6.1 BACKGROUND FOR ESTIMATING HANDLING TIME
As per Van Zelst et al. [76], handling costs in the stores in the two retail chains investigated are equal to around 60 million dollar per year. In another empirical study by Saghir and Jonson [67], they have found that 75% of the handling time in the retail chain occurs in the store. This shows the need for a model which adequately describes the handling process and estimate the handling time in the store. We have modeled the handling activity of one of the oldest retail store in India known as Spencer’s hyper. We present below the heritage, differentiators, format and product range of the Spencer retail chain to have the insight of the retail stores.

6.1.1 HERITAGE
Since 1863, Spencer’s has been a part of the Indian retail landscape. At one time, the Spencer’s Empire stretched from Peshawar to Cochin, from Karachi to Chittagong, spanning the length and width of undivided India. Originally owned by a British gentleman – yes, there was a Mr. Spencer (John William Spencer, to be precise) – it acquired Indian ownership in the 1960s, and became part of the RPG Group in 1989.

In 1995, RPG Enterprises, the flagship company of the RPG Group, launched Food world as a joint venture with Hong-Kong based Dairy Farm International. The joint venture, which operated supermarkets under the name “Food world” and hypermarkets under the name “Giant”, was terminated in 2006. RPG retained 48 of the 93 stores it owned. These were
re-furbished and their launch under the brand name, Spencer’s, kicked off a new phase in both the history of the Spencer’s brand, and the retail in India.

Since inception Spencer’s has been a consumer-centric brand, constantly innovating, pioneering formats, evolving over time but always keeping consumer needs and satisfaction center-stage. Back in 1920, they were the first grocery chain in India. In 1980, they became the first supermarket chain, and in 2001, they introduced India to the joys of hypermarket shopping.

What has remained unchanged in almost 150 years is the trust the Spencer’s brand evokes. To the consumer, it carries the promise of innovation, quality, and service; the confidence that they will always be able to find a Spencer’s at a convenient location; that it will have a pleasant ambience; and that it will offer a wide range of products at affordable prices.

6.1.2 DIFFERENTIATORS

In the Indian milieu, there are only two routes to survival – discounting and differentiation. Most retailers choose to play the price game. They, however, preferred to focus instead on establishing themselves as the preferred shopping destination for discerning young customers looking for a range of quality products that let them participate in a global lifestyle.

Their brand positioning – Makes Fine Living Affordable – embodies this approach, delighting shoppers with the best products and services that enable a fine living at reasonable prices while providing them with a warm, friendly and knowledgeable retail environment.

The following characteristics distinguish the Spencer’s brand and create memorable 360° shopping experiences for consumers:
1) **Products** – They offer the widest range of food and lifestyle (fashion, home, entertainment) brands, with a special expertise in food.

2) **Quality** – They lay a huge emphasis on all-round quality: in products, stores, service standards, and customer engagement programs and that too since their inception at 1863.

3) **Heritage** – They are India’s oldest retailer, with many firsts to their credit.

4) **Multiple Formats** – from daily to weekly and specialty shopping, they fulfill every need and provide maximum convenience.

5) **Promotions** – They seek to offer the right products at the right time at the right price, with promotions carefully designed to suit the buying cycle and shopping basket of the consumers.

6) **Brand Imagery** – Their stores and staff seek to make their customers feel right at home, being international, contemporary, accessible, empathetic and trusted.

6.1.3 **OWN BRAND**

Private Brands in Spencer’s offer a wide range of products from food, personal care, and fashion to home utility items. Spencer’s Smart Choice, Tasty Wonders, Clean Home and Maroon are some of their brands which host a varied choice that fulfils almost all needs of a modern household. Rice, pulses, whole spices, dry fruits and nuts, sauces, instant noodles, breakfast cereals, honey, breads, beverage, wafers, pickles, jams and cookies- to name a few in their food range. While their personal care range covers face wipes, tissues, baby needs, hand wash etc. Detergents, dish wash, toilet cleaners, floor cleaners support the home needs. Maroon is a brand for premium home care solutions. From cooking to serving- Maroon is their complete kitchen partner. From a range of premium storage and
kitchen utensils, to beautifully designed melamine ware and foil wraps, you will also find smart backpacks and convenient travel accessories.

In fashion, they have choices, both contemporary and classic. Sporty or stylish, as one prefer. Office or occasion-specific formals, casuals for lounging or leisure, and accessories like leather items, junk jewelry and footwear to complete the look. Trendy designs in comfortable fits and cheerful colors, to express personal style. Some of their popular labels are Island Monks and Mark Nicolas (both for men and women), Asankhya (women’s ethnic wear), Scorez (sportswear), La Bonita (footwear). All private brand products are conveniently priced and come with a promise of great quality. All these brands and products are available in all stores.

