The Mindanao Forum, Vol XV1, No. 1 (June 2001)

The Inventory Management of Selected Accredited Contractors of Iligan City

DAISY LOIDA N. SERATE
ALITA TIMONERA ROXAS, D.M.

Abstract

The study deals with how accredited contractors in Iligan City manage their inventory by looking at their level of awareness on the importance of inventory control, their extent of usage of inventory control techniques and their purchasing practices. The study found out that contractors, when divided into different groups of license categories, exhibited a general awareness of the important effects of the usage of inventory control, with the exception of the small contractors who exhibited minimal awareness. The study further found out that the contractors in different category groups exhibited the same frequency of usage of inventory control techniques, that is, most of the time. Regarding the extent of usage of inventory control techniques, when the different contractor groups were tested with the one-way analysis of variance, no significant variance between their frequency of usage of the inventory control techniques was found. The relationship between the level of awareness and the extent of usage of the inventory control techniques was tested with the least squares linear regression analysis and the relationship was found to be linear. However, even though the contractors are aware of the importance of inventory control, they do not order the optimum order quantity. The difference between the actual quantity purchased and the optimum order quantity is highly significant.

DAISY LOIDA N. SERATE is a civil engineer. She finished her baccalaureate degree in UP Diliman. She also holds a Master in Business Management, major in Production Management, which she obtained from MSU-Iligan Institute of Technology. She is now working in Canada. ALITA TIMONERA ROXAS, D.M. is a faculty member of the Economics Department and the Coordinator of the Master in Business Management Program of the College of Business Administration, MSU-IIT. She obtained her MA Economics from the Ateneo de Manila University and her Doctorate in Management, major in Human Resources Management, from the University of San Jose Recoletos.

Introduction

Construction is a service industry whose main responsibility is converting technical plans and specifications to a finished project, like a building or a road. The project itself involves complex interrelationships among owners, contractors, architects, engineers, suppliers, government agencies, labor and many more. Each project task involves complex details and scheduling. Though it is the duty of the designer to design a structure that will most satisfy the requirements of the owner at the lowest possible cost, it is the duty of the contractor to deliver the finished project at the specified time and cost.

Government projects go through a bidding process before they can be awarded to a contractor. The winning bid is the submitted cost with the lowest responsive total price comprising the price of materials, labor, equipment, overhead, contingencies, and profit. The estimates are made in accordance with the technical plans and specifications. From these plans the contractor computes for the volume of materials, and the number of hours labor and equipment will be used to install these materials. From these quantities the cost to be incurred in performing the tasks will be made and a bid price is made. In order to win, the contractor not only searches out the best personnel and cheapest approved materials, but should find the most efficient construction methods that will give the best performance of the workforce and will make use of the available resources most effectively.

Complacency is therefore a danger for contractors, as well as for any businessman. Without continuous improvement, the contractor will be under-bidded by his competitors. The cost of the project is dependent on materials, labor, equipment, overhead and profit. Controlling the cost of the first four items controls profit. Forty to sixty percent of the project cost comes from the cost of materials; this explains why in construction projects there is little room for shortages and excesses in inventory. Proper management of materials could mean savings, and therefore a lower bid price. This study then aims to look into how Iligan contractors manage their materials or inventory. Inventory management seems to be given the lowest priority in Iligan's construction industry, as compared to meeting project schedules. Almost all purchasing and inventory decision seem to be done according to intuition or to the owner's discretion and not to any inventory control technique.

Inventory control is very important in construction but is sometimes taken for granted or rationalized. Rationalizing it out of operations is a naïve mistake for entrepreneurs who should be ever vigilant on the efficient use of their resources, financial and otherwise. Inventory control provides better cash flow by reducing inventory, minimizing overhead by having lesser security personnel and storage space requirements, lower loan interests and lesser wastage due to damage, theft or obsolescence.

