Role of Waste and Performance Management in the Construction Industry

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ABSTRACT
Companies generate waste everyday but do not manage them properly. Waste management is very important for a company’s profitability. This is because if a company can manage its waste properly, reduction in waste can help the company to reduce its cost. Cost control is an important element in performance management. There are a lot of methods that can be used to manage waste, for example, to dispose the waste properly, recycle or reuse the waste which have residual value, or minimize the waste generated by the companies. Environmental management systems, green supply-chain management, reverse logistics, workforce education and training and Incentive Rewards Programs (IRP), can help companies reduce their waste. The main focus of this paper is to seek the most effective waste management methods that can help the companies to reduce their cost and thus increase their corporate profits.

Key words: Waste management, green supply chain management, incentive rewards programs, cost reduction, performance management

INTRODUCTION
Profit maximization is one of the key objectives of any business organization. In accounting, profit is the residual amount after deducting cost from revenue. Therefore, in order to maximize the profit, the companies can increase the revenue, reduce the cost, or increase revenue and reduce cost simultaneously. Waste is one of the cost components that needs to be managed to reduce overall cost and to increase profits. It can also assist the companies to increase their competitive advantage (Denton, 1996; Pitt, 2005; Ravi et al., 2005). Companies can further increase their revenue by selling their recycled goods or materials with residual value in the secondary markets (Dainty and Brooke, 2004). As such, waste management is an important strategic issue for companies to consider and implement in order to achieve higher corporate profits.

The majority of waste in most countries are disposed of in landfills (Pitt et al., 2002). However, over reliance on this disposal method results in the shortage of landfill sites, especially in the United Kingdom and other developed countries. Therefore, the governments in these countries are trying to raise the cost of waste disposal to force the companies to reduce their waste (Laughlin and Varangu, 1991; Dainty and Brooke, 2004; Pitt, 2005). Certain legislation and regulation have been enacted, which aim to reduce the volume of waste and increase recycling rate, for example, the Environmental Protection Act (EPA) and the European Union Landfill Directive in the United Kingdom.
MATERIALS AND METHODS

A lot of companies treat waste management as a cost center. However, if the companies manage their waste properly, they can control the cost and generate additional revenue. Waste management can act as a profit center too (Srivastava, 2007; Denton, 1996; Dainty and Brooke, 2004).

Sources of waste: In the construction industry, one of the most significant source of waste is from the last minute alteration in the building design resulting in the wastage of construction materials already ordered, left-over materials due from wrong estimate, waste from packaging and non-reclaimable consumables, poor storage and handling materials that cause material spoilage and insufficient protection of the completed works (Dainty and Brooke, 2004; Kulatunga et al., 2005).

Rawabdeh (2005) defined waste as anything other than the minimum amount of resources which can add value to the product. Waste can be categorized into seven categories, there are waste from overproducing, inappropriate processing, unnecessary inventory, transporting, producing defects, time waiting for materials and unnecessary motion waste (Rawabdeh, 2005; Seth et al., 2008). All of these waste increase the cost for the company, adversely influence the company's productivity and performance and also have a negative impact on the environment. Attempts to identify and eliminate these waste can reduce the overall manufacturing cost, save time and money and provide an opportunity for the company to reallocate these saved resources to other profit generating activities.

Rawabdeh (2005) also mentioned that all types of waste affect each other by different weights. He argues that overproduced waste and defective waste have the biggest impact compared to other types of waste and inventory waste is highly affected by all others wastes. So, a company should identify which type of waste causes an impact on the total waste generated and then find out the ways to eliminate them.

In addition, there are also office waste, like paper and electricity wastage; solid waste, like, plastic bags used in shopping malls; energy waste and water waste (Denton, 1996; Pitt, 2005; Pitt et al., 2002). Rapid changes in new technology also generate huge number of waste. For example, computer hardware, hand phones and other digital devices which have a short product life cycle gets outdated in a short span of time. The users are always on the lookout for new and attractive electronic products and that leads them to dispose their old devices and these become waste (Ravi et al., 2005).

Waste disposal: The most traditional methods to dispose waste is landfill, followed by incineration. Landfill means burying the waste to dispose it. Normally, landfills are always created in disused quarries, mining pools or burrow pits. A properly designed and well managed landfill is a hygienic and cheap method for the company to dispose their waste materials. However, this is not the best way to manage waste. The United Kingdom is facing a serious shortage of landfill sites and the enactment of the European Union landfill directive has compelled the UK to use more sustainable waste disposal methods (Pitt, 2005).

