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Leveraging the Principles of Lean Six Sigma in Creating Value for the User Community

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Abstract

This is a case study on how Singapore Management University (SMU) Libraries used an evidence based approach to decision making, based on the principles of Lean Six Sigma. Academic Libraries and the services offered by them have been evolving over the years along with the changing landscape of higher education. By using a data-driven methodology, SMU Libraries, was able to provide a service that was relevant and tailored to the needs of its community.

Background

Provisioning of personal computers for use is one of the services provided by SMU Libraries to support the learning and research needs of the user community. A total of 48 computers are provided spread over 2 levels of Li Ka Shing Library, one of the two libraries under the umbrella of SMU Libraries. Of these, about 8 are dedicated for access to specialized financial databases with the remaining being used for general purposes. The computers are commonly used by students to access electronic databases or for initiating print jobs.

In recent years, the library had seen a sharp increase in the number of laptops owned and operated by its patrons. In addition, the library had also undergone a master planning exercise to better utilize its space. As result of the evolving external environment, the Library decided to study if the current model of providing common PC's was effective in supporting the learning needs of the SMU community. Anecdotal and casual observation gave strength to the opinion that students did not require such PC's anymore, and their needs would be better served by removing the PC's and turning the whole area into a student study space.

Introduction

Previously, the next logical step would have been to re-design the space based on these observations and implied assumptions. However, in 2013, SMU Libraries also embarked on an initiative for creating a "Culture of Assessment" among its staff. Lakos & Phipps (2004) define this as "…..an organizational strategy requiring decision-making based on "facts, research, and analysis, and where services are planned and delivered in ways that maximize positive outcomes and impacts for customers and stakeholders". As of today, over 95% of staff have been trained in Lean Six Sigma and had worked on a number of business improvement projects. As a result of this training, a small team tasked with the study, decided to test the assumption using scientific methods.

In his book, *The Laws of Subtraction*, author Mathew E. May, talks about how ignorance tends to be classified as an absence of knowledge. However, in the authors' view this offers a

very simplistic reasoning and tends to ignore the various types of ignorance that even rational people fall prey to. He elaborates on two. One type of ignorance is misconception – often mistaken or disguised as a well-formed opinion or theory. When this is applied to real world scenarios, these may even appear to hold true. However, when faced with the test of a scientific method, misconceptions are forced to yield to empirical fact. Another type of ignorance is the confirmation bias or prejudice that acts on the rational mind to deny reality in place of a reality that is somehow more personally favourable.

In the case of SMU Libraries, though conventional wisdom dictated that the students' needs would be best served by removing the PC's since they had their own devices, our Lean Six Sigma training cautioned us to take a closer look, moving beyond just assumptions and bias. Enter "Genchi genbutsu", a philosophy commonly used in Lean Six Sigma. This is a Japanese Term for "go look, go see". The practise is simple. Observe first, design second. The goal is to observe people and their behaviour in the context of their entire lives. In this context, it meant observing student behaviour and their interactions with the space in the microcosm of a day in the life of an SMU student.

Methodology

The main principle behind the Lean Six Sigma approach was evidence based decision making. By using this approach, the Library was able to build a business case for future follow-up actions.

The study was split into 3 tracks. Both quantitative and qualitative measurements were used and carried out over the course of an entire academic term starting from 2nd Jan 2014 – 31st March, 2014.

➢ The first was to obtain quantitative measurement on the usage of the PC's. This was accomplished by observing and recording usage patterns of the PC's over the course of the 3 months. The data was recorded for every week, with each day being split into periods of 2 hours starting from 10 AM to 6 PM. The findings were recorded into Excel.

➢ The second was to obtain qualitative feedback through a few communication channels. The first channel was Facebook. Comments were invited on the Facebook page, regarding the placement of PC's. The second methodology used was a survey. The survey was responded to by slightly over 100 participants, and the responses were tabulated and analyzed.

➢ The third track was to analyze the common issues that were highlighted during the measurement phase. The team explored various technological solutions along with the University's IT Department, to mitigate some of the major issues faced in the availability and the usage of the common PC's.

