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### Investigating the Effect of Green Supply Chain Management on Sustainable Competitive Advantage

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#### ABSTRACT

Globalization, increased regulation of governmental and nongovernmental organizations, customers' pressure and demands in terms of environmental compliance have led the organizations to review the necessary steps to implement Green Supply Chain Management (GSCM) in order to improve environmental and economic performance. In addition, green supply chain management is regarded as a successful strategy in recent century due to following strategic advantages: compatibility with nature, reduced costs(cost leadership strategy),innovation in production (differentiation strategy) and production of singular products for a specific range of customers (focus strategy). Recently, manycompanies have addressed the concept of green supply chain management. However, few studies have investigated the effect of green supply chain management on sustainable competitive advantage from the perspective of Porter, which covers three components of cost reduction, differentiation and focus. Hence, this paper aimed to fulfill this gap by providing empirical evidence in order to encourage the companies to implement green supply chain management in order to improve environmental performance and enhance their competitive advantage in the global market. For this purpose, the required data was collected using a questionnaire that assesses competitive advantage both before and after obtaining ISO in 114 companies in Iran. The collected data was analyzed using the paired t-test. The results showed significant achievements in case of green supply chain management (ISO 14001) among which cost reduction, differentiation, focus and ultimately sustainable competitive advantage can be cited.

**Keywords:** Green supply chain management, sustainable competitive advantage, environmental performance, sustainable development.

## 1. INTRODUCTION

Over the past few decades, the world has witnessed extraordinary economic growth due to access to new technologies, globalized economy and financial resources, development of global markets, expediting the movement of goods and production factors. In these circumstances, such environmental problems as ozone depletion, rapid destruction of forests, water and air pollution, global warming, acid rain, etc. threaten the quality of human life. Thus, guaranteed and continuous sustainable development of any country relies on conservation and efficient use of limited and irreplaceable natural resources [13]. Various measures were adopted by governments to deal with this issue among which practice of green rules and principles such as using environmentally friendly raw materials in industrial and production centers, reducing use of fossil and oil energy resources and reusing waste materials can be noted. Adopting investment strategy to improve environmental performance of the supply chain has many advantages and benefits such as saving energy resources, reducing pollutants, eliminating or reducing waste materials, creating value for customers and ultimately improving efficiency for service manufacturing organizations [8]. International organizations always endeavor to achieve competitive advantage through innovation and new methods. Some organizations gain competitive advantage by improved environmental performance, compliance with environmental standards, increased customer knowledge and reduced negative environmental impacts of their products and services [10].

**The aim of the article** is to investigate the impact of Green Supply Chain Management on Sustainable Competitive Advantage.

## 2. THEORETICAL FOUNDATION

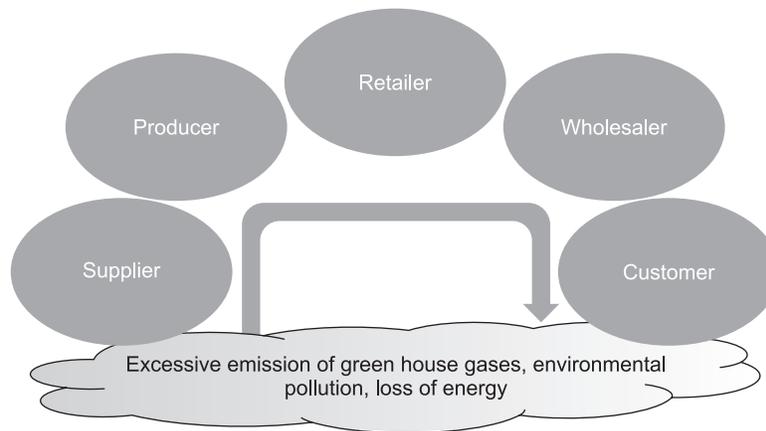
Green supply chain management integrates supply chain management with environmental requirements at all stages of product design, selection and supply of raw materials, manufacturing, distribution and transmission processes, delivery to the customer and management of recycling and reuse of consumed products in order to maximize energy and resource efficiency along with improved performance of the entire supply chain [8].

