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Feasibility Evaluation for Introducing EMC from the European Economic Community to the Electronic Information Industry in Taiwan

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Abstract

As the member countries of the European Economic Community established a unified market in Europe, numerous marking and procedural issues related to product verification developed as member countries tried to ensure the quality of the products and services circulating in the European market. Electromagnetic Compatibility (EMC) is a testing standard for ensuring products do not cause electromagnetic interference. EMC is crucial for electronic, electrical machinery and information companies in Taiwan that export their products to the European Union.

This investigation adopts a questionnaire method for collecting information on the effect of performing EMC items in the electronic, electric machinery and information industries in Taiwan, and statistically defines performance indices measuring importance and ease. A performance matrix introduced by a standardization system is presented. Performance levels are assessed and the strategy for improving the performance of EMC introduction is formulated based on the positions of two indices of EMC essentials on the performance matrix. Finally, critical product function items are specified via the quality function deployment (QFD) method in accordance with EMC fundamentals concepts of low importance with high ease and high importance with low ease. This approach can achieve the best countermeasure to serve as a reference for the electronic, electric machinery and information industries while implementing EMC fundamentals.

Keywords: EMC, Technical Documents, Performance Evaluation Matrix, Performance Zone, System Introduction Performance Matrix, Quality Function Deployment (QFD).

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1. Introduction

The European Union (EU) comprises fifteen member countries [7] [8]. Owing to major differences in language, words, currency, laws and systems among these member countries, unification and integration must be conducted to promote the economic development of this regional market. The EU Headquarters specifies different CE directives for different products to ensure products circulating among member countries can meet basic safety and other requirements. Among 20 directives already proclaimed by the EU, compulsory directives include those for Toys, Machines and Electromagnetic Compatibility Directives, and so on [10] [16] . Electromagnetic Compatibility (EMC) is a type of CE marking. CE markings are usually divided into five major categories, including Regulation (REG), Directive (DIR), Resolution (RES), Commission (COM) and Opinion. CE marking directives can be further divided into General Applicable Directives, General Directives and Product Specific Directives [4] [5] [6] in compliance with different requirements. EMC directives belong to the class of General Directives. Extended EMC standards comprise Basic Standard, Generic Standard and Specific Product Standard. Manufacturers must consider four dimensions while implementing EMC, namely preparation of technical documents, technical measures, product certification and administrative requirements, and these four dimensions can be further specified to include 29 directive items [9]. The importance of these directive items varies with the different times, places, backgrounds and industries in which they are introduced. Additionally, the ease of implementing essential items of various directives varies owing differences in company properties, backgrounds and technologies. As successful introduction of EMC is closely related to business opportunities in the companies involved as well as to user safety and environmental protection, this investigation presents a performance evaluation model introducing CE marking.

First, importance and ease indices are specified for 29 directive items. This investigation suggests that scholars should assess the importance index and also that the ease index varies in compliance with the implementation ability of individual companies. Generally, the ease of implementing a specific directive item is high for companies with strong capabilities for performing a certain directive item, and vice versa.

Next, this investigation modifies the performance evaluation matrix developed by Lambert and Sharma [7]. The importance of introduction and ease of achievement replaces customer emphasis and service satisfaction in the performance evluation matrix respectively and an EMC introduction performance evaluation matrix is established accordingly. Generally, when items which are important and very easy to be implemented, then the performance of introducing the whole system is significant. Meanwhile, when the importance of an item is high and ease is extremely low, the performance of system introduction will be poor. Consequently, the level of performance can be assessed easily by simply indicating the locations the importance of introduction and ease of achievement in the evaluation matrix. Nevertheless, cost and timeliness must be considered during the introduction process. Therefore, the priority of essential items in the critical directives must be determined based on the levels of importance and ease to develop improvement strategies to modify the evaluation matrix. Finally, critical product function items are specified via quality function deployment (QFD) in two stages, involving related directives with low importance and high ease and those with high importance and low ease, respectively. This approach can seek the optimum solution to enhance the ease of introducing the involved directive and provides a reference for the industry while introducing EMC.

2. Performance Evaluation Model of System Introduction

As stated above, the ease of implementing, and the importance of each directive item, varies with the industries and the companies. Thus, the random variable I is used to represent importance and variable E is used to represent ease. The ease of introducing the system changes with the manpower and resources of the company. Generally, when a company has plenty of talent or abundant resources, the ease of implementation will be higher.

