
Condition	No Device	Average All Three Conditions	No Device	Payment Only	Order and Payment
Meal Duration	1:02:58 (13:41)	57:40 (8:27)	1:01:08 (16:08)	50:33 (12:43)	42:04 (7:28)

Notes: standard deviations are reported in parentheses after the means: Pre-adoption N = 115 table observations; post-adoption N = 103 table observations.

Exhibit 2

Comparison chart of dining time pre- and post-implementation, Study 1



Meal Duration: Research Question 1—Findings from Study 1

The average dining time in the pre-adoption period was 1 hour, 2 minutes, and 58 seconds (N = 115, SD = 13 minutes, 41 seconds). In the post-adoption period dining time was classified in three ways: **(1)** for those who did not use the tabletop device, **(2)** for those who used the device to pay, and **(3)** for those who used it both to order and pay. For those who did not use the tabletop device the average dining time was 1 hour, 1 minute, and 8 seconds (N = 63, SD = 16 minutes, 8 seconds); for those who used the tabletop device for payment only the average dining time was 50 minutes and 33 seconds (N = 33, SD= 12 minutes, 43 seconds); and for those who used the tabletop device for ordering their food and beverages and payment the average dining time was 42 minutes and 4 seconds (N=7, SD = 7 minutes, 28 seconds). The total average meal duration across all three post-adoption conditions was 57 minutes and 40 seconds (N=103, SD = 8 minutes, 27 seconds (see Exhibits 1 and 2).[6]

When compared to the pre-adoption period, there was a significant difference in meal duration in the post-adoption period, of 5 minutes and 18 seconds ($p < .05$), which represents an 8-percent reduction in meal duration. When we analyze the post-adoption period based on how the tabletop device was used (or not used), we found no significant difference in meal duration for guests who did not use the tabletop device (difference = 1 minute and 50 seconds, $p > .05$). We did find significant differences for guests who used the tabletop device for payment only (difference = 12 minutes and 25 seconds, $p < .05$) which rep-

[6] While not observed during this set of observations, there are circumstances where a guest uses the tabletop device to order, but pays with cash. This service scenario will obviously require additional service interaction on the part of the server to tender the payment.

Exhibit 3

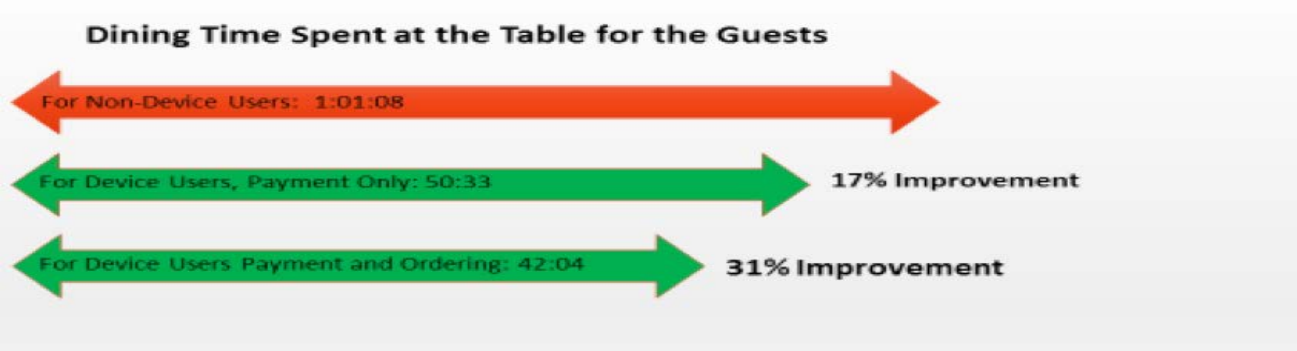
Applied variable labor analysis per guest check, Study 1

Ordering Time	POS Time	Check-ins	Total Labor	% Change	
Non-Device Users	2:30 (1:29)	2:46 (0:46)	11 (3.44)	10:16 (2:17)	-—
Used Device for Payment	1:50 (2:04)	1:40 (1:12)	9 (2.80)	6:30 (2:25)	-36%
Used Device for Ordering and Payment	0:00	0:00	7 (3:17)	3:30 (1:57)	-65%

Note: A check-in is defined as anytime the waiter interacts with the guests at the table (e.g., discussing the menu and specials, taking orders, delivering food or drinks, and socializing with the guest). Standard deviations are reported in parentheses following the mean.

