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*Full Length Research Paper*

# Rethinking information-technology company rankings for better decision-making

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**Numerous groups have created various kinds of company rankings which can change ordinary companies into celebrity firms. Such company rankings have the power to deeply affect the decision-making process of both internal and external stakeholders of a company. Typically, a company ranking is produced in response to a special concern, and uses a specific evaluation method or weighting. Since, however, a truly robust and effective decision-making process should not depend solely on a company ranking, this paper suggests using Data Envelopment Analysis (DEA) and Grey Entropy (GE) scoring method to conduct supplementary analyses. These two suggested methods do not require the use of subjective weightings. As an application of the proposed methodology, an empirical study of the Taiwan InfoTech 100 is presented. The proposed solution can be further extended and developed as business models. For example, Google or Yahoo might conduct both a DEA-based ranking and a GE-based ranking, "DEA-InfoTech 100" and "GE-InfoTech 100", as supplementary analyses to be compared with other available company rankings.**

**Key words:** Company ranking, data envelopment analysis, grey entropy.

## INTRODUCTION

Company rankings are regularly reported by media around the world, and these rankings are so influential because they are able to transform ordinary companies into celebrity firms (Fombrun, 2007). The company ranking can be viewed as a sort of corporate reputation, and it has the power to deeply affect decision-making on the part of both internal and external company stakeholders, ranging from stockholders, creditors, labor unions and governmental bodies, to employees, customers and suppliers (Alam et al., 2010). Graham and Bansal (2007) reported that, consumers are willing to pay more for a better corporate reputation. Indeed, a good reputation has a range of positive effects, such as reducing stakeholder uncertainty about future organizational performance, strengthening competitive advantage, contributing to public confidence, and creating value by maximizing an organization's ability to receive a premium for product or services (Vidaver-Cohen, 2007). Status as a celebrity firm brings with it a number of advantages:

1) Motivating consumers to buy the company's products,
2) Attracting high quality employees,
3) Encouraging outside investors,
4) Earning praise from local communities, and
5) Helping to retain essential transaction partners such as suppliers and distributors (Fombrun, 1996).

Hence, companies increasingly seek to maintain a good ranking order, with the goal of leveraging reputation for competitive advantage. Usually, a company ranking is produced in response to a special concern, and uses a specific evaluation method or weighting. For instance, in order to assist readers in picking through the world best-performing tech companies, BusinessWeek annually conducts a company ranking named "InfoTech 100". The "InfoTech 100" is an aggregate ranking: ranked companies are required to be publicly traded corporations with revenues of at least $300 million, and are ranked using four criteria; 1) return on equity, 2) shareholder return, 3) revenue growth (all of which are given equal weight), and 4) total revenues (which is weighted). Like the "InfoTech 100" compiled by Business Week, the "Taiwan InfoTech

100" is produced by Business Next in Taiwan. The "Taiwan InfoTech 100" demands that ranked companies are publicly traded corporations with revenues of at least $30 million, and it employs a weighting method in which a 50% weight is added onto the criterion "total revenues".

However, different criteria and weightings can generate diverse results in the calculation of company rankings. This paper argues that a robust and effective decision-making process should not depend solely on a company ranking based on subjective assessments. The author recommends performing supplementary analyses, in order to obtain pure company rankings with objective weightings. Data Envelopment Analysis (DEA) and Grey Entropy (GE) scoring method are proposed as excellent ranking tools for the task of conducting unadulterated company rankings. The author also suggests that, implementing the company ranking is a sort of multiple criteria decision-making (MCDM) problem, that needs to consider a set of complex factors as multiple evaluation criteria, and thus, in order to effectively handle such MCDM problems; it is necessary to make use of MCDM methods. Among the various available MCDM methods, the DEA and the GE scoring method have the advantage that, they can be used to rank a list of companies without asking experts' opinions in order to assign a weight to each criterion (Wu, 2011).