Incineration is another way to dispose waste using the process of burning. In Japan, where land is scarce, it is commonly used. Facilities for incineration do not require big area as landfill needs. However, incineration is also not a good waste disposal method due to the pollution issue such as emission of toxic gas.
Landfill and incineration will pollute the environment and the cost for waste disposal is also a burden for corporations. Laughlin and Varangu (1991) noticed that Canada had embarked on a policy to change their waste management methods, from waste disposal to recycle, reuse and waste reduction. The UK government has reduced the landfill site and use the collection of landfill tax to increase awareness among businesses and industry to reduce waste (Laughlin and Varangu, 1991; Dainty and Brooke, 2004; Pitt, 2005).

**Recycle and reuse:** Recycle is the process to extract resources or value from waste, meaning to recover or reuse the material. It is the reprocessing of old materials into new products, to prevent the waste of potentially useful material, reduce the use of new fresh raw material and reduce energy usage. Methods for recycle are still developing continuously, for example physical reprocessing, biological reprocessing and energy recovery.

Physical reprocessing is to collect the physical waste, sort them, then pick out those which can be recycled or reused and then to reprocess them into new products. Steel, glass, aluminum and paper are the materials that can be recycled or reused. For example, soft drink bottles can be cleaned and refilled (Laughlin and Varangu, 1991). Waste materials which are organic in nature like plant material and food scrap can be recycled using biological reprocessing. These organic materials are reprocessed into mulch or compost, which are used for agricultural or landscaping purposes. With energy recovery, the energy content of waste products can be used directly as direct combustion fuel or processed into another type of fuel.

Direct savings can result in recycling and reusing waste that results in lower raw material costs and waste disposal costs. Researchers like, Ravi et al. (2005). Five mentioned that when a product reaches its product end life, some of its parts still can be used in their original function. Companies can collect the returned products from their customers, identify the parts that still can be reused, then remanufacture or recycle, then finally redistribute. In this manner, companies can reduce the quantity of buying new raw materials, thus resulting in cost reduction.

**Waste reduction:** Waste reduction is one of the most important methods for waste management. The concept is to prevent waste material being created. Denton (1996) gave the example of the Compaq Company, which had implemented a paperless order and work request system. This new system saved a few pages of paper for each ordering transaction and work request, so with over 90,000 transactions and 17,000 work request per year, this company was able to save over 6,000 lb of paper per year, resulting in lower paper costs and improved profits. Laughlin and Varangu (1991) also agreed that waste reduction and prevention is a better method to manage waste, compared with recycling. They gave the example that in the soft drink industry, they still need to use additional energy to transport the heavy refillable containers to the recycle factory and need extra energy, water and chemicals to clean the containers. These will create other types of waste and increase the cost for the company. Therefore, a good waste minimization system is needed in this industry.

Methods to reduce waste, reduce energy consumption and to make more efficient use of scarce energy resources and materials can save the environment, reduce pollution and also reduce the cost for businesses (Chavan, 2005). Waste minimization can solve the problems prevalent in the construction industry in the UK, like shortage of landfill sites, government regulation and increased costs due to waste disposal (Dainty and Brooke, 2004).
Waste minimization: Waste minimization is the process to reduce the amount of waste produced by a person, a society and a company. It is also related to minimize the resource and energy used when manufacturing a product. The less the materials used to produce the same output; the less the waste that is produced. By using more efficient manufacturing processes and better materials will reduce the production of waste. Improved quality control is also one of the methods to minimize waste. Frequent inspection of the manufacturing process can identify the defects of the product in the early stage. Quality control will keep the number of default products at a minimum, thus it can reduce materials usage and cost consumed in production.

Denton (1996) felt that waste management is better than waste control. That is because waste management is more than cost control, it can be a revenue generator. The companies that pay attention to only waste control just make sure they comply with all relevant laws and regulations and their goal is just to keep the cost of waste to a minimum level, which is short term in nature. Waste management is more long term, which involves investment in new technology, processes, products and training that can improve production efficiency and reduce waste. Denton (1996) also suggested eliminating waste, including wasted inventory scrap and electricity. In using the least amount of materials to make and package the products can reduce the material, cost and waste. His theory was that even small improvements (reduce a little bit cost) can have dramatic impact on the bottom line (final profit).