Findings

A. Usage Tracking through cyclic observation -

Starting from term 1, the usage of the PC's was tabulated over a period of few weeks, in intervals of 2 hours. The team took turns to observe and record the findings in an excel worksheet. The purpose of the unobtrusive observation, was to gain an understanding of how students interacted with the space. The observation also highlighted the peak and non-peak usage patterns among the users. Generally, the first 3 weeks of the term was observed to be quiet, with minimal usage of the terminals. At this point, students were also using the terminals more for printing purposes. Sample from one of the weeks highlighted below –
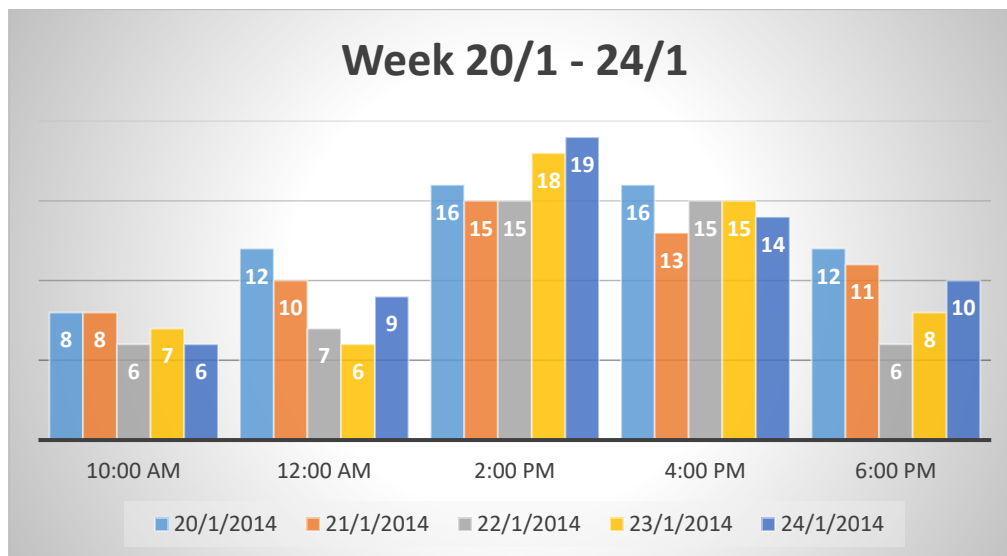

Fig 1 – Usage of Public PC's during Week 3 of Term 1, 2014

However, as the weeks progressed, the usage started to climb steadily, with the focus of the usage being accessing electronic databases and working on assignments. Based on the figures collected and averaged over the study period, the maximum usage was found to be during the 2 PM – 4 PM period.
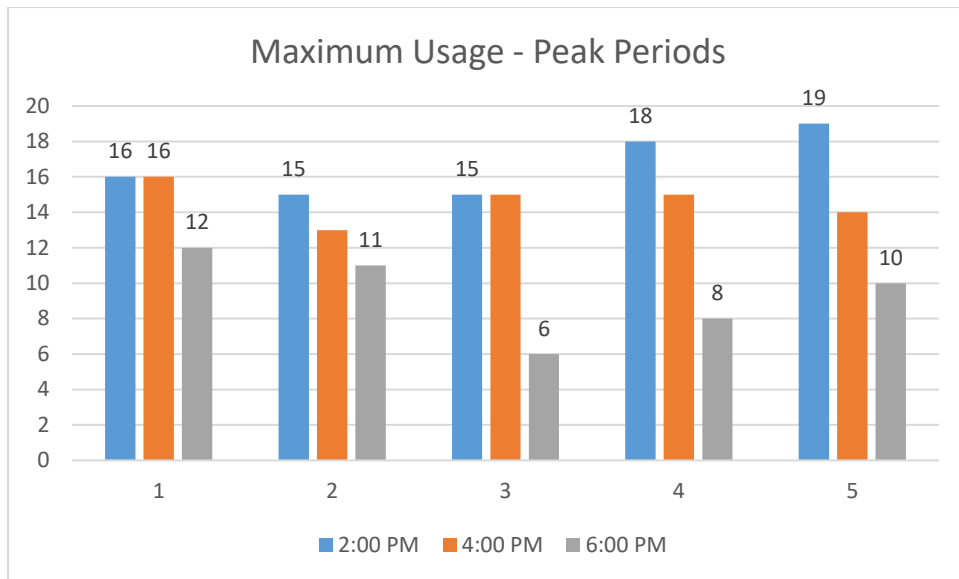
Fig 2 – Peak Periods for Public PC Usage