Since company rankings have the power to intensely influence the decision-making process of both internal and external stakeholders of a company, multiple ranking methods based on objective weightings are needed for gaining robust ranking results. Hence, the purpose of this paper is to demonstrate a proposed solution, that uses the DEA and the GE scoring method, to perform supplementary analyses in order to achieve better decision-making. Additionally, an empirical study of the Taiwan InfoTech 100 is presented as an application of the proposed methodology. Finally, based on the findings of this research, the author presents some conclusions and implications for management.

## LITERATURE REVIEW

### Company ranking and corporate reputation

Achieving top status in a company ranking constitutes a good corporate reputation, and this has a positive influence on corporate financial performance, finally corporate financial performance, in turn, affects corporate reputation (Alam, 2009). This is probably because a company's outstanding ranking order may command a high level of public attention and positive emotional responses, and this will increase economic opportunities available to the company. Ultimately, company rankings can turn ordinary companies into celebrity firms, and can also topple the famous into infamy (Rindova et al., 2006; Fombrun, 2007).

Vidaver-Cohen (2007) define reputation as a perceptual phenomenon emerging from observers' collective judgments about an organization based on assessment of the organization's performance over time. Gabbioneta et al. (2007) remarked that, corporate reputation can be broadly defined as a set of collectively held beliefs about a company's ability to satisfy the interests of its various stakeholders and they suggest four dimensions of corporate reputation, including: 1) financial performance, 2) vision and leadership, 3) financial disclosure, and 4) corporate governance. Recently, the Reputation Institute has proposed an organizational reputation model that identified 23 reputational attributes for a range of seven predictors (Vidaver- , and approach to innovation (Vidaver-Cohen, 2007). It is especially noteworthy that Barnett et al. (2006) make the following points: (1) reputation is an evaluative assessment of an organization; (2) cumulative positive assessments over time yield reputational capital; and (3) the reputational capital is a valuable intangible asset that enhances an organization's competitive standing relative to others in its field.

In the past few years, several kinds of company rankings have been created by a variety of groups, and among the existing company rankings, a large number focus on specific financial criteria such as size, accounting results or stock market performance. Some studies consider that, even though financial performance rankings can have a significant effect on corporate reputations, such company rankings based on financial criteria are, in fact, financial performance rankings, not reputation rankings (Fombrun, 2007). The study may, however, deem that (1) every company ranking represents a form of reputation; (2) a financial performance ranking is also a sort of reputation ranking; and (3) reputation rankings can be divided into financial based and non-financial based reputation rankings. If there is need to make careful use of the company ranking, the following factors must be considered.

Firstly, although, celebrity alters the economic opportunities available to those who achieve it, phenomena such as the Enron scandal reveal that achieving celebrity is not necessarily indicative of the long-term effectiveness and success of a firm (Rindova et al., 2006).

Secondly, referring to Fombrun (2007), (1) none of the rankings are comprehensive, and various filters are applied by the rating agents that naturally influence who gets on the list, and so how well a company can perform; and (2) some rankings are inclusive of all types of companies while others examine only the largest companies or those in a particular industry, region or country.

Thirdly, caution is required regarding both the reason and the impact in terms of the criteria and weightings used in a company ranking. This is because different criteria and weightings can generate diverse results. In this regard, if there is need to conduct a robust and effective decision-making process, it is a must to perform supplementary analyses to properly evaluate a company

ranking and, for this, there is need for some favorable ranking tools, such as the DEA and the GE scoring method, which can be used without the aid of subjective weightings.

## Company ranking and MCDM

When the study undertakes the task of ranking, MCDM methods are best suited for effectively dealing with a number of multifaceted evaluation criteria. The use of a MCDM method usually involves asking experts to express their opinions in terms of criterion selection and weighting according to their knowledge, experiences, and special concerns. There are several MCDM methods that can serve as ranking tools for implementing company rankings, such as AHP (Analytical Hierarchy Process), ANP (Analytic Network Process), TOPSIS (Technique for Order Preference by Similarity to Ideal Solution), and so on. All these methods, however, have in common that an indispensable part of the procedure is to ask experts' opinions for deciding the criterion selection and weighting by subjective judgments.