Dainty and Brooke (2004) had done a research on the methods used for waste minimization in construction projects. The most effective and easiest is establishing supply chain alliances with suppliers or recycling companies. Partnership with suppliers can help the company easier to remove, reprocess or reuse the excess materials. The second method, is to increase the use of off-size prefabrication to control waste and damage. Prefabrication reduces the amount of on-site damage and rework, thus reducing waste. Thirdly, a standardization in design can reduce the quantity of materials used. Besides, standard sizes prevent the waste from being created, so remedial or corrective action is unnecessary.

Stock control is another effective way in waste minimization. Stock control method for example, in the use of just-in-time or lean production method can avoid over ordering of materials and reduce storage. Besides, a good stock control system, companies must also be careful to monitor the on-site progress, that can help to reduce the amount of unnecessary waste. Other useful methods are improved education of the workforce on the benefits of waste minimization practices, just-in-time delivery strategy, hire a specialist waste management firm, design management to prevent the over specification of materials and waste auditing to monitor and record waste management performance.

Dainty and Brooke (2004) found that the three most popular waste minimization strategies are trying to remove waste at source and deal with waste as it is produced on site. They are trying to prevent the waste to be created. Only adequate financial and logistical support, coupled with commitment from all participants to the project can have a successful waste minimization system. By working together among all business stakeholders as a partnership to integrate waste minimization strategies, there will be a great improvement in waste reduction. However, they also cautioned that every project was unique in the volume of waste produced and the type of waste generated, hence different waste minimization methods should be employed.

Waste minimization strategies can lead the company to improve resource efficiency and as such help in financial savings. The implementation of a systematic waste minimization program can
allow the companies to better understand material usage, utility consumption, waste generation, waste management procedures and waste disposal costs. With this knowledge, the companies can have greater control on waste and reduce the cost incurred (Pitt, 2005).

**Environmental management system:** Environmental Management System (EMS) is part of a management system of an organization to manage the impact of the organization’s activities on environment. An EMS monitors and checks the company’s environmental performance to enhance its long-run financial performance by developing the processes and products that improve the competitive and environmental performance. It integrates environmental management into the company’s daily operations, long-term planning and other quality management systems. Having an EMS is an effective method for the company to control its waste, to reduce the cost and increase the profit (Chavan, 2005).

Watson et al. (2004) said that the strategic use to manage and improve the environmental performance is the total quality management techniques. The Cost of Quality (COQ) framework identifies four types of cost associated with product and process quality. Firstly, the internal failure cost, include waste disposal and environment cleanup cost, or penalties or fines from government. Secondly, is the external failure cost which include loss of market share due to consumer sentiment that the company has poor environmental image and medical or environmental costs due to pollution in the communities which is near the manufacturing or waste disposal facilities. Thirdly, appraisal costs are associated with environmental monitoring and finally the prevention cost is the cost to design the product for sustainability, recycling and to reduce environmental impact. Internal and external failure costs are the costs that occur due to waste, so waste minimization can help to reduce these costs. However, appraisal cost and prevention cost are the costs that occur from environmental management. So, a properly designed waste management is very important for companies to reduce their costs.

Chavan (2005) stated that, to develop an EMS, the company must assess its environmental impact, then, set targets to reduce the impact and finally plan to achieve the target. EMS can assist the company to minimize the environmental liabilities, maximize the efficient use of resources, reduce waste, build a good corporate image, build awareness of environmental concern among employees and finally increase the company’s profit through more efficient operations and lower cost.

However, the implementation of EMS incur costs, such as, professional fees to consultants to oversee the implementation, staff wages incurred in helping to establish the EMS and purchasing of new equipment or machinery to comply with the system. The most significant area of cost reduction after implementing EMS is the reduction in material wastage. For example implementing an EMS in the construction industry will reduce the overall cost to about 10%, which is substantial.

**Green supply chain management and the reverse logistics:** In Fig. 1 above, reverse logistics include all of the operations that relate to the reuse of products and materials. It is the process of moving the products from their final destination to capture their residual value or properly dispose them. Logistics is the process that brings the products to the customers, so reverse logistics is to move the products from the customers to the distributor or the manufacturer. Green supply chain which includes reverse logistics helps company to manage the waste better through recycling, reusing and reducing materials used.
Fig. 1: Green supply chain design (Sources: Srivastava, 2007)

Ravi et al. (2005) said that reverse logistics is most useful in computer hardware industry due to the rapid change in hardware design and models. New models keep on appearing in the market to satisfy the discerning taste of consumers which change over time. This results in consumers disposing their old version of computer hardware to change to the new model. However, some parts in the old computer hardware can still be used.