Objectives of the Study

The study sought to determine the Iligan contractors' inventory control practices. Specifically, the study wanted to find out the relationship between the contractors' current capitalization with their initial capitalization, number of years of operation, number of workers, number of current technical personnel, and the types of projects undertaken by their respective firms; it also wanted to know the contractors' level of awareness on the importance of the use of inventory control techniques and how their level of awareness differ; likewise, the study wanted to find out the contractors' extent of usage of the analytical techniques used to control inventory levels of stock items and how their extent of usage differ; the study also wanted to know if there is a significant relationship between the level of awareness and the extent of usage of the different inventory control techniques; and finally, the study wanted to investigate if the actual quantity purchased by the contractors vary with the optimum quantity of the economic order quantity theory .

Theoretical Framework and Hypotheses

The study theorizes that the contractors' current capitalization is affected by their initial capitalization, number of years of operation, number of workers, current technical personnel and the types of projects undertaken by their respective firms. It also holds that the contractors' level of awareness on the importance of inventory control will affect their extent of usage of the inventory control techniques. Moreover, as the contractors are all engaged in local projects, the study also assumes that they have similar level of awareness on the importance of inventory control, and that they have similar extent of usage of inventory control techniques. Finally, the study assumes that the contractors' purchased quantities are similar to the optimum quantity of the

economic order quantity theory.

The inventory control techniques being referred to in the study are the qualitative, quantitative, and classification techniques and application procedures.

Qualitative techniques involves ABC analysis where items are grouped according to peso volume or value. "A" items include 10 to 20 percent of all items and account for 50 to 60 percent of total cost. "B" items include 30 to 40 percent of all items and account for 30 to 40 percent of total cost. "C" items account for 40 to 50 percent of all items and account for five to 10 percent of total cost. The reason for this analysis is that important items require close monitoring and the status of the stock should be updated after each withdrawal (Hax and Candea, 1984). "A" items are counted frequently, or at least once a month; "B" items are counted at lesser frequency, maybe quarterly; and "C" items are counted the least frequently, maybe annually (Heizer and Render).

Quantitative techniques make use of specific formula to come up with the desirable quantity, taking into consideration order cost and storage or holding cost. The study specifically made use of the basic economic order quantity model or EOQ. The model is used to identify the most efficient order quantity that will minimize the sum of holding cost and order cost.

Other quantitative techniques tackled in the study are the fixed-order-interval model, and the single-period model. In the fixed-order-interval model orders for different quantities are made in equal time intervals,e.g., weekly or monthly (Stevenson, 1990). In the single-period model the materials required are ordered only once (Adam and Ebert, 1992).

In classification techniques the purchasing order or the moving out of items from the warehouse is based on urgency of usage and need, that is, based on the significance of the items to operations (Stevenson, 1990).

Application procedures pertain to the manner of selecting and applying inventory techniques on the basis of suitability to one's operations or needs.

The study also referred to the just-in-time or (JIT) principle in inventory management. JIT recommends that orders be placed when needed and at quantities needed for the demanded tasks only (Stevenson, 1990).

The hypotheses resulting from the objectives of the study are all in null form and shall be tested at the five percent level of significance:

1. There is no significant relationship between the contractors' current

capitalization and the following profile of their respective firms:
1.1 initial capitalization
1.2 number of years of operation
1.3 number of workers
1.4 current technical personnel
1.5 types of projects undertaken by their respective firms.

2. There is no significant difference among contractors' level of awareness of the importance of inventory control.
3. There is no significant difference among contractors' extent of usage of the inventory control techniques.
4. There is no significant relationship between the contractors' level of awareness of inventory control and their extent of usage of the inventory control techniques.
5. There is no significant difference between the contractors' purchased quantities and the optimum quantity of the economic order quantity theory.

Scope and Research Method

The subjects of the study are Iligan contractors who have projects in the locality and another one from Cagayan de Oro City which has projects in Iligan City. This is because inventory control activities are affected by the location of suppliers or material sources. Confining the respondents to those with projects in the locality equalizes the choices of suppliers among the contractors. As of December 1999, the total number of accredited contractors by the Iligan City government was only 22 and all of them served as respondents of this research. To have a bigger sample, developers and a few contractors to private companies were included. This brought the total number of respondents to thirty. The study utilized purposive sampling. The choice of contractors was limited to those who provide labor, equipment, materials and supervision for the completion of a project. Those who deal in labor contracting or financing only were not included in the study.