Referring to Liu et al. (2010), weighting methods can be divided into subjective (for example, AHP, Delphi) and objective approaches (for example, DEA, Entropy). For purposes of obtaining a purely objective company ranking, the DEA and the GE scoring method are most appropriate. Among the various MCDM methods, the DEA has the advantage that, it can perform the task of efficiency evaluation and ranking without criterion weights decided previously, while the GE scoring method can objectively uncover criterion weights with no need for additional information. The basics of DEA and GE scoring method are as follows.

The DEA was formally developed by Charnes et al. (1978). Well-known as an efficiency measurement technique, the DEA is a mathematical method that measures the relative efficiency of decision-making units (DMUs) with multiple inputs and outputs, and without any need for predefined production functions or assumptions. DEA models have been widely used as evaluation tools for measuring performance measurement. For example, Lin et al. (2010) employ DEA to evaluate debt-paying ability of the shipping industry; moreover, Sufian and Habibullah (2009) utilize DEA to calculate the technical, pure technical, and scale efficiency of individual banks. There are several famous DEA models, such as the CCR model (Charnes et al., 1978), the BCC model (Banker et al., 1984), the super-efficiency model (Andersen and Petersen, 1993), and so on. Among these DEA models, the super-efficiency DEA model uses an efficiency score above one for ranking the efficient units, and assigns an efficiency score less than one to inefficient units; that is, the efficiency scores of the efficient units can be greater than or equal to one, when using the super-efficiency model (Nahra et al., 2009; Banker and Chang, 2006).

Obviously, the super-efficiency model is a superior method for handling efficiency measurement in practice, and is also highly suitable for use as a total ranking tool for conducting company ranking.

The GE is a favorable weighting technique based on grey system theory. Grey system theory was initiated in the 1980s by Deng (1982) and is designed to deal with systems or objects having well-defined external boundaries but internal uncertainty or vagueness (Liu and Lin, 1998). Conventional statistical methods require a bigger sample size and a typical distribution of samples, but allow the use of small variable factors; while grey system theory enables us to analyze data which is characterized by uncertainty, multi-input, discreteness of data, and small sample size, as well as unknown distribution of samples. According to Wang et al. (2007), the entropy weighting method is an objective weighting technique that can calculate the relative importance among all attributes/criteria by comparing the entropy value for each attribute/criterion. Moreover, Wen et al. (1998) propose the GE based on the discrete type of entropy in order to properly conduct weighting analysis. Furthermore, Wu (2011) develops a GE scoring method based on the GE, in order to deal with the task of benchmarking.

## The proposed solution

For purposes of using the DEA and the GE scoring method as ranking tools for solving the MCDM problem of company ranking, referring to Opricovic and Tzeng (2004), the procedure of this proposed solution is divided into four main phases. As shown in Figure 1, the first phase required is to define the decision goal. The next is to select DMUs and evaluation criteria. According to Bouyssou (1999), when DEA models as MCDM tools were utilized, DMUs are viewed as alternatives while inputs/outputs are regarded as criteria.

In phase 3, it was required to employ multiple methods for purposes of achieving improved decision-making. In this paper, the super-efficiency DEA model (Andersen and Petersen, 1993) and the GE scoring method (Wu, 2011) are recommended. For DEA models, the relative efficiency can be defined as the ratio of total weighted output to total weighted input. However, CCR or BCC models produce an efficiency score (between zero and 1) for each unit, and they do not allow for a ranking of the efficient units themselves (Golany and Roll, 1989). For this issue of ranking efficient units, the super-efficiency model can completely rank efficient units. Additionally, the GE scoring method is employed to compare with the DEA in ranking results of efficiency evaluation.

Finally, the purpose of phase 4 is to compare ranking results among the super-efficiency model, the GE scoring method, and the reported company ranking. Such a comparison may provide valuable information enabling us to conduct a better decision-making procedure.