B. <u>Facebook Post and Comments</u>

The next step was to obtain some feedback from the main user group and this was first achieved through the use of Facebook. The following question was posted on Facebook in the month of February, and comments were invited. The attached is a snippet of some of the comments received –
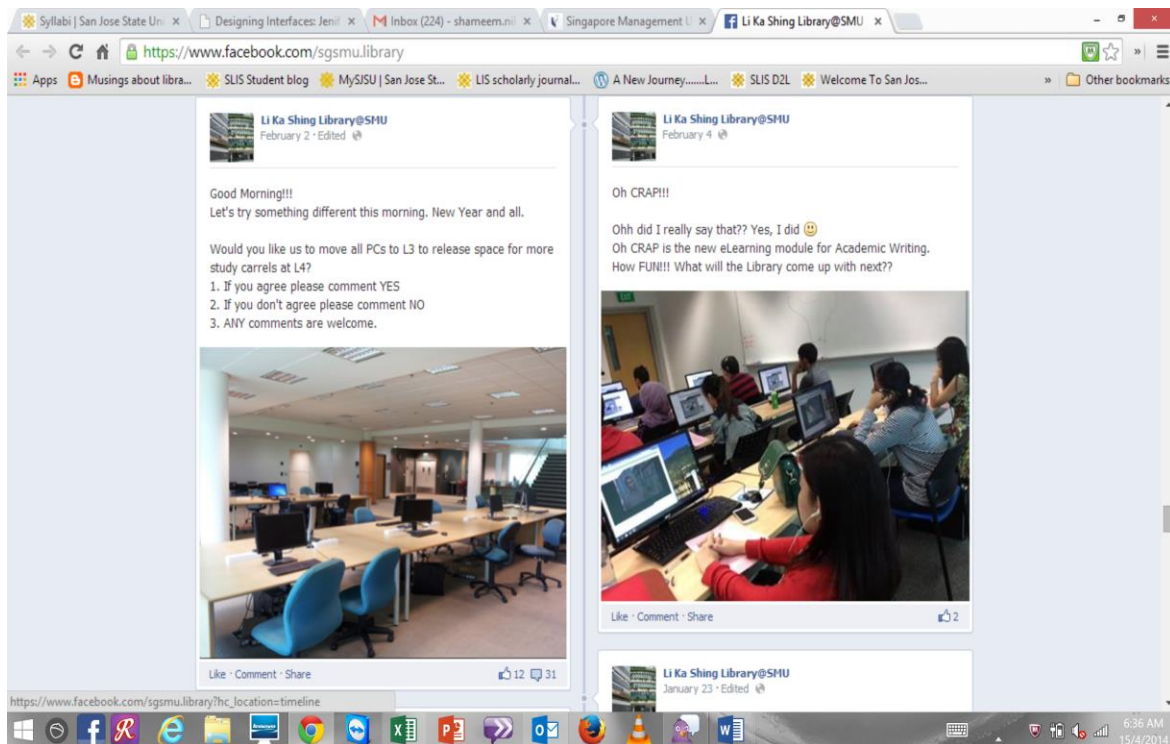

Fig 3 – Snapshot of Facebook question posted

Some Responses

"Yes, the space in between the computers can be smaller".

"We could tweak the spaces a bit".

"More study spaces are welcome. I notice that people mostly use the tables for studying anyway, as opposed to working on the computers. The result is that the space between every terminal goes unused, because there is no chair to sit on"

"The actual space between every terminal is too big, with more computers together can be more efficient".

The sample from Facebook respondents was heavily tilted in favour of moving PC's to level 4 and consolidation. Of the 31responses received, 2 were in favour of this move.

C. **PC Usage Survey**

The Public PC Survey was a short survey to gather public users' experience on using the library pc's and address the issues they are facing.

The survey contained 4 simple questions. With the help of Circulation team and student helpers, a total of 100 pieces of survey was distributed with 98 responses.

