Research on the Imitation Path of Corporate Low-carbon Management—A Multi-Case Analysis

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Abstract. Benchmarking imitation within the fields is feasible for the corporate low-carbon management. Three cases of Danfoss, GE and Hitachi were selected to conclude their way to realize the low-carbon management. For verification, semantic analysis, context graph and a causal state diagram is adopted for the multiple case duplications. It is verified that Imitation is especially suitable for the enterprise which is at the beginning of low-carbon management and in a puzzle for the management mode. Imitative isomorphism is an effective way for the spread of organizational legitimacy.

Introduction

In view of institutional economics, as the organization's external environment is uncertain or vague, organization imitation is an effective way for organizational learning from other organizations experience and gain legitimacy [1], and imitation has significant economic advantages to get competitive advantage and lower cost for the enterprise [2]. Therefore, according to the research of new institutional economics, this paper captures a path for the enterprise imitation through case duplication.

Conceptual Model

According to the New Institutional Economics, it is proved that the formation of low carbon enterprise management mode is a process of internal integration and external adaptation; As for the construction of internal enterprise low-carbon management builds in an order of low-carbon consciousness rating system-service-oriented production low carbon management ritual; Low-carbon management ritual is a continued activation process, the formulation of which should experience a long term with the cognitive schemata, low-carbon action framework, low-carbon production process and low-carbon product design, so a imitation path of low-carbon management is proposed as follows:
Sources: author edited

**Data Sources and Case Selected**

The three companies chosen by this paper view the ecological values as their ultimate embodiment of corporate values as well as the highest standard. And their contributions to whole ecological system are directly reflected in natural environment, stakeholder groups and ultimate values created by the enterprises. In the 796 documents quoted in this paper, there are 285 documents on case studies, in which the cases of GE appear 71 times, accounting 25% of all case studies. Danfoss appears 85 times, accounting for 30% of all; Hitachi appears 68 times, accounting for 24% of all cases. The total number of case studies of altogether the three enterprises amounts to 224 documents, which occupies 79% of all recited documents. Therefore, it is reasonable to consider choosing these enterprises as case studies, and they are typical and representative. Furthermore, since 2005, GE has been publishing their corporate citizen reports every year; since 2007, they have been releasing Ecomagination Annual Reports; in 2008, they issued the corporate environmental report, and was passed on. Similarly, from the year of 2007, Danfoss has been releasing 4 issues of Global Danfoss every year, which has 9 editions of different languages and provides a comprehensive introduction towards Danfoss’ projects and managements on energy-saving and emission reduction. Hitachi has been publishing its enterprise sustainable development reports since 2007, which have one issue a year and introduces their environmental strategies and CO₂ emission reduction activities.

The data of this paper is collected from environmental reports, corporate social responsibility reports, financial reports, press conferences and analysis reports of consulting agencies of the three companies. Meanwhile, part of the data is collected from the interviews of General Manager’s Office, environmental monitoring office, business development department and other departments of the competent manager, etc.

**Case Analysis**

The paper is based on cross-case studies, which selects cases instead of samples, so the paper uses analytical inductive method. That is, using previous theories as “template”, and comparing the empirical results with the “template”. If two or more empirical results accord with one theory, then it can prove the repeatability and validity of the research [3].
The Low-Carbon Managing Mode of Danfoss

Semantic analysis of the data. Firstly, the paper does semantic analysis to the collected data, and summarizes it. The analytical results are displayed in Tab.1:

Table 1. Semantic analysis of Danfoss.

<table>
<thead>
<tr>
<th>Time</th>
<th>Analytical results</th>
<th>Semantic analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2001</td>
<td>Expectations of corporate image and cost-effectiveness</td>
<td>The company insists on producing under the Guidelines on Energy Savings, and provides the satisfying products with all customers. Their basic principles of production are listed as the following: the first principle is energy saving and production increasing, as well as improving comfort and protecting ecological environment.</td>
</tr>
<tr>
<td>2006</td>
<td>Energy control and utilization ahead of regulations</td>
<td>Danfoss implements the management of “solutions ready”, which means mastering many possible solutions internally before the decree of regulations or corporate needs. And it also includes using the Environmental management system, gray material lists and corporate environment reports to monitor and control the corporate actions of energy using.</td>
</tr>
<tr>
<td>2010</td>
<td>For low-carbon products</td>
<td>The enterprise can use groundbreaking technologies to produce energy-saving products to reduce carbon remissions as well as to achieve innovational values through Carbon dioxide emission reduction.</td>
</tr>
<tr>
<td>2012</td>
<td>Low-carbon values</td>
<td>The consciousness of energy saving and emission reduction is implanted to various departments so as to create an active atmosphere of participating low-carbon activities on the whole scale and consequently, to transform the enterprise into a Green Kingdom.</td>
</tr>
</tbody>
</table>