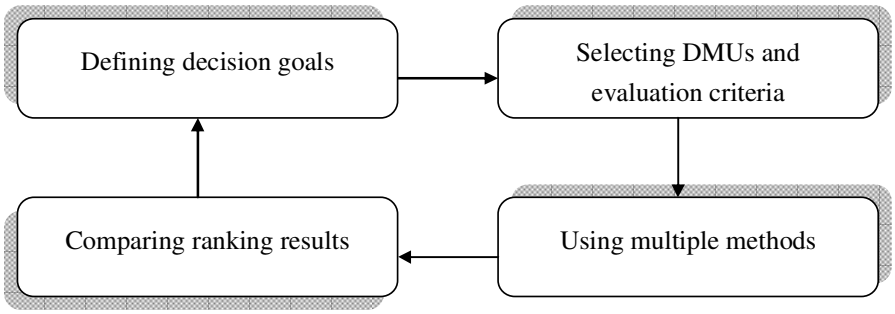


**Figure 1.** The proposed solution.

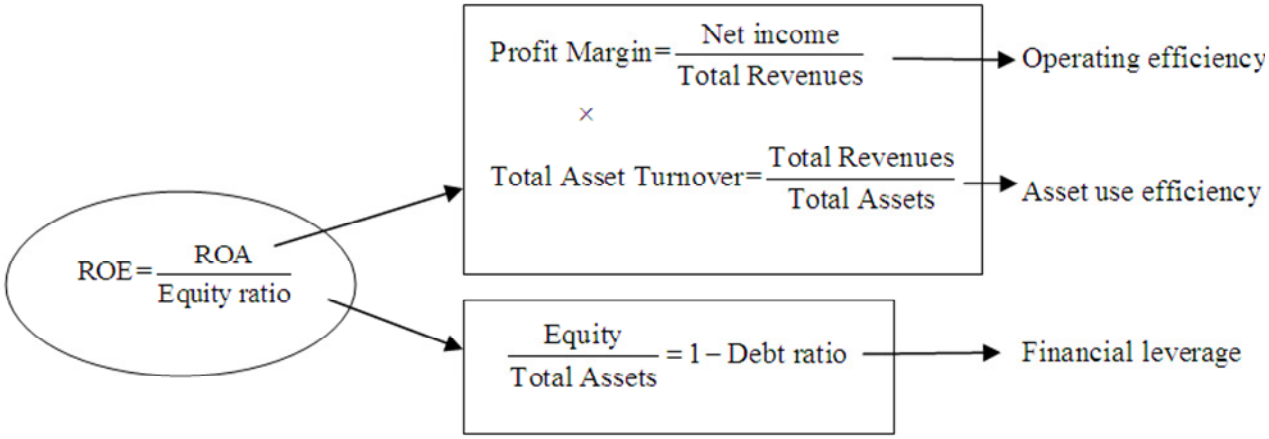


**Figure 2.** The DuPont ratio model.

## EMPIRICAL STUDY

### Application of proposed solution

Here, an empirical study of the 2009 Taiwan InfoTech 100 is presented as an illustration of the application of the proposed solution. The decision goal is to make a comparison of the Taiwan InfoTech 100 with the results of supplementary analyses, in order to gain useful information for better decision-making.

Phase 2 requires selecting DMUs and evaluation criteria. The Taiwan InfoTech 100 is ranked using four criteria: 1) return on equity, 2) shareholder return, 3) revenue growth, and 4) total revenues (a 50% weight is added on), and is obviously a form of financial performance ranking. Referring to the DuPont ratio model (Figure 2), it exhibits clearly that, ROE (return on equity) is influenced by ROA (return on assets) and equity ratio. Furthermore, it may be noted that there are four variables (Net income, Total Revenues, Total Assets, and Equity) which can affect the performance of the ROE. Hence, in this study, ranked companies are treated as DMUs, and two input variables (Total Assets, Equity) and two output variables (Net income, Total Revenues) are adopted for further analysis.