In comparison with traditional supply chain, green supply chain has the following characteristics:

In traditional supply chain, material and information follow a linear chain. Participation and transparency in such chains is usually low. Furthermore, organizations have little information on environmental issues related to other partners in the supply chain. For example, there is little information about the amount of carbon and other greenhouse gas emissions from companies belonging to other partners in the supply chain. As a result, each partner in the supply chain only pays attention to carbon emission from its own organization. Furthermore, each partner attempts to reduce carbon emission from its own organization regardless of its impact on upstream and downstream partners. Although some traditional supply chains focus on reducing costs throughout the chain, the costs are not optimally reduced due to imperfect shared information. The difference of these two chains is shown in the following figure.

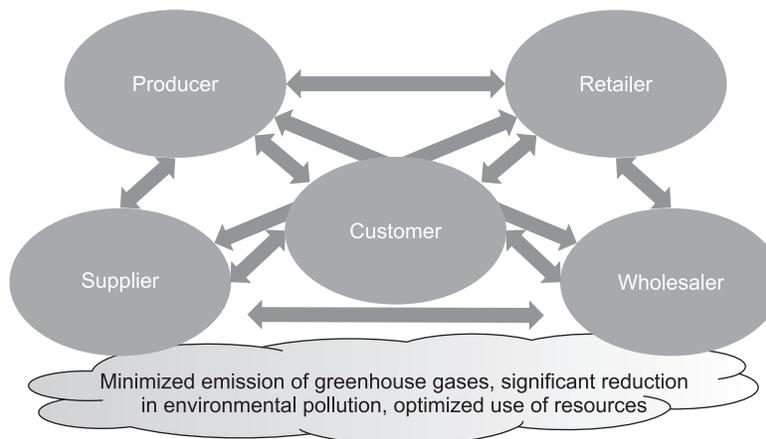
An example of traditional supply chain:

In contrast, all effective factors in the environment are considered in green supply chain from the beginning to the end, i.e. from raw material to the consumer, consumption and recycling of the product.



**Figure 41.1: Traditional supply chain**

An example of green supply chain:



**Figure 41.2: Green supply chain**

As shown in the above figure, each member in a green supply chain tries to advance environmental goals. In the green supply chain, each member provides effective information, tips and scientific and technical support for other members in the chain to achieve environmental goals. This partnership makes possible achievement of a set of supply chain objectives such as minimizing waste, minimizing environmental impacts while increasing customer satisfaction and health benefits. These goals cannot be realized unless every member help other partners [18].

*Generic Strategies:* There are basically three generic strategies to get ahead of other competitors in a company in an industry in order to combat with five competitive forces.

- I. Cost leadership
- II. Differentiation
- III. Focus

Cost leadership requires efficient procurement of equipment, abundant efforts to reduce costs through experience, strict control of expenditure and current spending, avoidance of the end-customer accounts

and minimum cost in areas such as research and development, services, sales force, advertising, etc. Cost control management should be greatly highlighted in order to achieve these goals. Cost reduction strategy led to the fact that corporate revenues (return on investment) within the industry were higher than average despite strong competitive factors. Corporate cost reduction strategy led to adoption of a defense strategy against competitors. This is because lower costs highlights the issue that the company can still gain revenues and profits although the competitors have spent their revenues to win the competition. In addition, cost reduction strategy protects the company against buyers. This is because the buyers solely force the companies to reduce prices to the level of the next most efficient competitor. Moreover, cost reduction strategy increases flexibility to cope with increased cost of purchase, which creates a defense mechanism to deal with powerful suppliers and contributes to corporate stabilization [16].

Differentiation is the second generic strategy in which the company offers distinctive products or services. This measure results in a unique industry. Distinction is an extraordinary tool that the company should access in order to adopt a valid strategy to gain higher returns than average. This is because differentiation combats with the five competitive forces. Certainly, differentiation forms a protective shield against challenging competition through customer loyalty to the brand and consequently less sensitivity to price, which differs from cost leadership strategy. In addition, differentiation increases profit margins, which eliminates the need for cost reduction strategy. Customer loyalty and the need to overcome a unique competitor create entry barrier [16].