Question 1 asks if students think library should move all the public PCs to one level. Figure 1 shows that 27 students (27.55%) answered 'Yes' and 71 of them (72.45%) answered 'No'.
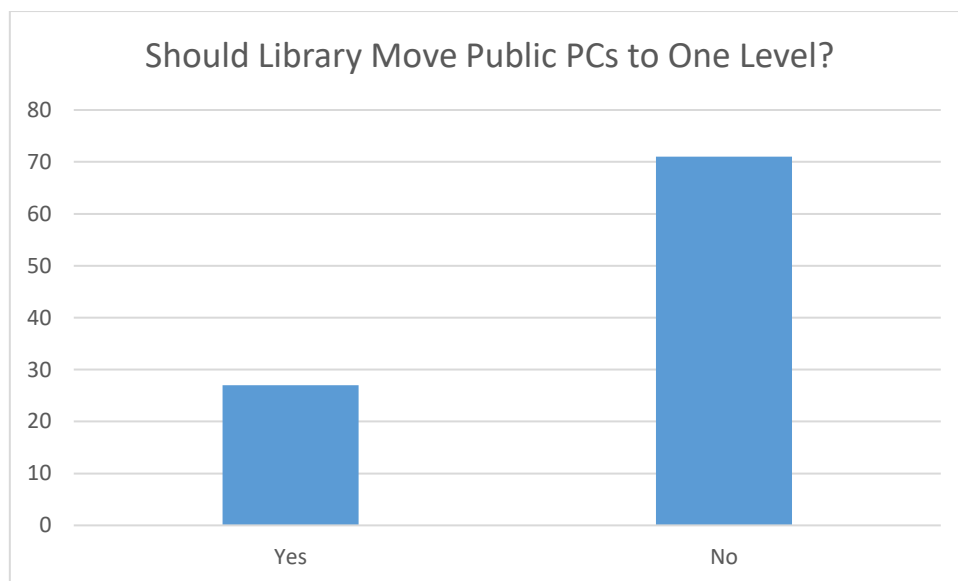

Fig 4 – Responses to Survey Question 1

The respondents were also asked to explain their reasoning. The majority of the reasons for a 'Yes' were:

a. Convenience to access the public PCs.
b. Easy to find the available PCs.
c. More space for studies.

And the majority of the reasons for a 'No' were:

a. Crowd
b. Noisy
c. Messy
d. Easy access on different levels

Question 2 asks about the time that students use public PC. The result shows that, most of the students (68.36%) use Public PC less than 2 hours. Only 31% of the students use the PC for more than 2 hours. About 30% of the students use the PC less than 30 minutes.
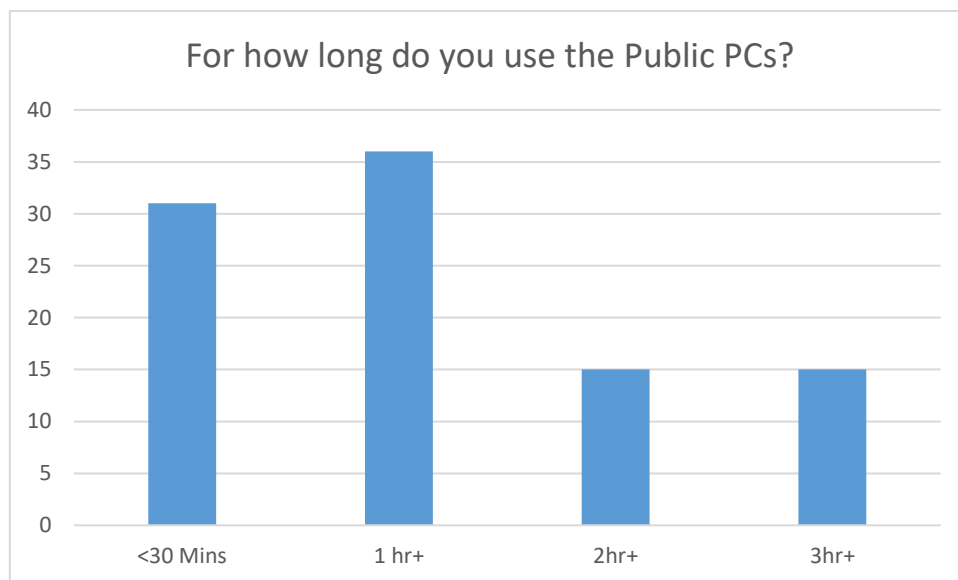

Fig 5 – Responses to Survey Question 2

Question 3 aims to understand what students do with the Public PCs. The result shows that the top 3 activities that the students do on Public PCs are: Assignment, Database and Printing.