Source: collected from the interviews and relative documents by the author

Context graph. The corporate behavior can only be comprehended within a particular context, which can be an aspect of instant related scenario[4], or relative aspects of one corporate behavior.

Figure 1. Story line of Danfoss’ low carbon legitimacy.

Resource: author edited
This paper demonstrates the formation of the legitimacy of Danfoss’ low-carbon managing mode as is shown in Fig.1.

**Causal state diagram.** Causal state diagram is featured with its abstraction and deduction, which can combine the data with its explicit directivity and order in all dimensions[5]. Therefore, this paper deals with the interactive relationships of Danfoss’ low-carbon managing mode by the aid of causal state diagram.

From the qualitative analysis of Danfoss, it can be inferred that Danfoss’ advanced conception on low-carbon action plans and low-carbon recognition is propitious to the formation of self- image and brand value which are synchronized with external institutional environment. It can also help to form the legitimacy of low-carbon managing mode. Danfoss forges the tools of low-carbon assessment such as ISO14001, lists of gray material and etc. into the corporate management, maximizing the low-carbon management and environment, enhancing corporate viability and regulatory legitimacy. According to the needs of customers, the enterprise can redefine the product values by innovative products and institutional environment, which can help the enterprise to acquire social recognition of its low-carbon efforts, and consequently, to get the regulatory legitimacy. On the assumptions that the low-carbon values can be achieved by environmental management system and the low-carbon education, which marks the formation of low carbon practices, the enterprise can obtain the cognitive legitimacy. At the same time, low carbon practice is also the ultimate expression of the legitimacy of low-carbon management[5]. Though the four elements of low-carbon consciousness, rating system, service-oriented-product and low-carbon practices are four dimensions of the category, yet in the formation of Danfoss’ low-carbon management legitimacy, they do not function independently. Instead, they are linked and deepened with each other. The linkage polymerizes the four dimensions, so as to realize the Danfoss’ legitimacy of internal low-carbon management as follows in Fig. 2.

![Figure 2. Causal diagram of Danfoss’ low carbon legitimacy.](Resource: author edited)
The Low-Carbon Managing Mode of GE

Semantic analysis of the data.

Table 2. Semantic analysis of GE.

<table>
<thead>
<tr>
<th>Time</th>
<th>Analytical results</th>
<th>Semantic analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>Expectations of corporate image and cost-effectiveness</td>
<td>By reconstructing the enterprise's attitude towards the low-carbon affairs, GE establishes the cornerstone of its low-carbon advantages. GE often decreases the rates of return for ecomagination projects from standard 30% to 10%, and prolongs its payback period, even admits zero payback sometimes.</td>
</tr>
<tr>
<td>2005</td>
<td>Environmental contributions of stakeholders</td>
<td>After launching “Ecomagination” and the slogan “Green is Green”, GE pays more attention to the scorecard system, which is more targeted, measurable and can change the rules of the game. By using the scorecard, GE not only concerns whether corporate internal operations are in compliance with &quot;Ecomagination&quot; standard, but also takes the complete value chain into consideration, trying to utilize the resources, improve performances and the overall effect.</td>
</tr>
<tr>
<td>2009</td>
<td>Green products located in customer value</td>
<td>In order to ensure the Ecomagination products are introduced to the highest standards of integrity, GE uses the rigorous certification process, and certifies the new Ecomagination products. Recently, GE upgraded the Ecomagination website (<a href="http://www.ecomagination.com">www.ecomagination.com</a>) so that the public can learn more about the GE’s Ecomagination products, customers and interests from the site.</td>
</tr>
<tr>
<td>2011</td>
<td>Low-carbon system management</td>
<td>GE makes its senior executives, general managers, and employees joining in the &quot;Ecomagination&quot; vision, and uses the target, sense of responsibility and motivation to motivate employees, integrating the low-carbon consciousness into all aspects of business, as well as making low-carbon awareness and action the corporate “DNA” to form the corporate culture and values.</td>
</tr>
</tbody>
</table>

Context graph.