Focus strategy divides into two categories: focus on costs and focus on differentiation. Focus strategy relies on selection of a specific target market with unusual or distinctive needs and optimization of corporate activities in order to provide the services that satisfy those needs. In focus on cost strategy, the company determines the need to meet specific manufacturers who consider lower cost of production in comparison with their competitors in order to use this cost reduction advantage to gain higher than average profits. In focus on differentiation strategy, the company identifies the segment with diverse and higher needs than the broad markets introduced by competitors and attempts to satisfy those needs. Porter argued that a company that focus on general strategies should clearly select one strategy among the above mentioned ones and does not select a mediatory strategy to achieve sustainable competitive advantage and gain higher than average profits. It should not be interpreted that differentiation ignores the costs and vice versa. If prices were close to average industrial levels, successful cost leader ship should look for any differentiation opportunity that do not add any cost to basic predetermined costs. A successful differentiator should also look for any cost reducing factor that does not sacrifice differentiation if prices were close to average industrial levels [15].

There are two important points in competitive advantage. First, competitive advantage is a continuous process, which leads to excellent performance and competitiveness in an organization. If the organization gains sustainable competitive advantage due to its own competency, which is valuable for the customers, that organization will always be superior to competitors, which resembles a great performance [2]. Second, competitive advantage can easily be imitated by competitors or will fade soon from the perspectives of customers and should be replaced with new advantages due to increased environmental complexity and intensity of competition [20]. Accordingly, the organization should think about sustainable competitive advantage. This can be largely defined as organizational quality, which surpass the competitors and keeps returns excessively higher than normal value [9].

*The role of green supply chain in gaining competitive advantage:* Michael Porter addressed three differentiation, focus and cost reduction strategies as general strategies for gaining sustainable competitive advantage. Porter stated that those firms that simultaneously benefit from cost reduction and differentiation strategies more successfully gain competitive advantage. Supply chain strategies are divided into accountability and efficiency strategies. Green supply chain combines the above two strategies to benefit from higher efficiency and cost reduction strategy by taking into account economic principles in achieving the goals of saving on resources, energy, warehouses, avoidance of unnecessary transportation, reduced pollution by using ecofriendly raw materials, reducing waste, etc. The chain benefits from innovation in design and production of ecofriendly and recyclable products in addition to reducing the cost of environmental degradation. In other words, the chain uses accountability or differentiation strategy. All these three strategies present a desirable criteria, so that minimum-cost economic policy would be adopted to gain competitive advantage. Therefore, green supply chain by taking into account maximized net benefits of pollution not only leads saves on energy, costs, etc., but also maximizes profitability in enterprises with regard to innovation in design and production of ecofriendly and recyclable products [19].

### **3. RESEARCH BACKGROUND**

Hwang proposes the issue of green procurement, meaning that in the process of product manufacturing and distribution, large quantities of raw material, office tools, etc. are needed. In order for companies to be able to manufacture green products, they should make use of materials and products that meet environmental standards. Therefore, in negotiating with their suppliers (with the aim of preserving market share or even survival), organizations should pay due attention to environmental issues. Some of the reasons for the tendency of companies towards green procurements include responding to consumer interest in environmentally friendly products, making a distinction between the company's products and those of its rivals and reducing costs [7].

Yustates that consumers have come to the realization that their purchases have an impact on the environment and they are motivated to not only pay attention to the quality of the products, but also to conditions under which they are produced. Green consumption first began in Europe and in the 1980s reached its climax and was most popular in Germany. Consumers have supported manufacturers who are accountable with regards to environmental issues. Consequently, green consumerism lead to environmental awareness becoming a competitive advantage for manufacturers. Green consumerism also emphasizes manufacturers' guaranteeing that their products are compatible with environmental standards [24]. Rao and Halt conducted the first experimental evaluation of correlation between green supply chain management practices and a rise in competitiveness and improvement of economic performance in Southeast Asian organizations through sending questionnaires to companies in possession of ISO 14001. This article suggests that making the various section of supply chain green leads to an integrated green supply chain. The findings of this study also suggest that in this region, companies are making great efforts to increase their competitiveness on both domestic and international scales, and a green supply chain in these companies not only leads to a reduction in their costs but also through an increase in sales, market share, and exploitation of new opportunities will lead to a better economic performance [17]. Clemens in a paper titled "Economic incentives and small businesses: do they deal with greenness?" examines the relationship between green practices, environmental activities and financial performance in small