Some of the students made the remarks said that they heavily use some of the terminals for specific database access like Bloomberg, Capital IQ or Data stream. Some of them use advance office applications and do thesis research.
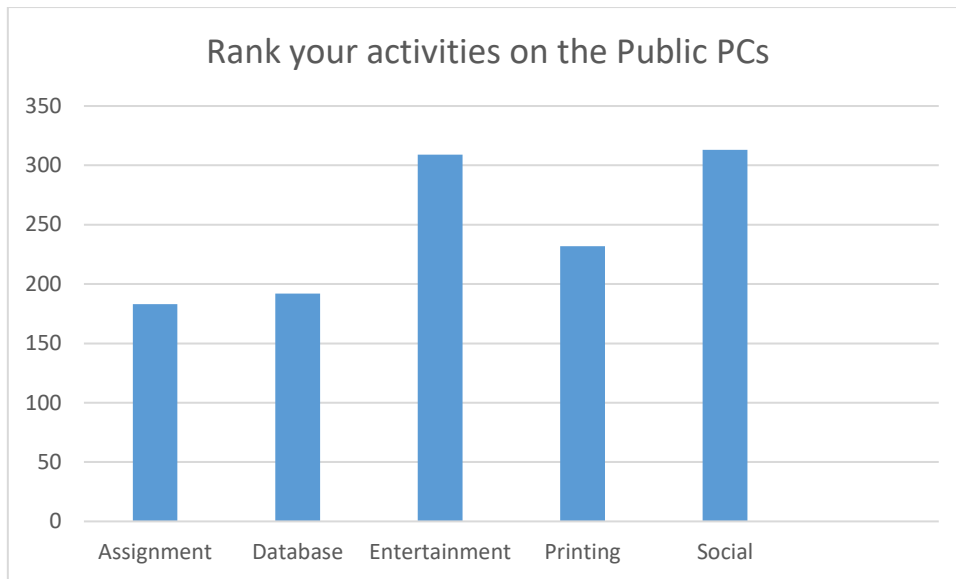
Fig 6 – Responses to Survey Question 3

Question 4 asked about the problems that students facing during using of public PCs. The results shows that 68% of the students have issues finding an available terminal. 51% of the student think the PCs are slow. 23% of them encountered printing issue, and at the end, 26% of the students think the place is noisy.
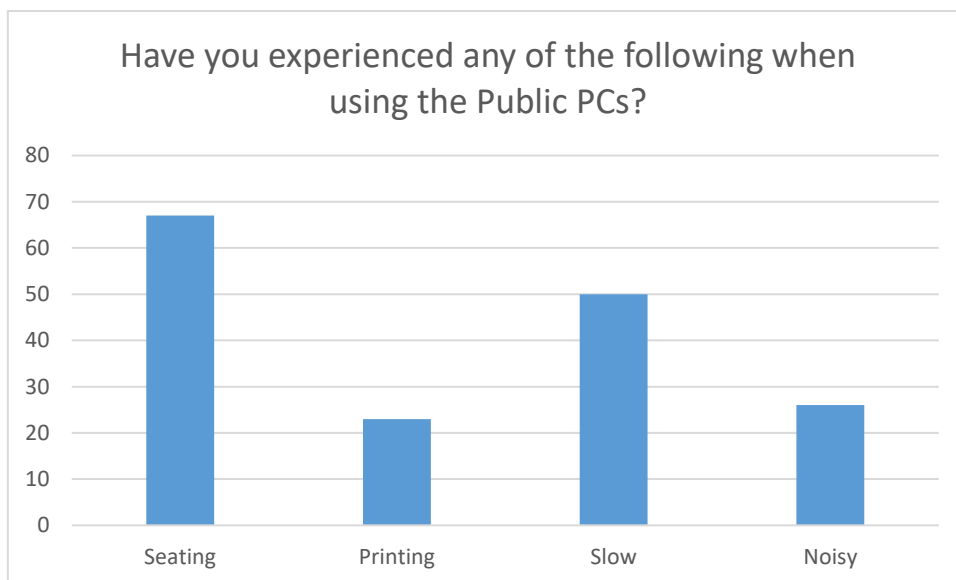