Following Parasuraman et al. [12] and Parasuraman et al. [13], the performance index of each activity item is defined. A k-point scale is used to evaluate the importance and ease of implementation of each directive item [18]. The indices of importance and ease of implementation are defined as follows.

$$P_I = \frac{\mu_I - \min}{R} \text{ (index of importance)} \tag{1}$$

$$P_E = \frac{\mu_E - \min}{R} \text{ (index of ease)} \tag{2}$$

The terms μ_I and μ_E are the means of importance (I) and ease of implementation (E), respectively. $\min = 1$ represents the minimum of the k scale and $R = k - 1$ is the full range of the k scale. A lower value corresponds to a directive that is less important or less easy to implement. Clearly, these two indices are within $(0,1)$. For example, on a 5-point scale ($k=5$) with $R=k-1=4$, when the mean importance (or ease) exceeds 3 (medium), the corresponding index will exceed 0.5 and the integral average importance (or ease) will be positive. On the contrary, when the average importance (or ease) is below 3 (medium), indices will be below 0.5 and the integral average importance (or ease) will be negative. Consequently, through the values of the indices, which represent a convenient and efficient tool with which company management can evaluate the effectiveness of the introduction of EMC.

The index of importance is plotted as a Y-coordinate and that of ease as the X-coordinate. A performance matrix is redefined based on various strategic requirements of companies, as a tool for use in the performance analysis of, and the improvement of a newly introduced system. Since indices $\hat{P}_I$ and $\hat{P}_E$ are within the range [0, 1], four thresholds [0.0, 1/3, 2/3, 1.0] are adopted to define three levels of ease of implementation — least easy [0.0, 1/3], moderately easy [1/3, 2/3] and most easy [2/3, 1.0] and three levels of importance — least important, moderately important and most important. $(P_E, P_I) = [0.0, 0.0]$ means least easy and least important;$(P_E, P_I) = [1.0, 1.0]$ means the easiest and the most important. Indices (P_E, P_I) between [1/3, 1/3] and [2/3 , 2/3] mean moderately easy and moderately important. The dotted line parallel to the y-axis in Figure 1 [15] ($P_E = 0.5$) indicates medium ease. The area to the right of the dotted line represents a high average higher than average ease and that to the left of the dotted line represents a lower than ease. The dotted line parallel to the x-axis ($PI = 0.5$) stands for medium importance. The area above the dotted line represents (higher than zero importance and the area below the dotted line represents less importance than average).

As stated above, the system-introduced performance matrix is divided into nine Performance Zones that represent the effectiveness of various system-introduced directive items. $B_{ij}(i = 1,2,3,\ j = 1,2,3)$ is used to represent the performance zones, where B_{31}, for example, is the directive with the least ease of implementation and the most importance — it is thus the zone that demands most improvement. B_{13} is the directive item with the most ease of implementation and the least importance, corresponding to greatest effectiveness . With $i=3$, the three performance zones B_{31}, B_{32} and B_{33} represent the greatest importance and are called the "most important zones." With $i=2$, the three performance zones B_{21}, B_{22} and B_{23} represent medium importance and are called the "medium important zones." With $i = 1$, the three performance zonesn B_{11}, B_{12} and B_{13} are called the "least important zones." With $j = 3$, the three performance zones B_{13}, B_{23} and B_{33} represent the most easy implementation zones and these are so called "easiest zones." With $j = 2$, the three performance zones B_{12}, B_{22} and B_{32} represent moderate ease of implementation and these are so called "moderately easy zones." With $j = 1$, three performance zones B_{11}, B_{21} and B_{31} represent the least easy implementation and these are so called "least easy zones." With $i = j$, the importance of three performance zones B_{11}, B_{22} and B_{33} the importance equals the ease of implementation and the zones are so called the appropriate performance zones. Although certification is important for the sustainable success of a company, critical directive items must be identified and requirements met with regard to cost. Therefore, if a company adopts the management strategy of obtaining an "appropriate performance level," a certain performance level can be maintained and the cost of introducing a system will be reduced. Consequently, an enterprise must set the priorities of directive items (as shown in Figure 1). The "target zone" is the "appropriate performance zone" in which the importance equals the ease$(i = j)(B_{11}$, B_{22} and $B_{33})$. The ease is lower than the importance $(i < j)$ in zones B_{12}, B_{13} and B_{23}. Applied resources should then increase the cost of meeting the directives. Ease exceeds than importance $(i > j)$ in zones B_{31}, B_{32} and B_{21}. All available resources then should be increased to enhance performance. The performance should be improved to the "target zones", in the direction of the arrow in Figure 1. The strategies for improvement in each performance zone are of three types—increase resources to enhance effectiveness, decrease resources to reduce the cost of introducing the directive, and maintain the present situation. For example, performance study of EMC certification includes ten directive items, distributed as in Figure 1 (Q1~Q10). Clearly, Q1, Q3, Q9 and Q7 are four directive items critically important to obtaining certification, which are more important than they are easy to implement $(i > j)$. Located in zones B_{31}, B_{32} and B_{21} which means extremely not easy, applied resources must be increased to increases performance. The three directive items Q2, Q4 and Q5 fall in zones B_{12}, B_{13} and B_{23}, in which importance is lower than ease of implementation $(i < j)$, so resources need to be reallocated so that additional resources can be applied; in opposite side of Figure 1., to implement four directive items Q1, Q3, Q9 and Q7 with greater importance and less ease. Accordingly, the EMC can be promoted without increasing the cost, and perhaps even reducing it.