businesses (active in American steel industry) and the effectiveness of economic incentives to this aim. In this paper, he argues that small businesses can benefit from increased attention to environment, and through investment in the development of environmental activities they can avoid the cost of fines and government regulations. The findings of the study also show that there is positive relation between green practices and financial performance when there are several financial incentives for small companies [4]. Zhu et. al., examined the implementation of green supply chain management duo to increased pressures on managers to simultaneously increase environmental considerations and economic performance in China's auto-industry. Some factors putting pressure on managers to accept and implement green supply chain management include: consumers' pressure, lack of resources, competitors' green approaches, organization's environmental responsibility and national and international regulations [25]. In a paper titled "Combining sustainability into supply chain management in car manufacturing industry (the case study of Volkswagen Company)", Koplín et. al., examined adding and combining sustainability into the car industry's supply chain management. This article states that companies are the key players in the social path towards sustainability the establishment of which by companies requires executive measures beyond mission statements and they must continuously look for scientific ways to establish sustainable development inside the company. It is also argued that one of the procedures of carrying out social responsibilities of the company is the merging of sustainability into their supply chain [10]. Linton et. al., initially offer a definition of sustainability and then address the interaction between sustainability and the supply chain [12]. Chiou, et. al., examined the effect of suppliers' greenness and green innovation on environmental performance and competitive advantage through a questionnaire-based survey of 124 companies from 8 different industries in Taiwan using structural equation analysis. The results of this study suggest that through green product innovation, green process innovation and green management innovation, companies manage to gain a competitive advantage [3]. Yang et. al., examined the effects of internal and external green measures of the company on its green performance and competitive advantage through sending questionnaires to 163 container transportation companies in Taiwan. The examination of hypotheses in this study shows that internal green practices have a positive effect on external green cooperation, and internal green practices and external green cooperation have a positive effect on the green performance and competitive advantage and eventually the green performance has a positive impact on the competitive edge of the company [23].

Therefore, the present study focused on the impact of green supply chain management on sustainable competitive advantage in the companies with ISO 14001 certificates in Iran. Although other studies have examined the impact of green supply chain management on competitive advantage, the present study examined the effect of green supply chain management on sustainable competitive advantage from Porter's generic strategic perspective (cost reduction, differentiation and focus). Theoretically, this paper examined the impact of green supply chain management on sustainable competitive advantage from the perspective of Porter (cost reduction, differentiation and focus), which has not been previously considered. Specifically, this study sought to test one main question and three sub-question. In order to test the question, a questionnaire with 45 items was designed, which examined the state of sustainable competitive advantage both before and after obtaining ISO. The questionnaire was distributed among the participants. The article is organized as follows: a review of literature, materials and methods, data analysis, conclusion, recommendations.

#### 4. RESEARCH METHODOLOGY

These consisted of one main question and 3 sub-question as follows.

**The main question:** does the green supply chain management have a positive impact on sustainable competitive advantage?

**The first sub-question:** Does the green supply chain management have a positive impact on cost reduction (a component of sustainable competitive advantage)?

**The second sub-question:** does the green supply chain management have a positive impact on product differentiation (one component of sustainable competitive advantage)?

**The third sub-question:** does the green supply chain management have a positive impact on focus (one component of sustainable competitive advantage)?

This is an applied descriptive survey. According to available data, there were 195 companies with ISO 14001 certificates and green supply chain in Iran. The statistical population consisted of 195 companies with ISO 14001 certificates. According to available data with no specific classification and the list of the companies with ISO certificates, simple random sampling method was used to determine the appropriate sample size. Simple random sampling has the highest level of generalizability among different sampling methods, which increases validity of the study. In this study, Cochran method was used for determining the sample size. Sampling formula is shown as follow:

$$n = \frac{N \cdot Z^2 \cdot P(1 - P)}{d^2(N - 1) + Z^2 \cdot P(1 - P)}$$

where (N) refers to size of the population, (*n*) shows the sample size, (Z) denotes standard unit normal variable, which is equal to 1.96 at 95% confidence level, (P) shows ratio of trait in the population and (*d*) refers to accuracy rate, which is equal to 0.05.