The respondents were grouped into license categories as classified by the Philippine Contractors Accreditation Board or PCAB of the Department of Trade and Industry. The PCAB ranks contractors according to the experience of the technical personnel, projects completed, ownership of construction equipment, and capital. Within PCAB is a division, known as the Inter-

Agency Committee or IAC, which is tasked to classify contractors into kinds of projects and the size range they can bid for in government projects.

The classifications of the respondents are: (1) big contractors, or those with AA and AAA PCAB license categories and with IAC classifications from small A to large B; they are qualified for projects in the range of P3 million to P50 million; (2) medium contractors, or those with A, B, C license categories and with IAC classifications from small A to medium B; they are qualified for projects in the range of P3 million to P30 million; (3) small contractors, or those with D PCAB license category and those with no PCAB license but with DTI registration and with IAC classifications from small A to small B; they are qualified for projects up to P3 million. Those with DTI registration only are also called DTI-developers and have clients in the private sector only; as they don't deal with government entities a PCAB license is not required.

The study was conducted during the first week of December 1999 until the end of January 2000.

Research Instruments

Two sets of questionnaires, both designed by the researchers, were used. The first questionnaire was for the *level of awareness on the importance of inventory control* and the second was for the *extent of usage of inventory control techniques*. Pre-testing was done on both questionnaires. The split-half method of odd-even correlation was done to test the reliability of the instruments. The level of reliability of the first questionnaire was high with a reliability coefficient of 61.8 percent, but that of the second questionnaire was low with only a 40 percent reliability coefficient. Revisions were made on the instrument to make the statements simpler and easier to understand.

The Level of Awareness Questionnaire. This questionnaire has three sections. The first section focused on the profile of the contractors in terms of their initial capitalization, current capitalization, number of years in operation, legal status of the business, average number of workers per project, current technical personnel and types of project undertaken. Initial capital used were the values reported by the respondents and did not account for the time value of money. The legal status of business identifies whether the contracting firm is a sole proprietorship, a partnership, or a corporation. The second section dealt with the purchasing practices of the contractors in terms

of the quantity they order, the ordering cost and the holding cost of the ordered quantity. The third section inquired on the respondents' awareness of the importance of controlling inventory levels, consisting of ten statements. Responses to these statements use a four-point Likert-type scale response category, which are as follows:

4 *Highly Aware*, which means that the respondent is very well informed about the item being discussed;
3 *Generally Aware*, which means that the respondent is reasonably informed about the item being discussed;
2 *Minimal Awareness*, which means that the respondent has limited knowledge on the item being discussed;
1 *Not Aware*, which means that the respondent does not have information on the item being discussed.

The responses are interpreted based on the following values:

1.0 to 1.7	Not Aware
1.8 to 2.5	Minimal Awareness
2.6 to 3.3	Generally Aware
3.4 to 4.0	Highly Aware

The range of the values above was computed using the following formula:

$$\text{Range} = \frac{(\text{Highest value of the scale} - \text{Lowest value of the scale})}{\text{No. of Intervals}}$$

The Inventory Control Techniques Questionnaire. This questionnaire comprised of only one section which focused on the characteristics of inventory control techniques, consisting of 36 statements. The questionnaire asked the respondents to indicate their level of application of the purchasing priorities and inventory control practices as described by the statements. Each statement is preceded by responses using a four-point Likert-type scale for the respondent to choose from. The responses have the following meanings:

4 *All the Time*, which means that the item being discussed is practiced continually;
3 *Most of the Time*, which means that the item being discussed is

practiced to a great extent;

2 *Sometimes*, which means that the item being discussed is practiced occasionally;

1 *Never*, which means that the item being discussed is not practiced at all.

The responses are interpreted based on the following values:

1.0 to 1.7	Never
1.8 to 2.5	Sometimes
2.6 to 3.3	Most of the Time
3.4 to 4.0	All the Time

The range of the values above was computed using also the earlier mentioned formula.