A green supply chain with reverse logistics will collect the returns of the product from customers, examine its status and then separate the products or the parts which can be reused, remanufactured or recycled (Srivastava, 2007; Ravi et al., 2005). Using a computer as example, the computer keyboard can be directly reused, its motherboard has to remanufactured to fit the new model of computer and casing can be recycled. Finally, the recovered products or the parts will be redistributed in the original or secondary markets. For the parts which cannot be reused or reprocessed they have to dispose in a proper way. The process is show in Fig. 2.

Reverse logistics can help companies to reduce the materials used in production and minimize the waste and energy. This leads to cost reduction, because companies can save their cost from the production processes. Companies that use reverse logistic to reuse, recycle or remanufacture the products are estimated to save 40-60% of the cost compared with manufacturing a totally new product. Reverse logistics also will increase the productivity and performance of the companies.

Workforce educational and training: Kulatungs et al. (2006) noticed that the attitudes and perception of the workforce will influence the generation and implementation of waste management strategies. Causes of waste are also directly or indirectly affected by the attitudes and perception of the workers in the company. If the workers do not take care of what they are doing, they will cause more materials to be wasted. The authors gave the example that if the designer in a
construction company properly identifies customer requirements and documents it thus avoiding most of the waste which generate from rework.

Dainty and Brooke (2004) also agreed with this view and they suggested that the workforce be educated to improve the waste minimisation performance. Pitt et al. (2002) found that the tips given by the Scottish Environment Protection Agency (SEPA) to reduce office waste for example to photocopy on both sides of the paper, to use narrow margins for printing, to only print when necessary and to check spelling and layout before printing can apply and be useful in business sectors. All of these waste minimization practices require the co-operation of all of the staff. However, there are still many managers and employees, who do not recognize the importance of waste management. They do not know how the waste management can link with their work. So, if a company wants to improve the efficiency and to reduce waste and overheads cost, they should educate and train their employees (Denton, 1996).

Lack of leadership, commitment from top management, poor communication channels from the top level management to bottom level of the organization and poor management skills have negative affect towards waste management practices. Hence, company should develop a better communication channel and improve their management skills to implement a useful waste management system, which can improve their profitability and performance.

Incentive reward program: Another method which encourages the workforce to pay attention on waste minimization practices is Incentive Reward Program (IRP) which was suggested by Li et al. (2003). IRP is designed to encourage the workforce to reduce the waste generated by rewarding them based on the amounts and values of the materials they save. The more they save, the more they get rewarded. Workers can save the materials through reduced operational mistakes, return unused materials which can be reused or recycled.

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Kulatunga et al. (2006) also agreed that rewarding workers by giving them bonus or allowance when they manage waste properly can help to change the workers' attitude towards waste management practices. Without the reward system, workers may become careless when handling the materials, for example they will simply throw those materials which can be reused or recycled.

IRP is more useful in the construction industry. Li et al. (2003) found that using the group-based IRP is more suitable in this industry. Group-based IRP is used to evaluate the performance of the workforce in waste reduction practices based on the group to which they belong. If the group helps to reduce the material waste, all of the members of the group will get rewarded equally and, if they increase material waste, all of the members will get punished. This is due to the fact that workers in the construction industry are always organized into groups according to their type of work. The evaluation process will be conducted by the respective project manager.

RESULTS AND DISCUSSION

The research framework employed was based on the following methodology, as depicted in Fig. 3.

Waste management is important because operational cost is on a steep increase fuelled by inflationary cost and other uncontrollable market forces. As such, companies must manage their cost parameters to operate on a more efficient effective manner. This calls for the implementation of waste management measures to reduce cost. If companies manage the waste properly to meet the government regulatory waste disposal requirements, this can reduce the risk for being fined by government and avoid the embarrassing news reports which will send the wrong signals to
potential investors and other market analysts. This can affect the company’s corporate image which may result in bad publicity, reduced sales, less profits and a demotivated workforce.

Waste disposal is the easiest way for companies to manage waste. However, the traditional methods to dispose waste, landfill and incineration, will pollute the environment. Due to this problem, many countries try to increase the cost of waste disposal, with the hope that companies will reduce the volume of waste that needs to be disposed.

Increase in the cost of waste disposal will increase the companies cost and finally affect companies’ profit. Waste disposal is no longer a good method for companies to manage waste. It is time that companies explore other more efficient and useful methods to replace their original waste disposal method.