Fig 7 – Response to Survey Question 4

Based on the survey, the major feedback from the students regarding the usage were:

a. Seat hogging for public PCs.
b. Studying on public PC tables but not using them.

    c. PC is locked by other students.

    d. PC takes too long to start.

Analysis

The results of the study were a revelation in terms of understanding expectations of the various student groups as well as space design. In addition to students who undertake full-time courses for their Under-graduate and post-graduate studies, SMU receives groups of International exchange students, every term. This group of students rely on the common PC's provided by SMU Libraries to carry out their assignment work as well as to access online electronic resources.

The following findings were recorded from the measurements obtained –

1) The overall results showed that students want more space for study and more convenient access to the public PCs, but at the same time, they don't want the space to be too crowded and the level of the noise must be controlled

2) The top problem that users faced was a seating issue. These include hogging PC, hogging the seat and space. A number of students used their laptops or text books on public PC tables which deprived students, who were looking to work on a PC, to finding one.

3) The design of the PC tables themselves allowed for collaborative study among groups not necessarily requiring a PC, which was counterproductive to the purpose of the space.

4) Though the usage of the PC's had its peak and non-peak hours, the general pattern observed did not justify the reduction of PC's from the library at that point. Respondents' to the survey pointed out the need to have more of them during the assignment weeks.

Conclusion

The following conclusions were derived from the study conducted -

- ✓ There was a valid demand from students for Public PC's.
- ✓ The major issues which affected them in this area were seat and space hogging.
- ✓ The major tasks they do with public PCs were assignments, database access and printing.
- ✓ The current space which housed the PC's ran counter to the purpose and usage of the space.
- ✓ Noise control was a cause of concern to the users of the space.

Based on the results of the study, the team made the following recommendations -

I.   Retain the number of current PC's available in the library. The current demand does not justify a reduction in the overall numbers. There was no clear cut response either way on the actual location of the PC's. However, from the survey responses, there was a preference for 2 distributed levels, rather than a consolidated space, as a means of noise reduction.

II.   The design of the PC tables needed to be modified in ways that discourage the use of the space for purposes other than working on the PC's themselves. The design should promote user behavior in such a way that the space is conducive for individuals or groups of no more than 2 to be able to work on the common PC, without affecting the experience of other users in the same area.

III.   An effective software system that can manage the booking and usage of PC's can ensure that PC/Seat/Space hogging issues can be minimized. In addition, this would enable the team to continue its assessment on a regular basis by providing qualitative data on the actual usage of the PC's, which would aid strategic decision making later on as the environment evolves.

Recommendation I & II

With regards to Recommendation I - the Library used this opportunity to revamp the space to create a shared space concept for students facilitating noise control as well as collaboration.

Shared space is a design concept, borrowed from the Field of Urban Planning – According to this concept, a road by definition is for automobiles only, while a street is a place of integration, not of segregation. Streets are to be shared equally by all who travel within a city space, without giving priority or assigning a right-of-way to a single traveller. In essence, a street represents the concept of a shared space. It requires a different way of thinking, to produce a more user-friendly social context, governed by human interaction.

In the context of the Library space, this principle was used to remodel the area such that computer users and student groups will need to calibrate and maintain the equilibrium through self-governance with the aid of well-modelled modular furniture that can accommodate various needs. This in part also fulfilled Recommendation II arising from the findings. By using a form factor that follows the function of the space, students were encouraged to model the right behaviour expected of the space.

Fig 8 – Picture of Level 3 space before modifications

Fig 9 – Picture of Level 3 space after modification

Fig 10 – Picture of Level 3 space after modification

This exercise taught us a number of things –

> ➢ Noted usability expert Jakob Nielsen, had this to say about Usability and User Experience"…*To design the best UX, pay attention to what users do, not what they say. Self-reported claims are unreliable, as are user speculations about future behavior. Users do not know what they want."* The team used a multi-pronged methodology to identify what the users were saying as well as what

they were doing in order to come up with a solution that worked for the benefit of all.