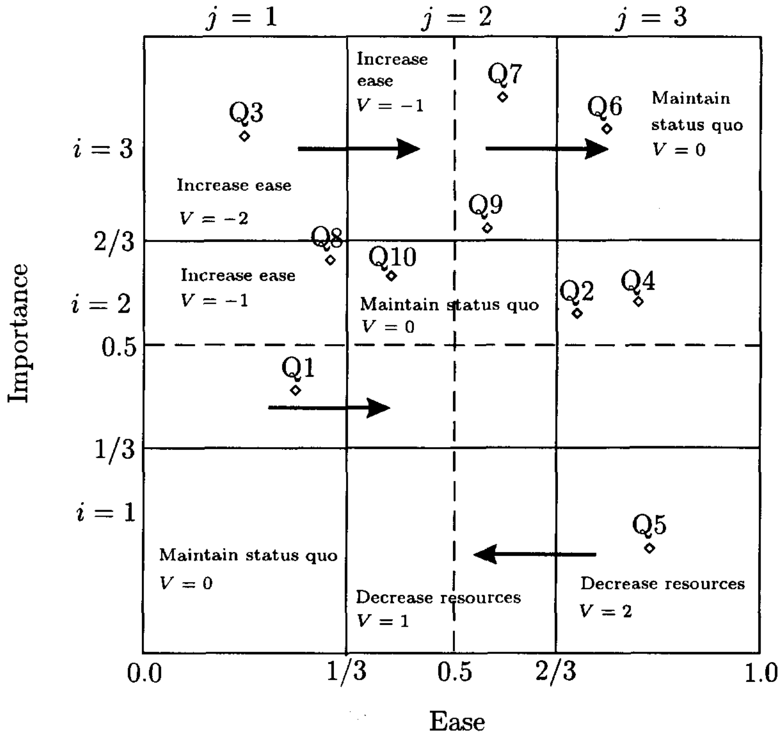

Figure 1. Moderate Performance Block.

When analyzing the performance matrix of the introduction EMC, management needs only determine the type of the performance matrix from the position (P_E, P_I) of the indices of importance and ease of implementation of the directive items of interest. Accordingly, the performance level of each directive item can be assessed and projects and strategies for improvement formulated. Thus, the performance matrix is a simple and easy-to-use graphic analysis tool and, which is quite helpful in evaluating the performance of introduction of EMC.

3. Coordinate Weighted Index and Quality Function Deployment (QFD)

Next, the coordinates of importance of the performance matrix of introducing EMC and those of ease are integrated to one coordinate weighted index. According to related coordinates in Figure 1, the coordinate weighted index V_i, will be defined as follows:

$$V_i = j - i;\quad i = 1 \ldots n;\quad j = 1 \ldots m;\quad -2 \leq V_i \leq 2.$$

The terms i, j are the coordinates of importance (I) and ease of implementation (E), respectively, and range from 1 to 3. Clearly, V_i will be between -2 and 2. When $V_i = 0$, importance equals ease ($i = j$), and the coordinates are in the most suitable "target zones", B_{11}, B_{22} and B_{33}, implying not only that requirements are met, but also that costs are saved. When $V_i > 0$, importance exceeds ease ($i < j$), and coordinates lie in zones B_{13}, B_{12} and B_{23}, implying that the directive items less important and can be performed more easily. Therefore, resources must be reduced to reduce the cost of implementing the directive. When $V_i < 0$, the importance is less than the ease ($i > j$), and the coordinates are in zones B_{31}, B_{21} and B_{32}, implying that the directives are more important and more difficult to implement. Thus, more resources must be assigned to increase effectiveness.