Figure 3. Story line of Danfoss’ low carbon legitimacy.

Resource: author edited
**Causal state diagram.** Through the qualitative analysis of GE, it can be seen that the GE’ low-carbon action framework and ecological value orientation help to form the cost and self-image expectation with mutual infiltration of the external system environment, and establish the legitimacy of low-carbon management. Also, the enterprise internalizes the score card system, which is developed in collaboration with the green order[6], and widely recognized low-carbon assessment tool in institutional environment, such as LCM, so as to obtain the legitimacy by maximizing the low-carbon management and institutional environment. The product environment file targeted at customers’ low-carbon needs does good to acquire the social recognition of the low-carbon efforts.

In the end, on the assumptions that the low-carbon values can be achieved by environmental management system and the formation low-carbon consciousness[7], which marks the formation of low carbon practices, the enterprise can obtain its cognitive legitimacy. At the same time, low carbon practice is also the ultimate expression of the legitimacy of low-carbon management. Though the four elements of low-carbon consciousness, rating system, service-oriented-product and low-carbon practices are four dimensions of the category, yet in the formation of Danfoss’ low-carbon management legitimacy, they do not function independently. Instead, they are linked and deepened with each other. The linkage polymerizes the four dimensions, so as to realize the GE’ legitimacy of internal low-carbon management as follows in Fig 4.

![Causal diagram of GE’s low carbon legitimacy.](image)

**Figure 4. Causal diagram of GE’s low carbon legitimacy.**

Resource: author edited

**The Low-Carbon Managing Mode of Hitachi**

**Semantic analysis of the data.**

<table>
<thead>
<tr>
<th>Time</th>
<th>Analytical results</th>
<th>Semantic analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2003</td>
<td>Expectations of corporate image and cost-effectiveness</td>
<td>Presenting the slogan” create a better society by solving basic issues facing earth and society” as corporate vision, the Hitachi dedicates itself to becoming an international enterprise that can share the corporate values with the society by forming the cognitive schema of energy-saving and emission reduction internally.</td>
</tr>
</tbody>
</table>
Table 3. Semantic analysis of Hitachi (Cont.).

<table>
<thead>
<tr>
<th>Time</th>
<th>Analytical results</th>
<th>Semantic analysis</th>
</tr>
</thead>
<tbody>
<tr>
<td>2007</td>
<td>Low-carbon assessment system</td>
<td>Since 2005, every year, Hitachi group will release the Chinese version of &quot;CSR report&quot;; at the same time, on its official website, the page of “corporate social responsibility” is established.</td>
</tr>
<tr>
<td>2009</td>
<td>Low-carbon properties of the products</td>
<td>In order to build an environment-friendly and harmonious society through the products and service, Hitachi promotes the service-oriented-product manufacturing to reduce the environmental load caused by the product lifecycles.</td>
</tr>
<tr>
<td>2012</td>
<td>the institutionalization of low-carbon management</td>
<td>The enterprises depend on the ecological benefits and provide service relying on the ecosystem. Hitachi carries out low-carbon management internally from two aspects of &quot;cause&quot; and &quot;related social contribution activities&quot;.</td>
</tr>
</tbody>
</table>

Resource: author edited

**Context graph.**

![Context graph](image)

Figure 5. Story line of Hitachi’s low carbon legitimacy.

Resource: author edited

**Causal state diagram.** Based on the qualitative analysis of Hitachi, it is fair to say that Hitachi’s low-carbon awareness including low-carbon guidelines, low-carbon action plans and environmental value orientation is beneficial to forming the low-carbon consciousness which penetrates the institutional environment. After the formation of low-carbon consciousness, widely recognized low-carbon assessment tools such as, GREEN21, low carbon-design
evaluation system, environmental CSR product manufacturing and research regulations, are internalized. And by maximizing the low-carbon management and institutional environment, Hitachi acquires the regulative legitimacy. Though the four elements of low-carbon consciousness, rating system, service-oriented-product and low-carbon practices are four dimensions of the category, yet in the formation of Hitachi’ low-carbon management legitimacy, their functions are not independent. Instead, they are linked and deepened with each other. The linkage polymerizes the four dimensions, so as to realize the Hitachi’ legitimacy of internal low-carbon management as follows in Fig.6.