6.1.4 FORMAT

As the pioneer in organized food retailing in India, the modern-day Spencer’s started operations back in the early 90s, in South India. They run more than 200 stores across 35 cities in India. Currently, they offer customers two retail store formats:

- Convenience stores, called Spencer’s
- Hypermarkets, called Spencer’s hyper

Spencer's are neighborhood stores that cater to the daily and weekly top-up shopping needs of consumers. Ranging from 1,500 to 15,000 sq. ft. in size, they stock, at minimum, an assortment of fruits and vegetables, food and non-food fast moving consumer goods, staples and frozen foods. The larger of these stores, having a floor area of more than 10,000 sq ft sometimes offer a selected range of baked, chilled and frozen foods; personal and home care products; baby care; basic apparels and electronics and electrical.
Spencer's hyper are mega stores, which combine a supermarket with a department store. At least 15,000 sq. ft in size, they stock, on average, 70,000 items, giving shoppers fantastic deals across food, fashion, home and entertainment … all under one roof. Each Spencer hyper is replenished by back room store (warehouse). The size of back room store is at least 3000 sq. ft.

6.2 MODEL DEVELOPMENT

In the Spencer’s hyper the replenishment process for the items on the shelves starts from back room (warehouse). Items arrive from the regional distribution center and local suppliers in the backroom based on a reduced set of underlying factors, given a specific inventory replenishment rule, assortment, shelf space and package. Since, the shelves are organized in the store into different product categories and handled by store workers individually. Handling operation in the backroom and store consists of the following steps:

a) Receiving and storing of incoming items from regional distribution center and local suppliers in the back room.

b) Issuing and loading of items in the material handling equipment like jack and trolley.

c) Handling of items during transportation from back room to shelves in the hyper store.

d) Handling of items during shelf stacking.

Operations (a) and (b) are handled by backroom persons and operations (c) and (d) are handled by store workers.
In our analysis, handling operation during replenishment will include operation in steps (c) and (d) which consists of the following activities:

1) Move the deliveries near the shelf from back room using Jack or trolley.
2) Grab and unpack the case pack.
3) Search for the assigned location in the shelf.
4) Travel to the shelf.
5) Check the shelf life of inventory on the shelf.
6) Prepare the location on shelf for stacking
7) Put the new inventory on the shelf.
8) Put the old inventory back on the shelf.

Replenishment process in the store is a continuous process which depends upon the stocking policy of the store. Estimation of handling time in stores will consist of total traveling time, \( TTT \) (operation(c)) and total stacking time, \( TST \) (operation(d)).

\[
THT = TTT + TST \quad (6.1)
\]

Total traveling time will depend upon the distance between back room and the shelf location in the store i.e. variable \( F \), pace of worker, efficiency of material handling equipment and crowd in the store which may slow down the movement if traffic is high. Efficiency of material handling is given irrespective of worker and we have no control over the crowd in the store. Thus, the independent variables are hypothesized to have the following influence on TTT, 

(1) The higher the distance between backroom and shelf location, the higher the TTT will be
(2) Fast worker in comparison to other worker will have less TTT.
The basic starting equation for TTT will be as follows:

\[ \text{TTT} = a' + f'F \] 

(6.2)

Where,

\[ a' = \text{Constant} \]
\[ f' = \text{Regression coefficient} \]
\[ F = \text{Distance from backroom to shelf location in feet} \]

TTT will remain the same whether there is one product or many product units on the jack or trolley. Thus:

\[ \frac{\text{TTT}}{\text{PU}} = a' + f'F \] 

(6.3)

Now, let us consider the second part of the equation 6.1 i.e. T.S.T (Total Stacking Time). Shelf stacking represents the daily process of manually refilling the shelf in the store with product from new deliveries. As with most manual activities, such processes are often time consuming and costly. Furthermore, unless clear and reliable work standards are implemented, such activities may well suffer from a lot of variations which will negatively affect the overall store performance. Shelf stacking process in the store is seen as the reverse of the order picking process at the warehouse [76]. For estimating the TST this work closely follows the methodology presented by Van Zelst et al.[76]. Let us go to the details of the activities (2-8) of shelf stacking process. Activities (2) and (4) will depend on the number of case packs (CP) filled. Activity (3) and (6) are done only once for each stock keeping unit (SKU) and will be independent of the number of CPs or PUs. All stacking activities are handled by store worker, so TST will also depend on the pace of the workers (not every employee works equally fast). Thus, TST will depend on the number of CPs, PUs and the pace of the worker.
The independent variables are hypothesized to have the following influence on the TST:

1) The higher the number of PUs to be filled, the higher the TST will be.
2) The higher the number of CPs, the higher the TST will be.
3) Fast worker in comparison to other worker will have less TST.