Next, V_i values of abnormal directive items are entered into the QFD table and experts brainstorm the weightings W_{ij} of directive items and product function items in QFD [1] [2] [14] [17] . The approach is to add the improved weighted indices V_i of abnormal directive items. The total weighted T_j values of function items of product can be obtained as follows. Table 1 is a QFD table.

$$T_j = \sum_{i=1}^{n}\sum_{j=1}^{n} V_i W_{ij}, \qquad i = 1 \ldots n, \quad j = 1 \ldots m \tag{3}$$

Table 1. QFD Table of V_i Values for Abnormal Directive Items

Product Function Item Abnormal Directive Item	Coordinate Indices	1	$\cdots$	j	$\cdots$	m
1	V_1	W_{11}	$\cdots$	W_{1j}	$\cdots$	W_{1m}
$\vdots$	$\vdots$	$\vdots$	$\vdots$			
i	V_i	W_{i1}	$\cdots$	W_{ij}	$\cdots$	W_{im}
$\vdots$	$\vdots$	$\vdots$	$\vdots$			
N	V_n	W_{n1}	$\cdots$	W_{nj}	$\cdots$	W_{nm}
Total Weighted Value		T_1	$\cdots$	T_j	$\cdots$	T_m

Finally, the total weighted T_j values are sorted in ascending or descending order and critical product function items are determined for improvement. When the total weighted value is negative, investment in resources must be increased to improve the effectiveness until the optimum value $T_j = 0$ is reached. However, when the total weighted value is positive, the resources must be reduced to yield $T_j = 0$ to reduce the cost of implementing the directive. Table 2 facilitates a strategy for improving the abnormal total weighted T_j values. Therefore, the introduction of EMC can be systematically evaluated and improved using assessment model developed in this article.

Table 2. Table of Strategies for Improving Abnormal Total Weighted T_j Value.

Type of Index	Coordinate Weighted Index T_j	Matrix Coordinates	Improvement Order	Improvement Strategy
Ease lower than importance	Negative	B_{31}, B_{21}& B_{32}	Higher priority ease for smaller negative	Increase resources to promote until optimum value $T_j = 0$ is reached.
Ease higher than importance	Positive	B_{13}, B_{12}& B_{23}	Higher priority for bigger positive	Decrease resources to reduce costs of implementing the directive until optimum value $T_j = 0$ is reached.

4. Performance Evaluation and Improvement Procedures of System Introduction

A set of simple evaluation procedures is provided to facilitate the assessment of the effectiveness of the introduction of EMC and perform a systematic QFD evaluation of all directive items. This process includes five major steps in Figure 2.

Step 1: Conduct a survey of the importance and ease of 29 introduced directive items by using a questionnaire. Experts will judge the Indices of importance, and a certified company will evaluate the indices of ease. P_E and P_I are calculated from the importance and ease of implementation indices defined in this article.

Step 2: Input the importance index P_I and the ease of implementation index P_E of each directive item into the system introduction performance matrix defined in this article.

Step 3: Use the formula provided calculate the improved weighted indices V_i the coordinates of indices P_E and P_I in the system introduction performance matrix. If $V_i \neq 0$, it refers to an abnormal directive item.

Step 4: Input the improved weighted index V_i of abnormal directive items into the QFD table and discuss to establish the weighted W_{ij} for each product function item through the development of QFD. Add the improved weighted indices V_i and weighted to determine the total weighted T_j of an individual product function item. If $T_j \neq 0$, it refers to a critical product function item.

Step 5: Priorities for improvement will be determined by the total weighted T_j values for critical product function items. When the negative value is smaller or the positive value is larger, the priority of the item is higher. Refer to the suggestions in Table 2 for strategies for improvement. When the total weighted T_j is negative, resources must be increased to increase the effectiveness to yield the optimum value $T_j = 0$. However, when the total weighted T_j is positive, investment in resources must be reduced to reduce the costs of implementing the directive, to obtain the optimum value $T_j = 0$.