In this study, a questionnaire was used to collect data, which was developed by the scholar. Cronbach's alphas were respectively as 0.8441, 0.7973 and 0.8026 for the three factors, which are all greater than 0.7. As a result, the questionnaire has acceptable reliability. The questionnaire consisted of two parts. The first part of the questionnaire consisted of three items, which measures individual characteristics such as age, gender and education. The second part of the questionnaire encompassed closed questions, which tested the question. This part covers 45 items (15 items for each variable) with five options based on a 5-point Likert scale. The participants were asked to assign a score to each item before and after obtaining ISO 14001 certificate. The range of the scores varied from one to five. Furthermore, 130 questionnaires were distributed among corporate experts and managers. In total, 114 questionnaires were collected.

In this study, the impacts of green supply chain management on three components of sustainable competitive advantage (cost reduction, differentiation, focus) were examined both before and after obtaining the ISO certificate using paired *t*-test were. The Friedman test was used to rank factors. SPSS was used to analyze the collected data.

## 5. FINDINGS

Following findings were obtained by analyzing the data collected from the questionnaires.

**Demographic characteristics of the participants:** According to Table 41.1, the majority of managers were between 40 and 50 years old. Most participants had master's degree, which shows highlighted the importance of increasing desire to promote education among experienced managers to keep pace with modern changing world in the given production and service units.

**Table 41.1**  
**Demographic characteristics**

<i>Age group</i>	<i>Number</i>	<i>Percent</i>
20 to 30 years old	12	10
30 to 40 years old	39	31
40 to 50 years old	35	34
Above 50 years old	28	25
Education	Number	Percent
Bachelor	27	24
Master	68	59
PhD and higher	19	17

**Replay to the questions:** The first sub-question: does green supply chain management have a positive impact on cost reduction (one component of sustainable competitive advantage)?

**Table 41.2**  
**Output of two sample *t*-test for the first sub-question**

<i>Two-sample t-test to test the first sub-question</i>						
	<i>t-value</i>	<i>Degree of freedom</i>	<i>Significance level</i>	<i>Mean difference</i>	<i>Difference interval with 95% confidence level</i>	
					<i>Lower bound</i>	<i>Upper bound</i>
Cost reduction	2.466	113	0.015	0.4231	0.0836	0.7626

Given that:

$$\text{Significant value} = 0.015 < 0.05$$

It can be stated that green supply chain management effectively reduces costs with 95% confidence level. In fact, equality of mean values of the population is rejected in both cases. Since upper bound is higher than lower bound, the mean difference is positive at 95% confidence level. In other words, cost reduction is higher in the case of green supply chain management (ISO 14001). Thereby, green supply chain management has a positive impact on cost reduction.

These results are consistent with the results of those studies conducted by Duber Smith [6], Imani and Ahmadi [8] and Doayi *et. al.*, [5]. In other words, establishment of green supply chain management in the organization leads to cost reduction due to reduced environmental penalties like waste production and transport of chemicals to water and air and reduced use of materials in packaging (more warehousing space). This ultimately creates competitive advantage for organizations.

**The second sub-question:** Does green supply chain management have a positive impact on product differentiation (one component of sustainable competitive advantage)?

**Table 41.3**  
**Output of two-sample *t*-test output for the second sub-question**

<i>Two sample t-test for the second sub-question</i>						
	<i>t-value</i>	<i>Degree of freedom</i>	<i>Significance value</i>	<i>Mean difference</i>	<i>The difference between mean values with 95% confidence level</i>	
					<i>Lower bound</i>	<i>Upper bound</i>
Product differentiation	3.011	113	0.003	0.4846	0.1662	0.8031

Given that:

$$\text{Significant value} = 0.003 < 0.05$$

It can be stated that green supply chain management is effective in product differentiation with 95% confidence level. In fact, equality of mean values of the population is rejected. Since the upper bound is higher than the lower bound, the mean difference is positive with 95% confidence level. In other words, product differentiation is more highlighted in the case of green supply chain management (ISO 14001). Therefore, green supply chain management has a positive impact on product differentiation.

These results are consistent with the results of the studies conducted by Razmi [18], Doayiet *al.*, [5] and Sarkis [21]. In other words, green supply chain management in the organization leads to corporate competitive advantage due to design of new products, which adhere to environmental requirements, human health and product safety from supply of raw materials to distribution of products, which leads to the fact that the customers pay special attention to differentiated products. In addition, market segmentation would increase for the company.

**The third sub-question:** does the green supply chain management have a positive impact on focus (one component of sustainable competitive advantage)?