The basic starting equation for TST will be as follows:

\[ TST = a'' + b'' PU + c'' CP \]  \hspace{1cm} (6.4)

Where, \( PU = CP(Q) \); \((Q = \text{Case pack size})\)

Since, we are interested in calculating TST per product unit, we rearrange the basic equation by dividing the TST by PU and substituting \( PU = CP(Q) \).

The revised model is:

\[ \frac{TST}{PU} = b'' + a''/CP(Q) + c''/Q \]  \hspace{1cm} (6.5)

Since, \( \frac{THT}{PU} = \frac{TTT}{PU} + \frac{TST}{PU} \)  \hspace{1cm} (6.6)

Combining equation 6.3 and 6.5 and rewriting in general form, we get:

\[ \frac{THT}{PU} = a + b/CP(Q) + c/Q + fF \]  \hspace{1cm} (6.7)

Since, TST and TTT both depend on the pace of the worker i.e. not every employee works equally fast. Consequently, \((n-1)\) dummies for store worker are added to equation 6.7 denoted as \( D_{wi} \), \((i=1,\ldots, n-1)\)

Where,

\[ n = \text{the number of store workers considered and} \]

\[ D_{wi} = 1, \text{if store worker ‘i’ is selected and ‘0’ otherwise.} \]

Thus, general regression equation for \( \frac{THT}{PU} \) will be (with error term ‘e’)

\[ \frac{THT}{PU} = a + b/CP(Q) + c/Q + fF + \sum_{i=1}^{n-1} d_i D_{wi} + e \]  \hspace{1cm} (6.8)
Or

\[
\frac{THT}{PU} = a + bK_1 + cK_2 + fF + \sum_{i=1}^{n-1} d_iDw_i + e
\]

Where,

1) \(a\) = constant of regression equation
2) \(b, c, d_i, f\) = Partial regression coefficient
3) \(K_1 = \frac{1}{Q}\)
4) \(K_2 = \frac{1}{CP(Q)} = \frac{1}{PU}\)

6.3 EXPERIMENTAL DESIGN

In the experiment, the data has been collected for handling activity during replenishment process from the backroom to shelf location. The retail store is categorized as hyper store. ‘Hyper’ are mega stores, which combine a supermarket with a department store. The data is collected by means of a motion and time study, which is defined as follows [5]:

“the systematic study of work systems with the purposes of (1) developing the preferred system and method – usually the one with the lowest cost; (2) standardizing this system and method; (3) determining the time required by a qualified and properly trained person working at a normal pace to do a specific task or operation; and (4) assisting in training the worker in the preferred method “.

In the experiment, for each product unit, total traveling time and total stacking time were measured using a stop watch.

6.4 DATA COLLECTION

Empirical data on the handling operation was collected at a hyper store using stop watch. Green [30] makes two rules of thumb for the minimum acceptable sample size, the first based on whether you want to test the overall fit of your regression model and the second based on whether you want to test the individual predictors within the model. If you want to test
the model overall, then he recommends a minimum sample size of $50+8k$, where $k$ is the number of predictors. So, with five predictors, you need a sample size of 90. If you want to test the individual predictors then he suggests a minimum sample size of $104+k$, so for 5 predictors you need a sample size of 109. In most cases we are interested both in overall fit and in the contribution of individual predictors, and in this situation Green recommends to calculate both of the minimum sample sizes and use the one that has the largest value (so, in our case with 5 predictors we would use sample size of 109). But in our case the total number of observation recorded is 201 (see Appendix II). Data was collected for the following variables:

- $Q = \text{Case pack size}$
- $CP = \text{Number of case packs}$
- $PU = \text{Number of product units}$
- $F = \text{Distance from backroom to shelf location in feets}$
- $D_{w1} = 1$, If worker 1 is present otherwise “0”
- $D_{w2} = 1$, If worker 2 is present otherwise “0”
- $TTT = \text{Total traveling time from backroom to shelf location in seconds}$
- $TST = \text{Total stacking time in seconds}$
- $K_1 = 1/Q$
- $K_2 = 1/(CP(Q)) = 1/PU$
- $THT/PU = \text{Total handling time per product unit in seconds.}$

During the data collection period, the store was not allowed to change their current operations and was asked to let the most qualified and properly trained, qualified personnel do the handling operations. The data were collected for the entire set of product groups available at hyper store.