P_E and P_I are calculated by indices of importance and ease of implementation.

↓

Mark the indices of importance, P_I, and ease of implementation, P_E into the performance matrix.

↓

Calculate the improvement weighted index, V_i according to the coordinates of P_E and P_I in the performance matrix.

↓

Fill V_i in the QFD table and establish the weighted W_{ij} for each product functional item. Multiply V_i and W_{ij} and add for the total weighted T_j of individual product functional item.

↓

When the total weighted T_j is positive, investment in resources must be reduced; however, as T_j becomes negative, resources need to be increased (When the negative total weighted T_j turns to be smaller or the positive total weighted T_j becomes bigger, the priority of improvement is greater.).

Figure 2. Flow Chart of Five Major Steps.

5. Discussion of Actual Example

The electronic information industry in Taiwan is headquartered in the central region. Manufacturers are working hard to become EMC certified to win more orders for their electronic tools. 29 directive items, related to EMC certification, are addressed in the questionnaire (Table 1). The 5-point Likert Scale is used to measure various variables: 1 implies very uneasy or very unimportant, 2 implies uneasy or unimportant, 3 implies average ease or average importance, 4 implies easy or important and 5 implies extremely easy or extremely important. The questionnaire is divided into two parts. The first part is for domestic consulting experts in EMC certification. The main purpose is to evaluate the importance of the 29 directive items. The second part is for EMC certified manufacturers to assess the ease of implementation of directive items for EMC certification for the electronic information industries in Taiwan. Random sampling is used to conduct the questionnaire survey of 50 experts and scholars and 100 manufacturers. The evaluation procedure is as follows.

Step 1: First, the means and indices P_I and P_E for the importance and ease of implementation of directive items are calculated. Table 3 presents the results.

Step 2: The importance index P_I and the ease of implementation index P_E of each directive item is input into the system introduction performance matrix. Figure 3 presents the results.

Step 3: Calculate V_i in compliance with the coordinate of indices P_E and P_I in the system introduction performance matrix. Abnormal directive items were located, including Items 1 and 6 on preparation of technical documents, Items 21 and 22 on product verification and Items 26 and 27 on management. Their coordinate index V_i is filled into Table 3.

Step 4: Fill the improved weighted index V_i of abnormal directive items into the QFD table and experts discuss to establish the weighted W_{ij} for each product function item through QFD development. Add improved weighted indices V_i and weighted W_{ij} values of all product function items after multiplying, which results in the total weighted T_j of individual product function item. If $T_j \neq 0$, it belongs to a critical product function item, shown as Table 4.

Step 5: Sort the either positive or negative total weighted T_j and locate critical product function items for improvement. The total positive weighted values were sorted in order from the maximum, which were 21 points of Item 48, 16 points of Item

Table 3. Means and Performance Values of the Importance and Ease of Related Directives while Introducing EMC