**Table 41.4**  
**Output of two-sample *t*-test related to the third sub-question**

<i>Two sample t-test for the third sub-question</i>						
	<i>t-value</i>	<i>Degree of freedom</i>	<i>Significance value</i>	<i>Mean difference</i>	<i>The interval of mean difference with 95% confidence level</i>	
					<i>Lower bound</i>	<i>Upper bound</i>
Focus	3.229	113	0.002	0.5077	0.1966	0.8187

Given that:

$$\text{Significant value} = 0.002 < 0.05$$

It can be stated that focus is effective in green supply chain management with 95% confidence level. In fact, equality of mean values of the population is rejected in both cases. Since the upper bound is higher than the lower bound, the mean difference is positive with 95% confidence level. In other words, focus is higher in the case of green supply chain management (ISO 14001 certificate). Therefore, green supply chain management has a positive impact on focus.

These results are consistent with the results of the studies conducted by Li [11], Polonsky [14] and Duber Smith [6]. In other words, a specific marketing program is designed for specific customers whom the focus strategy has been adopted for in order to offer differentiated products with establishment of green supply chain management. This program aims to absorb specific customers and meet their demands.

**The main question:** does the green supply chain management have a positive impact on sustainable competitive advantage?

**Table 41.5**  
**Output of two sample *t*-test for the main question**

	<i>Two sample t-test for the main question</i>				<i>The interval of mean difference with 95% confidence level</i>	
	<i>t-value</i>	<i>Degree of freedom</i>	<i>Significance value</i>	<i>Mean difference</i>	<i>Lower bound</i>	<i>Upper bound</i>
Sustainable competitive advantage	4.743	113	0.000	1.4154	0.8249	2.0058

Given that

$$\text{Significance value} = 0.000 < 0.05$$

It can be stated that green supply chain management effectively improves sustainable competitive advantage with 95% confidence level. In fact, equality of mean of the population is rejected in both cases. Since upper bound is higher the lower bound, the mean difference is positive with 95% confidence level. In other words, sustainable competitive advantage is higher in the case of green supply chain management (ISO 14001). Therefore, green supply chain management has a positive impact on sustainable competitive advantage.

These results are consistent with the results of the studies conducted by Imani and Ahmadi [8], and Li [11]. In other words, organizations can access to competitive advantage that cannot be easily imitated by competitors with establishment of green supply chain management. These organization cannot lose their value in a short period. Sustainable competitive advantage is considerably important in modern global market because global warming is threatening the earth as habitat of human, which greatly concerns governments and consumers. As a result, the organizations that adhere to these principles not only undertake their social responsibility, but also gain sustainable competitive advantage, which is greatly important for the customers in comparison with the competitors.

### Ranking Factors

The difference between ranks of factors of competitive advantage is shown from the perspective of the respondents both before and after obtaining ISO 14001 certificates.

**Table 41.6**  
**Ranking factors before obtaining ISO**

<i>Rank</i>	<i>Component</i>	<i>Score</i>
1	Cost reduction	3.94
2	Focus	2.03
3	Differentiation	1.65

**Table 41.7**  
**Ranking factors after obtaining ISO certificate**

<i>Rank</i>	<i>Factor</i>	<i>Score</i>
1	Focus	2.22
2	Differentiation	1.98
3	Cost reduction	1.33

As shown in the table, the companies highlighted cost reduction before obtaining ISO 14001 certificates and they addressed focus on the market and product differentiation after cost reduction. However, the companies prioritized focus on the target market after obtaining ISO certificate. The second priority was product and service differentiation. The third priority was reduced cost of production and delivery of services.

## 6. CONCLUSION

The present study aimed to investigate the impact of green supply chain management on sustainable competitive advantage in the companies with ISO 14001 certificates. For this purpose, the effect of independent variable on the dependent was examined by testing three sub-question and one main question. The findings showed the positive impact of green supply chain management on sustainable competitive advantages and its components. It can be concluded that green supply chain management benefits from strategies of cost reduction and innovation in production and delivery of services to specific target markets. These are successful strategies of sustainable competitive advantage in current century. It should be noted that a green supply chain will not only reduce costs, but also absorbs more customers, increases market segmentation and customer loyalty in current global market where competitive advantages are easily lost in a short period.

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