Phase 3 is to apply the super-efficiency DEA model and the GE scoring method for implementing company rankings. Finally, phase 4 is to compare ranking results with the reported company ranking. From Tables 1 and 2, it can be seen that there are seven efficient DMUs, according to the super-efficiency DEA model. Among these efficient DMUs, the company code: 2498 (No.2) has the highest DEA Score of 134.97%; this company also achieves the highest EPS (earnings per share) (37.97 NT$), and its debt ratio is less than 50%.

As for the company code: 3231 (No.1), neither its EPS nor its debt ratio are favorable. Interestingly, the company code: 6265 (No. 37) shows a low level of EPS (1.68 NT$) with a debt ratio less than 50%, but it is identified as an efficient DMU using either the DEA score or the GE score. Moreover, there are many DMUs, such as the company code: 2382 (No.3), which are graded as inefficient by the DEA Score while they are viewed as efficient according to the GE score.

This reveals that robust decision-making should not depend solely on a company ranking because different

**Table 1.** Data and efficiency scores for Taiwan InfoTech (1-50).

| Rank | Company code | ROE (%) | Shareholder return (%) | Equity (NT$ million) | Total Assets (NT$ million) | Total Revenues (NT$ million) | Net income (NT$ million) | EPS (NT$ ) | Debt Ratio (%) | DEA Score (%) | GE Score (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | 3231 | 19.76 | -11.89 | 368,712,250 | 1,078,928,930 | 4,222,813,680 | 68,779,290 | 4.57 | 65.83 | 108.09 | 294.81 |
| 2 | 2498 | 49.06 | -21.81 | 606,614,860 | 1,152,263,620 | 1,525,587,660 | 286,353,490 | 37.97 | 47.35 | 134.97 | 102.65 |
| 3 | 2382 | 23.31 | 8.36 | 860,753,490 | 2,239,854,110 | 7,630,641,910 | 202,194,500 | 5.58 | 61.57 | 96.04 | 251.34 |
| 4 | 2356 | 14.21 | -1.52 | 385,846,050 | 1,059,853,010 | 3,506,529,910 | 53,354,330 | 2.08 | 63.59 | 83.10 | 244.93 |
| 5 | 2353 | 14.76 | 3.58 | 823,189,590 | 1,780,468,650 | 4,189,390,150 | 117,421,350 | 4.72 | 53.77 | 63.39 | 164.70 |
| 6 | 3045 | 37.15 | -5.81 | 509,025,980 | 898,755,010 | 543,116,050 | 153,713,860 | 5.18 | 43.36 | 68.65 | 49.34 |
| 7 | 6121 | 25.56 | -14.24 | 99,656,180 | 171,359,160 | 307,992,060 | 23,535,970 | 11.28 | 41.84 | 70.13 | 121.93 |
| 8 | 5478 | 24.04 | 41.95 | 42,621,780 | 65,489,770 | 62,672,380 | 9,979,220 | 8.05 | 34.92 | 63.06 | 67.02 |
| 9 | 2330 | 20.74 | -12.17 | 4,763,771,110 | 5,405,592,470 | 3,217,670,830 | 999,331,680 | 3.86 | 11.87 | 73.26 | 41.42 |
| 10 | 2450 | 27.48 | -13.75 | 41,683,290 | 65,493,900 | 220,642,430 | 10,893,820 | 4.49 | 36.36 | 111.28 | 215.41 |
| 11 | 6163 | 33.94 | -12.25 | 11,656,460 | 30,492,230 | 52,884,420 | 3,136,640 | 4.24 | 61.77 | 73.68 | 132.24 |