	Directive Item during the Process	Importance	Ease	P_I	P_E	V_i
	1. Preparation of Technical Documents:					
1.	Translate technical documents from source languages to EU official languages.	**4.3333**	**3.2548**	**0.8333**	**0.5637**	**1**
2.	Present in written form to be consistent with technical documents.	4.2000	3.6750	0.8000	0.6688	0
3.	Product specifications (nomenclature, model, required standards)	4.2130	4.1058	0.8033	0.7765	0
4.	Instruction manuals (operation & maintenance instructions)	3.7000	4.2647	0.6750	0.8162	0
5.	Electric and mechanical full drawings	3.8000	4.1176	0.7000	0.7794	0
6.	Control lines and circuits	**1.8545**	**3.4567**	**0.2136**	**0.6142**	**-1**
7.	List of component parts	3.8667	4.2647	0.7167	0.8162	0
8.	Test reports	3.7667	4.3824	0.6917	0.8456	0
	2. Technical Measures:					
9.	Improvement of electromagnetic radiated emissions	3.8000	4.2059	0.7000	0.8015	0
10.	Improvement of electromagnetic conducted emissions	4.1333	3.9118	0.7833	0.7280	0
11.	Improvement of electrostatic discharge disturbance	3.8667	4.2647	0.7167	0.8162	0
12.	Improvement of radiated susceptibility	4.4667	4.2158	0.8667	0.8040	**0**
13.	Improvement of fast transient impulse disturbance	1.8545	3.4567	0.2136	0.6142	0
14.	Improvement of electric surge disturbance	3.7667	4.3824	0.6917	0.8456	0
15.	Improvement of conducted susceptibility	3.5489	3.2839	0.6372	0.5710	0
16.	Improvement of power frequency field disturbance	3.7000	4.2647	0.6750	0.8162	**0**
17.	Improvement of voltage transient disturbance	3.8000	4.1176	0.7000	0.7794	**0**
18.	Improvement of grounding system	4.3667	4.3235	0.8417	0.8309	0
19.	Selection of filter	4.1000	4.2059	0.7750	0.8015	**0**
20.	Selection of isolation device	4.4328	4.3235	0.8582	0.8309	0
	3. Product Certification:					
21.	Selection of product certifying body	**2.1356**	**4.5675**	**0.2839**	**0.8919**	**-2**
22.	Products can't meet specifications of directives	**2.8954**	**1.7565**	**0.4739**	**0.1891**	**1**
23.	Product features can't meet directive requirements.	3.9000	4.0882	0.7250	0.7721	0
24.	Insufficient experience of assistance organizations	3.9000	3.8824	0.7250	0.7206	0
25.	Difficulty in transforming EMC articles to practical implementation	3.9000	3.7353	0.7250	0.6838	0
	4. Administrative Requirements:					
26.	No complete implementation plans	**3.8667**	**2.0145**	**0.7167**	**0.2536**	**2**
27.	The management doesn't provide sufficient support.	**3.1080**	**1.7565**	**0.5270**	**0.1891**	**1**
28.	Related personnel aren't active in participation.	3.9000	4.0882	0.7250	0.7721	0
29.	Difficulty in acquiring EMC talents, technology & equipment.	3.9000	3.8824	0.7250	0.7206	0

Table 4. QFD Table of Abnormal Directive Items

Abnormal Directive Item	Product Function Item / V_i Value	5. Control System Safety	7. Actuation System Control	13. Hazard Prevention Stability	27. Power Protection Measure	39. Gas Leakage Protection	42. Mechanical Maintenance	48. Warning Indicator	51. Instruction Manual
Item 1	+1		3				3	3	4
Item 22	+1		3				3	4	4
Item 26	+2		2				4	5	3
Item 27	+1		2				3	4	2
Total Positive Weighted Value			**12**				**15**	**21**	**16**
Item 6	-1	4		5	1	2			
Item 21	-2	3		4	3	3			
Total Positive Weighted Value		**-10**		**-13**	**-7**	**-8**			

Note:
Item 1: Translation of technical documents from source languages to EU official languages; Item 6: control lines and circuits; Item 21: selection of product certifying body; Item 22: product features inconsistent with directive specifications; Item 26: no complete implementation plan; Item 27: The management doesn't provide sufficient support.

51, 15 points of Item 42 and 12 points of Item 7. Therefore, investment in resources may be increased to promote performance ease until the optimum value $T_j = 0$ is accomplished. For the total negative weighted values sorted in order based on the minimum, the results were -13 points of Item 13, -10 points of Item 5, -8 points of Item 39 and -7 points of Item 27. Likewise, investment in resources can be decreased according to this order so as to reduce the cost of introducing the system until the optimum value $T_j = 0$ is achieved. Last, the strategies of improving abnormal coordinate weighted index V_i are arranged and listed in Table 5. A systematic assessment and improvement can be conducted efficiently through this evaluation model while assessing the performance of introducing EMC for the enterprises.

Table 5. Table of Improvement Strategies for Critical Product Function Items

Critical Product Function Item	Coordinate Weighted Index T_j	Type of Index	Coordinate Location in Matrix	Improvment Priority	Improvement Strategy
Item 13 Item 5 Item 39 Item 27	-13 points -10 points -8 points -7 points	Negative T_j values (ease higher than importance)	B_{31}, B_{21} and B_{32}	Smaller negative values for higher priority	Decrease investment in resources to reduce the cost of introducing the system till optimum $V_i = 0$.
Item 48 Item 51 Item 42 Item 7	21 points 16 points 15 points 12 points	Positive T_j values (ease lower than importance)	B_{11}, B_{12} and B_{23}	Bigger positive values for higher priority	Increase investment in resources to enhance implementation ease till optimum $V_i = 0$.