![Figure 6. Causal diagram of Hitachi’s low carbon legitimacy.](Resource: author edited)

**Case Duplication**

Denzin believes that cross-case study should be interpretive synthesis, which means to build a theory based on the abstract phenomena and collect several cases, then “quote them”, instead of interpretive analysis. Therefore, the replication tests are very useful, which can compare the correlation of the same variable of two or more stages in one case.

![Figure 7. Case replication.](Resource: author edited)
To inspect the replication between cases, in this paper, a four–dimension-quadrant is set with the year as vertical axis, the legitimacy of low-carbon management as horizontal axis. Through observing the position of the legitimacy of different cases in the quadrant, it can reflect the distance and correlation between the cases, which can be connected to form a causal flow. The matching degree of the causal flows of the three cases can be identified through the causal flow and consistency in each separate so as to complete the replication test. The concrete steps and test results are as follows in Fig. 6.

The correlation test of the case

Danfoss’ low-carbon consciousness was formed in 2001; GE’s low-carbon consciousness appeared in 2002; Hitachi’s low-carbon consciousness was established in 2003, and all are in the quadrant of legitimacy consciousness, which proves the replication of low-carbon management in this dimension as well as the period divisions of corporate low-carbon managing mode through word frequency statistics. As the word frequency statistics show: the formation interval of legitimacy consciousness is from 2000 to 2004.

Danfoss’ rating system was founded in 2008; GE’s rating system appeared in 2005; Hitachi’s rating system was formed in 2007, therefore, the formation interval of rating system is [2000, 2004]; and all are in the quadrant of regulatory legitimacy which proves the replication of rating system in this dimension as well as the period divisions of corporate low-carbon managing mode through word frequency statistics. As the word frequency statistics show: the formation interval of regulatory legitimacy is from 2005 to 2008;

Danfoss’ service-oriented-product was formed in 2010; GE’s service-oriented-product appeared in 2009; Hitachi’s service-oriented-product was formed in 2009, and all are in the quadrant of regulatory legitimacy, which proves the replication of service-oriented-product in this dimension as well as the period divisions of corporate low-carbon managing mode through word frequency statistics. and as was shown by the statistics: the formation interval of regulatory legitimacy is from 2009 to 2010.

The low-carbon ritual of Danfoss’ products was formed in 2012; GE’s low-carbon management appeared in 2011; Hitachi’s low-carbon management was established in 2011; so the three cases all construct the low-carbon ritual or to say the final dimension of corporate low-carbon managing mode. And all the three cases are in the interval from 2011 to 2013, exactly in the quadrant of cognitive legitimacy, which proves the replication of low-carbon management ritual in this dimension as well as the period divisions of corporate low-carbon managing mode through word frequency statistics. Based on the statistics of the legitimacy of low-carbon management in the three cases, the spots are in the same quadrant and with close distance in every phrase of the low-carbon managing mode, which satisfies the principles of replication of a case.

Matching tests of the causal flow

1. the dimension of the legitimacy of three cases is in the sequence of time order; Danfoss’ low-carbon consciousness, grating system, service-oriented-product and low-carbon management ritual are formed following the time sequence of 2001, 2008, 2010, and 2012. That is to say, Danfoss’ low-carbon management legitimacy mode is gradually formed as time
changes. GE’s low-carbon consciousness, grating system, service-driven-product and low-carbon management ritual are formed following the time sequence of 2002, 2005, 2009, and 2011. So GE’s low-carbon management legitimacy mode is gradually formed as time changes. Hitachi’s low-carbon consciousness, grating system, service-driven-product and low-carbon management ritual are formed following the time sequence of 2003, 2007, 2009, and 2011. That is to say, Hitachi’s low-carbon management legitimacy mode is gradually formed as time changes.

II. The casual flows of the three cases are the gradual upward flows, and the low-carbon consciousness, rating system, service-oriented-product and low-carbon management ritual are all distributed from the first quadrant to the fourth quadrant.

III. The casual flows of the three cases all cross the four quadrants—legitimacy consciousness, regulatory legitimacy, normative legitimacy and cognitive legitimacy, and there are no breaks or flections. Therefore, the result of the matching test of the casual flows of the three cases is positive.

Summary
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References