Exhibit 4

Table-turn efficiency gains from device usage, Study 1



resented a 17-percent reduction in meal duration and for guests who used the tabletop device to order and pay (difference = 20 minutes and 54 seconds, $p < .05$), which represented a 31-percent reduction in meal duration.

Service Labor Usage: Research Question 2—Findings from Study 1

Building on our findings from Research Question 1, we examined the influence of this technology on service time and how it relates to potential service time or cost savings. To create the baseline for this set of analyses, we compared the guests who did not use the tabletop device during their meal and relied on their server to those who used the device. For the baseline group (non-users) the server would invest 10 minutes and 16 seconds on average in visits to the table ($N = 63$, SD = 2 minutes, 17 seconds). We then compared this baseline group to those guests who used the tabletop device to settle their bill or to both order and settle their bill. For the guests who used the tabletop device for payment only, the server would invest 6 minutes and 30 seconds on average in visits to the table, a decrease in 36 percent from baseline ($N = 33$, SD = 2 minutes 25 seconds). For the guests who used the technology for both ordering and payment the server would invest 3 minutes and 30 seconds on average in visits to the table, a decrease in 65 percent from baseline ($N = 7$, SD = 1 minute, 57 seconds; see Exhibits 3 and 4). This shows that servers invest less time on average managing their tables when their guests use the device. In short, the more the guest uses technology, the less labor is needed to deliver proper service.

Study 2 Data, Methods, and Findings

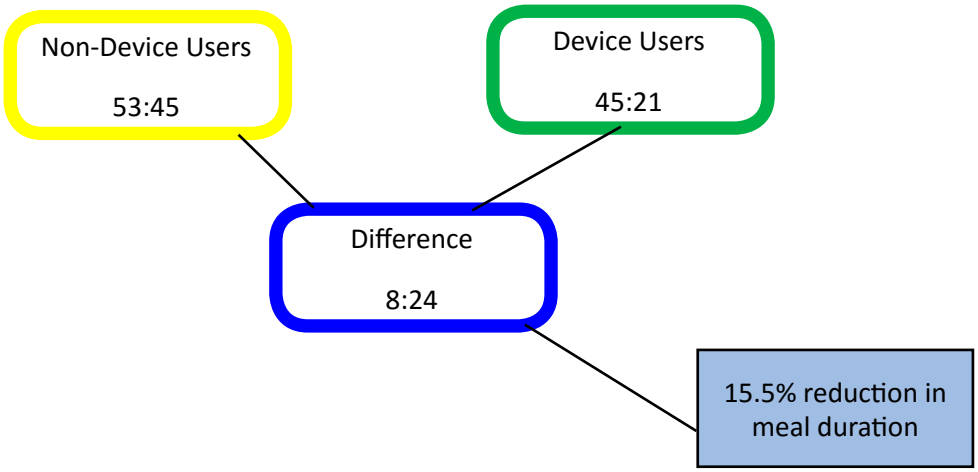
To verify and build on the results of Study 1, we gathered point-of-sales data from an additional 45 restaurants in the chain operated by a single franchisee in Southern California from January 1 to 31, 2016.[7] To gather the data, the technology company monitors the POS and collects information about each guest check. This information allowed us to identify each guest check's server, table number, check open and check close time, and total dollar amount spent.

To make this an accurate comparison we made sure we were only comparing checks that could have involved using the tablet had the customer chosen to do so. As a result, we excluded to-go orders and checks that originated at the bar. After collecting all of the checks we then cross-referenced the check numbers with a list showing whether that customer used

[7] This single franchisee was selected because the menus and prices were identical across all 45 restaurants. This helped control for variation due to differences in the menu and prices, as franchisees in the system have some latitude on what menu items they sell and how they are priced.

EXHIBIT 5

Meal duration and device usage, Study 2



the device to play games, order any food or drink item, order an entrée, and pay the bill. After marking each check we then subtracted the game-playing charge, when appropriate, from the total bill. This was to ensure that we measured the check average increase from food and drink purchases, not from games on the device.

We then excluded a number of checks that appeared to have faulty data, such as those with 0 minutes meal duration, $0 total, or a negative total. For the meal duration test, we eliminated all checks showing meal times of fewer than 15 minutes and more than 180 minutes. In the check average test we excluded bills less than $15 and greater than $200, given the average entrée price is about $10. In both instances filters are used to prevent outliers from skewing the results (typically caused by a device malfunction or improper use of the POS by the server). In the end, 265,414 transactions were collected. For the meal duration test there were 243,301 transactions, and for the average check test there were 231,495 transactions.