The study made use of the descriptive and correlational methods of research. Frequency counts, means, and percentages were used to describe the data gathered. The unweighted least squares regression analysis was used to determine the relationship between current capitalization and the following variables: initial capitalization, number of years in operation, average number of workers, current technical personnel and types of projects undertaken. One-way analysis of variance or ANOVA was used to determine whether the differences in the contractors' level of awareness of inventory techniques are significant and also to determine whether the differences in the contractors' usage of the inventory control techniques are significant. Finally, the two-sample t-test was used to determine if the differences between the actual quantity purchased and the optimum order quantity are significant.

All computations were done using Statistix version 4.1.

Findings

The proportion of Iligan contractors in the license categories big, medium, small are similar, or about 27 percent in each category. DTI – developers comprise about 20 percent. The current capital had notably increased from the initial capital when the business started, implying either a lucrative construction industry or a high inflation rate.

Mean initial capital for big contractors stood at P8.50 million, and only P1.3 million on the average for medium contractors. Mean initial capital of

DTI-developers was higher than that of small contractors, or P333, 300 against P300,000. Mean current capital of big contractors reached the amount of P12.53 million after an average of 16.63 years of operation or an increase of approximately P245,000 per year since the establishment of the firms. The average annual incremental increase implies either a low percentage of profits being reinvested or low profits for the big contractors.

Mean average current capital of medium contractors, meanwhile, is P2.74 million, up by an average of P155,000 per year for the average of 9.25 years that they have stayed in business. Comparing the average initial capitalization levels of the big and medium contractors with their respective current capitalization levels, it appears that medium contractors either reinvested more of their profits or had higher earnings, or had borrowed money to augment funds.

The small contractors and DTI-developers, on the other hand, had come up with an average of P1.18 million and P1.56 million current capital, respectively, after an average of 7 and 7.67 years of operation, respectively. Small developers reinvested and/or infused borrowed capital at an average amount of P125,000 per year, probably to cope with price increases given their low level of start-up funds. The same could apply to DTI-developers who reinvested and/or infused some P161,000 per year on the average.

These findings reveal that comparing the ratio of current against initial capital, the DTI-developers and small contractors had higher ratios when compared with that of medium contractors; similarly the ratio of current to initial capital was higher among the medium contractors when compared with that of the big contractors. Note, however, that the initial and current capital figures were nominal, suggesting that inflation required a higher capital to engage in a project, and explaining why contractors with smaller start up funds had to pour in more capital thru the years than contractors with higher capital to start with.

The average years of operation among the contractors in the various categories are still within the lifetime of the founders. This is the reason why 66.67 percent of the companies are still owned by the business founder, though the next generation is starting to take the reins, as evidenced by firms which are already corporate in form (23.33 percent). A few, or 10 percent are partnerships.

The number of workers are defined by the size and complexity of the project. The mean number of workers for the big contractors was 86,

suggesting that the projects undertaken by these contractors were larger and more complex than the projects undertaken by DTI-developers, medium and small contractors with an average of 37, 31 and 33 workers, respectively.

The average number of workers for all contractors was 46, implying that most projects were in the medium range in terms of project cost. The fact that only ten percent employed more than ten types of technical personnel also showed that projects undertaken were mainly in the medium range. The projects undertaken had been varied enough, from general engineering (project type that deals mostly in horizontal construction, like construction of roads, bridges and ports) to general building (project type that deals mostly in vertical construction, like the construction of buildings and industrial plants), to meet the needs of the locality. However, since specialized projects were the least commonly undertaken, only few technical consultants with specialized skills were available in the locality during the conduct of the study.

The profile of construction firms, consisting of initial capital, number of years of operation, type of project engaged in, number of workers and number of technical personnel, are tested against current capital for linearity of relationship by least squares linear regression analysis. The test resulted in an F distribution with a probability value less than 0.05, showing significant contributions of the predictor variables. However, though all the predictor variables are significantly related to the contractors' current capital with 81.09 percent contribution to its variation as shown by the by adjusted square of the multiple correlation R or R^2, only the initial capital is linearly related to the current capital. This is revealed by the T-test for initial capital which resulted in a significance level of 0.01.