Waste recycling is a better way to manage waste compared with waste disposal. However, some of the waste cannot be recycled. Some waste still have residual value although it has reached the end of its product life. Waste recycling finds out these types of waste and reprocesses them into new products. Recycle can reduce cost and reduce the use of fresh raw materials thus eliminating the need to purchase new materials. Reprocessing old materials into new products which have a resaleable value in the market can increase companies’ revenue. An increase in revenue and a decrease in cost, will lead to an increase in the companies’ profit.

However, as indicated earlier, some waste cannot be recycled. So, this method is not suitable for all type of waste. In addition, companies need to use extra energy to reprocess the waste. An increase in energy consumption will increase the cost.

Waste reuse is almost the same as waste recycle but the former is more favourable because reuse consumes less energy than the recycle method. For example, the refillable containers can be reused once after cleaning and the computer keyboard can directly be reused without any additional processes.

Waste reduction is the most effective method to manage waste. The cost to prevent the waste generated will always be lower than the cost to clear it up after that. Waste reduction can avoid the cost of disposal and also reduce the risk to pay additional cost for rework.

Waste reduction can proceed through resource optimisation. The optimisation of raw materials can reduce the waste creation and save the raw materials. The reuse of scrap materials and to re-incorporate them immediately at the beginning of the manufacturing line can reduce the use of new fresh materials and the scrap materials will also be not wasted.

The following Fig. 4 indicates the effectiveness of different waste management methods. The lowest in the hierarchy is the least favourable method and the highest is the most favourable method.

EMS is a very useful method, which is not just used in waste management. An environmentally friendly company can gain more customer confidence and would be viewed more favourably as contributing to the green campaign.

However, it is costly for companies to build an EMS. The top management needs to have the knowledge and skills to build a faultless EMS. Additional cost will entail in the hiring of consultants to oversee the implementation of the system, additional wages for the staff and management who may help to establish the EMS and the cost of new equipment and machinery to comply with the system.

Reverse logistics is very useful to companies in industries, where technology changes at a rapid pace. If there is no reverse logistics in a company’s supply chain, customers will simply throw away the out dated products and replace it with new ones. In reverse logistics, end-of-life goods are collected from customers, the parts to be reused are separated and then remanufactured.
Fig. 4: Waste management hierarchy

However, extra cost incur when using reverse logistics, for example, transportation cost incurred to collect and carry the goods, wages for the workers to separate the parts and energy used in recycling and remanufacturing activities.

Companies can educate or train their workers about waste management to increase their knowledge, change their attitude and perception, so they will know the importance of waste management and waste control. With this knowledge, workers can reduce the waste they create and help the companies to lower the cost. However, the usefulness of this method will be based on the workers personality. Some of the workers are likely to learn new things and willing to think like the management, however, some of the workers may not. They may think that waste management and waste reduction are the responsibility of the company itself but not them. They do not see any perceived benefits in it for them.

Incentive Reward Programs (IRP) can be used to encourage workers to involve in the company's waste management activities. A reward system will be more efficient than training and educating the workers. With reward, it can motivate workers to reduce the waste generated. If a worker successfully reduces the waste creation, the worker will get rewarded by the company. The monetary amount that the worker can get is based on the volume or value of the waste he saves.

The inherent problem in this method is hard for the company to measure the amount of waste a worker saves. Besides, it is possible for the workers to come out with low quality products just to reduce the materials used and beat the system. This would be counter productive to the company.

Every method has its own merits and demerits. Which method is most efficient is based on the nature of the company and the business sector it is involved in. Sometimes, company can combine two or more methods to increase the efficiency of its waste management. Besides, there is no doubt
that waste reduction and prevention is more effective than waste reuse, recycle and disposal. Preventing the waste to happen is better than to find ways to solve it after it has occurred. A more proactive approach is definitely better than a reactive one.

CONCLUSION

Waste can be managed through many ways, for example waste disposal, waste recycle, reuse and waste reduction. All of the methods have their own advantages and disadvantages. Waste disposal is an old method and costly to companies. Waste recycle, reuse and reduction are the better ways to manage waste. Governments are now attempting to increase the cost of waste disposal to compel companies to reduce waste. Reverse logistics is one of the most useful waste management methods which can accrue additional revenue for the company and also reduce its cost.

A perfectly implemented waste management system is hard to establish. The inherent set up costs are still prohibitive and not popular in practice. The methods discussed are still not accepted and used by many companies. However, it is imperative that top management pay more attention to waste management as one of the key drivers of performance management and corporate profitability.

REFERENCES