We used the data in two ways to answer the research questions in Study 2. First, to answer Research Question 1 the data were used to identify each check's open and close time. This measurement acts as a proxy for meal duration, similar to what was observed in Study 1. The next step was to separate the checks based on whether the guest used the tabletop device to pay for their meal. We then compared these cases to those who paid through their server. This allowed us to examine how using the tabletop device to pay is connected to meal duration compared to those who did not use the tabletop device to pay.

Because we had only aggregate check-level data for the restaurants and we had no measure of server time spent at the table from the POS (as we collected in Study 1), we were unable to test Research Question 2 from Study 1. Instead, we tested a new research question that examined the differences in guests' total spending on food and beverages by looking at the guests who used the tabletop device to place an order for an entrée and those who did not. In effect, we selected customers who stayed in the restaurant for a casual meal and used the device to order an entrée and those who did not use the device to place an order. These data allowed us to examine the differences in the guests' average check for those who used the device and those who did not.

Meal Duration: Research Q1—Findings from Study 2

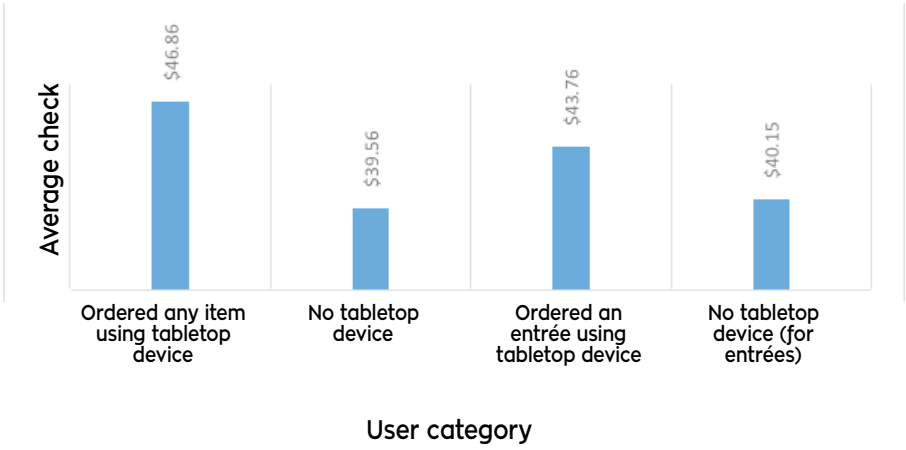
When we compared the check open and close time for these guest checks, we found that guests who paid with the tabletop device had a table-turn time of 45 minutes and 21 seconds (N = 66,016, SD = 17 minutes and 40 seconds), compared to 53 minutes and 45 seconds for those who did not pay with the device (N = 177,282, SD = 26 minutes and 2 seconds). This 8-minute, 24-second difference, or 15.5-percent reduction in table-turn time, is statistically significant ($p < .05$) and close to the 17-percent reduction we observed in Study 1, showing that meal duration is consistently reduced when guests use the tabletop device (see Exhibit 5).

Is Guest Spending Affected? Research Q2—Findings from Study 2

By examining the POS data we were able to determine whether guests who used the device to order an entrée spent more than guests who did not. On average, guests at tables who used the

Exhibit 6

A comparison of guest checks with and without the tabletop device



tabletop device to order a meal spent $3.61 more (M = $43.76, SD = 20.43, N = 13,320) than those who did not (M = $40.15, SD = 20.92, N = 218177), which was significant at the $p < .05$ level. Using this same set of guest checks to extend beyond the threshold of at least ordering an entrée, we expanded this analysis to examine whether the incidence of device-using guests purchasing any items using the tabletop device differed from guests who did not use the device. Guests who used the tabletop device to order any item spent $7.30 more on average (M = $46.86, SD = 22.75, N = 25,106) compared to those who did not use the device (M = $39.56, SD = 20.54, N = 206,389), showing that using the tabletop device during a restaurant meal is associated with higher check averages (see Exhibit 6).