Note:
Item 5. Control System Safety, Item 7. Actuation System Control, Item 13. Hazard Prevention Stability, Item 27. Power Protection Measure, Item 39. Gas Leakage Protection, Item 42. Mechanical Maintenance, Item 48. Warning Indicator, Item 51 Instruction Manual.

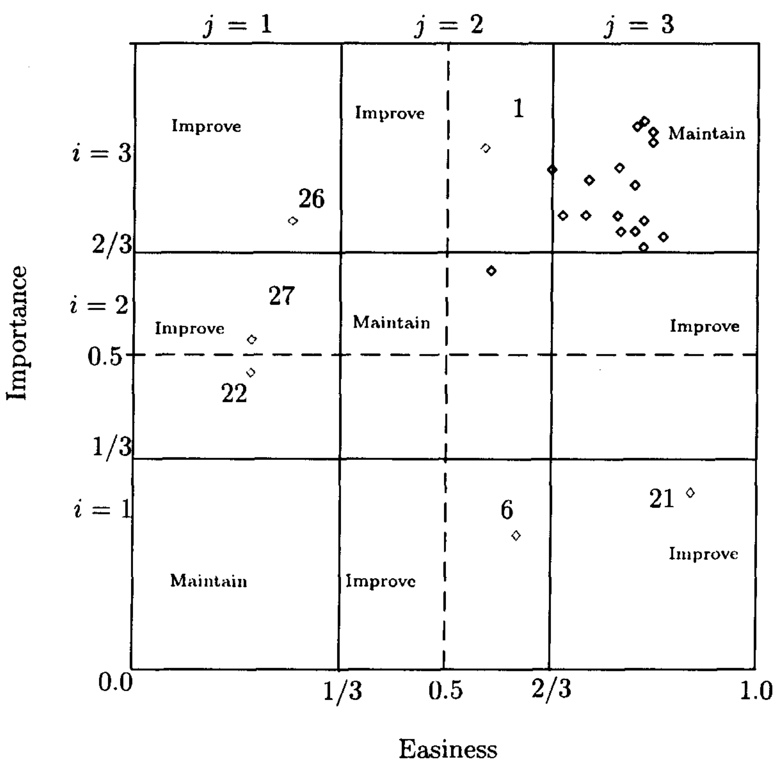

Figure 3. System Introduction Performance Matrix.

6. Conclusion

To reduce trade-dependence on the United States, the Taiwanese government is actively assisting manufacturers to develop the European market [3] [11] . However, EMC is used in Europe to specify the responsibilities of manufacturers towards the products and also to ensure the quality of the products circulating in that market. To overcome trade barriers and obtain a share of the European market, the government should provide a suitable environment, and assist manufacturers in developing quality certification systems to increase their industrial competitiveness in the European market. Therefore, promotion and introduction of EMC presently is a key issue and challenge for all industries. As the members of the European Communities have established a unified market in Europe, product safety standards and requirements have been imposed since 1995 to ensure the quality of products and services circulating in that market. EMC requires safe design and manufacturing, along with the preparation of related documents and papers, as well as the conduction of inspections to meet relevant directives and specifications required by the European market before launching the products unto the market. However, since properties of relevant directives are different, ease and importance of implementation vary, the ease and importance of relevant directives should be assessed and an effective improvement model should be presented to apply the EMC efficiently.

This investigation applies the questionnaire method to collect information on the effect of performing directives related to EMC in the electronics、electrical machinery and information industries in Taiwan. First, calculate P_I and P_E, the means of the importance level of directive items and implementation ease. Then, mark the importance index P_I and the implementation ease index P_E of each directive item into the system introduction performance matrix. Finally, calculate the improvement weighted index V_i in compliance with the coordinate locations of indices P_E and P_I of individual directive items in the performance matrix. Abnormal directive items then were located, including Items 1 and 6 for technical document preparation, Items 21 and 22 for product verification and Items 26 and 27 for administrative requirements. Table 4 lists results of coordinate index V_i of abnormal directive items through QFD. The total weighted T_j of respective product functions was obtained. Comparing the total weighted T_j vale and the target value $T_j = 0$ enables improvement priority and procedures to be determined. This approach enables enterprises to introduce EMC efficiently despite resource and time constraints, and enables enterprises to further increase the competitiveness of their products in the European market.

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