The study also reveals that the contractors were generally aware of the importance of the use of inventory control to ensure efficiency in their operations, to save on storage cost, to avoid over- and under-stocking problems as well as obsolescence, and to meet materials requirement schedule and project schedule. 'High awareness' was recorded in items that relate inventory control to money, profits and return on investments.

The contractors, when divided into different groups of license categories, exhibited a general awareness on the important effects of the usage of inventory control, with the exception of the small contractors who exhibited minimal awareness. However, when the differences of their responses were checked with the one-way analysis of variance, the variances were found to be insignificant.

hedge against inflation. Another reason for bulk purchases was the erratic payments to work accomplishments. There were times when payments are delayed and could not be scheduled, resulting in the purchase of materials when money was available. A critical material or a material facing supply bottlenecks was also purchased in bulk to do away with the problem of shortage. Materials that were not critical, like nails, were bought when needed.

Conclusions

The Iligan contractors included in the study were representatives of the whole spectrum of construction capabilities. From the statistical tests conducted on data gathered from them the researchers were able to reach these conclusions below.

Out of the five characteristics of their respective firms, namely; initial capitalization, number of years in operation, average number of workers per project, current technical personnel and types of projects undertaken, only initial capitalization is linearly related to current capital. The hypothesis that current capital has no significant relationship with initial capital is therefore rejected. The rest of the characteristics are still significantly related to current capitalization but the relationships are not linear. Therefore, the study cannot reject the hypothesis that current capital has no significant relationship with them.

The different groups of contractors namely; big, medium, small, DTI-developer, do not significantly differ in their level of awareness on the importance of inventory control. The hypothesis that there is no significant difference in their level of awareness cannot be rejected.

Likewise, the different contractor groups do not significantly differ in their extent of usage of inventory control., so the hypothesis that there is no significant difference on their extent of usage cannot also be rejected.

The extent of usage of inventory control is significantly related to the contractors' level of awareness on the importance of its usage. The hypothesis that there is no such significant relationship is therefore rejected. However, the contribution of the level of awareness to the variations in the extent of usage of inventory control techniques is very low, implying that a large proportion of the variations are attributable to other factors which are not explored by this study.

The contractors, though aware of the importance of inventory control,

did not order or purchase the optimum quantity of the economic order quantity model and the difference between actual quantities purchased and the optimum quantity are highly significant. The study therefore rejects that hypothesis that there is no significant difference between the two quantities.

Recommendations

As it was shown in the findings that the extent of usage of the inventory control techniques by the contractors is significantly related to their level of awareness of these techniques, the researchers recommend that interventions should focus on raising this level of awareness. The Department of Trade and Industry, Philippine Institute of Civil Engineers, and other professional organizations should give seminars, lectures and other educational inputs regarding inventory control so as to increase the contractors' level of its usage, thereby pushing the growth of the industry itself. The CHED Technical Panels should also mandate higher education institutions to include materials management in their business and engineering courses, and to highlight models of inventory control in the subject. This is to ensure that future contractors and businessmen will be better prepared to manage their inventories and will also be able to choose the techniques that will best fit their type of business.

References

Agapiou, A.; Clausen. L. E.; Flanagan, R.; Norman, G.; and Notman, D. "The Role of Logistics in the Material Flow Control Process." *Construction Management and Economics,* 16 (1998).

England, Wilbur B., and Leenders, Michiel R. *Purchasing and Materials Management.* Homewood, Illinois: Richard D. Irwin, Inc., 1975.

Hax, Arnoldo C., and Candea, Dan. *Production and Inventory Management* New Jersey: Prentice-Hall, Inc., 1984.

Heizer, Jay and Render, Barry. *Production and Operations Management* New Jersey: Prentice-Hall, 1998.

Stevenson, William J. *Production/Operations Management*. Homewood, Illinois: Richard D. Irwin, Inc., 1990.

Irwin, Inc., 1990; reprinted., Quezon City : National Book Store, Inc., 1991.

Wong, Eric T., and Norman George. "Economic Evaluation of Materials Planning Systems for Construction." *Construction Management and Economics* 15 (1997).

Minutes of Meeting between the Iligan – Lanao Contractors Association and Mayor Franklin Quijano, Iligan City Hall, 22 September 1998.