➢ Understanding the value created by SMU Libraries. This exercise was not only about adding or removing PC's, or creating additional study spaces for the students. Through this exercise, the team was able to gain a better appreciation of how Libraries contributed to student performance and success.

➢ Form follows function is a principle associated with modernist architecture and industrial design in the 20th century. The principle is that the shape of a building or object should primarily be based upon its intended function or purpose. By following this principle, the Library was able to create spaces that encouraged behavior conducive to the learning environment of all.

The team also studied various technical solutions currently available in the software market that would allow students to make a booking of the Public PC's when required. This helped the team address Recommendation III.

Recommendation III

The library installed a PC Booking system, on all PC's, with effect from the 27th of Feb, 2016. With the deployment, the library could track the utilization of the PC's on level 3. The installation of the system not only helped the library users with a service to plan their schedule and make the necessary bookings of PC's but also helped Library management in understanding the various user groups using the PC's as well as how and when the PC's were being utilized. Again, this is an example where a data driven approach, leveraging technology helped the Library understand its users better. For e.g., the summary of the utilization report for all of Level 3 has been attached below for the period of 1st – 30th March, 2016

User Bookings Report (Summary)   **MyPC**

Start date	01/03/2016
End date	30/03/2016
Booking Type	User Bookings
Booked for (Login ID)	All
Context	All
User Group	All
Show NTA/TA Usage	Yes
Show deleted users	Yes
Site	All
Location	All
Total Bookings	3804
Total Average Duration (hh:mm:ss)	74.22:01:54
Average Duration	01:44:07
Total Average Utilisation (HH:MM:SS)	51.01:40:01
Average Utilisation	01:10:59

Fig 11 – Total PC Bookings for the Month of March 2016

The summary of the utilization report for Level 3 excluding specialized financial database PC's has been attached below –

User Bookings Report (Summary)

MyPC

Start date	01/03/2016
End date	30/03/2016
Booking Type	User Bookings
Booked for (Login ID)	All
Context	All
User Group	All
Show NTA/TA Usage	Yes
Show deleted users	Yes
Site	Li Ka Shing Library
Location	Level 3
Total Bookings	816
Total Average Duration (hh:mm:ss)	28.08:48:15
Average Duration	02:48:05
Total Average Utilisation (HH:MM:SS)	17.17:21:50
Average Utilisation	01:45:01

Fig 12 – Total bookings of General Use Public PC's

Of a total of 3804 bookings, 816 bookings were made for the general use PC's on Level 3. Further breakdown of usage shows that there were a total of 1070 unique users in the month of March.

In order to understand how these figures compare to the actual usage of the library, the PC booking figures were correlated against the People counter figures for a specific period of time (7th – 13th March, 2016)

For the week 7th to the 13th March, and based on the opening hours, the PC's were available for a total of 1100 hours. Of these, they were **booked for a total of 917 hours** and actually **utilised for about 617 hours** or about **56% of the time**. When the booking is considered (i.e., 917 hours), this works to about 83% of the total time.

This report provided the Library with an insight into understanding usage patterns as they showed that the PC's tend to be utilized during the library busiest hours and not necessarily based on the entire opening hours of the library. This helped the library demonstrate the return of investment (ROI) in procuring PC's to support the user community.

In conclusion, this exercise was a timely reminder of how libraries cannot continue to think about initiatives purely in the context of services made available to the community. We need to ask ourselves "What business are we in?" and evaluate the initiatives based on the value it creates for the stakeholders. In the instance of SMU Libraries, we were able to re-design the physical space, by leveraging on the principles of Lean Six Sigma to create a shared space. But our work doesn't stop there. One of the basic assumptions of lean Six Sigma, is that all the activities of the organization should add and/or create business value, and this is best assessed through continuous monitoring. As the external environment evolves, the team

continues to listen to the voice of the community and the voice of the process to calibrate improvements to the learning spaces.

References

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May, E. Mathew. (2013). The Laws of Subtraction. New York, McGraw-Hill Education.