Discussion

Through our two studies we showed that the use of tabletop devices in full-service restaurants is connected to key efficiency gains: reduced table-turn time, reduced need for a portion of service labor, and increased spending under certain circumstances. We showed that when restaurant guests used the device to pay for their meal they spent less time in the restaurant. For restaurants that normally have long waits for their tables, guests' use of this technology is yet another revenue management tool to help operators improve table turn time. In restaurants where demand for tables exceeds the supply, controlling and monitoring meal duration is a key issue. If operators can use technology to better control this aspect of the service experience, they may be able to serve more guests each day. Of even more significance, as Millennials become the largest demographic group in our economy, and hence the largest group of restaurant consumers, we need to understand what is important to them. We do know that Millennials favor the use of technology in nearly all aspects of their lives, particularly the convenience that it offers.[8] Given our findings, the influence of tabletop technology on meal duration is beneficial to both guests and operators going forward. Additionally, based on reported consumer profiles and preferences of technology users, tabletop devices give restaurant operators a better chance when competing for younger guests and patrons who spend less time while dining.[9] While not the focus of this study, guests in previous studies reported that this technology improves the dining experience through greater convenience, faster delivery of food and drink (which we did measure), and improved security.[10]

Next, we found through Study 1 that when guests use the tabletop technology to order or pay, it reduces the amount of service labor needed for the table. This enables restaurant operators to reassign service labor and either increase the level of service delivered to the guests, or reduce staffing levels by giving servers more tables in their stations.

Last, we showed that the use of the tabletop devices is connected to higher sales when compared to when the technology is not in use. Assuming the demand exists, restaurant operators can increase profits through this technology by increasing the number of guests they serve, or by having their guests spend more while they are in the restaurant. Both outcomes are central to every operators' strategic and tactical plans. We look at these issues separately because we believe the tabletop device's ability to influence check size is not dependent on someone paying on the device, and similarly the time-saving benefits of paying on the device are not restricted to people that also ordered on the device.

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[8] Goldman Sachs (2016). Millennials coming of age. Downloaded from: www.goldmansachs.com/our-thinking/pages/millennials/ on April 28, 2016.

[9] White *et al.*, *op cit.*

[10] Susskind *et al.*, *op.cit.*; and Susskind & Curry, *op cit.*

Practical Implications

This new layer of technology has the potential to improve restaurant performance for guests, servers, and managers. For guests, there is more control over the dining experience; they can order when they are ready to, get refills on beverages when they want them, settle the bill at their convenience, and summon their server when needed. Hence, giving guests more control over parts of their service experience is likely to increase their satisfaction with the service experience and, as we have shown, can increase their spending.

For servers, the tabletop devices may reduce the number steps needed to do their jobs. Labor can be reduced or reapplied to different elements of customer service, such as upselling, increased attentiveness and care to each table, and cross training to improve servers' abilities. While these noted uses of saved labor are different, each approach can benefit the guest and the restaurant alike. Managers benefit from the technology by having more flexibility with the use of service labor in the dining experience, although this new technology also puts a burden on managers to ensure their guests are receiving the service they need. This will likely require additional training and oversight so that all staff members understand how and why the delivery of service is affected by the technology. Managers must understand that about one-quarter of all guests do not like to use the technology, and that all guests require appropriate service regardless of whether they use the tabletop devices.[11] Management must also ensure that service standards do not lapse as a result of the technology being used by guests.

Finally, for all of these benefits to be realized by full-service restaurants, it is crucial that the restaurants' standards for service delivery remain consistent. Any efficiencies gained through labor savings and table-turn time from the self-service aspect of the technology can be lost if any guests are not satisfied with core products: food, beverage, and service. Research shows that standards for service remain a key driver of guest satisfaction in restaurants. Moreover, some 20 to 30 percent of consumers using guest-facing technology remain uncomfortable with the idea.[12] The bottom line for restaurant operators, when introducing technology and making other changes to their business processes, is to create an excellent experience for their guests.

Ideas for Future Research and Conclusion

While our research represents an important step in examining the impact of guest-facing technology in full-service restaurants, there is much more to do to better pinpoint the costs and benefits of using this technology.

In future investigations, we plan to expand this research to concurrently examine the relationship of guest-facing technology use and other elements of the dining experience, such as guest satisfaction, employee engagement, guest return intentions, and purchasing behavior and spending. These additional factors should further our understanding of how tabletop technology in restaurants influences the entire guest experience. ■

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[11] Susskind & Curry, *op cit.*

[12] *Ibid.*; and White *et al.*, *op cit.*

[13] Susskind, A.M., Kacmar, K.M., & Borchgrevink, C.P. (2007). How organizational standards and coworker support improve restaurant service. *Cornell Hotel and Restaurant Administration Quarterly*, 48 (4): 370-379 (Susskind & Curry, *op cit.* ; White *et al.*, *op cit.*

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