| 12 | 3561 | 19.91 | 34.18 | 20,552,090 | 63,417,120 | 48,358,260 | 3,772,970 | 3.99 | 67.59 | 46.28 | 61.73 |
| 13 | 4906 | 15.13 | -7.31 | 73,771,420 | 121,353,170 | 181,342,920 | 11,365,520 | 4.83 | 39.21 | 51.14 | 98.46 |
| 14 | 6188 | 14.83 | -10.85 | 76,026,120 | 117,591,690 | 214,990,380 | 11,261,360 | 3.91 | 35.35 | 56.07 | 116.53 |
| 15 | 6282 | 13.74 | 48.47 | 68,591,510 | 113,787,680 | 169,681,980 | 9,052,960 | 1.84 | 39.72 | 47.11 | 97.69 |
| 16 | 3211 | 35.14 | -30.03 | 38,535,940 | 74,195,190 | 175,439,260 | 12,210,420 | 10.78 | 48.06 | 91.68 | 165.83 |
| 17 | 3059 | 20.56 | -19.85 | 95,677,690 | 181,832,460 | 229,649,700 | 18,369,620 | 5.36 | 47.38 | 52.82 | 89.04 |
| 18 | 6239 | 33.32 | -35.51 | 215,117,340 | 436,619,350 | 311,889,820 | 65,446,880 | 10.38 | 50.73 | 64.45 | 57.67 |
| 19 | 2376 | 5.92 | -8.87 | 189,797,250 | 259,798,240 | 457,970,100 | 11,402,310 | 1.76 | 26.94 | 43.77 | 104.16 |
| 20 | 2454 | 22.91 | -5.75 | 816,109,010 | 965,874,260 | 680,155,430 | 191,899,970 | 18.01 | 15.51 | 78.73 | 48.88 |
| 21 | 2385 | 36.33 | -4.76 | 82,939,970 | 154,160,190 | 158,033,540 | 29,007,890 | 5.79 | 46.20 | 76.00 | 78.61 |
| 22 | 8044 | 19.67 | 16.41 | 5,944,710 | 21,656,890 | 74,382,910 | 1,063,610 | 1.9 | 72.55 | 109.25 | 271.61 |
| 23 | 2324 | 16.19 | -10.2 | 778,365,070 | 1,478,969,390 | 4,049,929,100 | 126,390,370 | 3.26 | 47.37 | 73.58 | 184.31 |
| 24 | 3380 | 13.24 | -6.06 | 79,936,770 | 127,508,970 | 228,329,710 | 10,525,630 | 2.35 | 37.31 | 52.03 | 114.80 |
| 25 | 2317 | 15.49 | -36.28 | 3,611,668,470 | 6,486,639,880 | 14,730,262,800 | 551,331,750 | 7.44 | 44.32 | 63.50 | 150.80 |
| 26 | 3443 | 30.24 | -33.3 | 26,388,950 | 40,207,730 | 92,820,630 | 7,470,490 | 6.05 | 34.37 | 92.16 | 150.19 |
| 27 | 3504 | 29.38 | 69.7 | 22,892,250 | 33,046,780 | 60,100,600 | 6,137,770 | 5.76 | 30.73 | 85.50 | 118.12 |
| 28 | 3060 | 21.6 | -16.32 | 25,775,170 | 50,585,950 | 62,555,940 | 5,356,590 | 4.37 | 49.05 | 54.61 | 88.59 |
| 29 | 3209 | 15.98 | 13.93 | 9,356,210 | 20,062,430 | 61,925,180 | 1,423,970 | 2.33 | 53.36 | 79.10 | 214.41 |
| 30 | 2403 | 11.76 | -23.15 | 70,476,580 | 147,475,850 | 637,885,840 | 8,008,750 | 2.44 | 52.21 | 100.24 | 295.09 |
| 31 | 3514 | 24.86 | -74.67 | 86,240,830 | 229,023,380 | 158,276,490 | 19,086,280 | 12.79 | 62.34 | 50.41 | 55.97 |
| 32 | 2412 | 11.67 | -10.19 | 3,765,564,210 | 4,592,686,710 | 1,867,806,500 | 450,103,420 | 4.64 | 18.01 | 38.84 | 27.69 |
| 33 | 3519 | 36.63 | -47.53 | 52,556,590 | 129,784,670 | 87,889,930 | 14,680,510 | 13.91 | 59.50 | 60.16 | 55.99 |
| 34 | 2374 | 18.83 | -15.13 | 70,692,830 | 100,308,040 | 332,178,720 | 13,555,280 | 3.26 | 29.52 | 92.68 | 201.69 |
| 35 | 2308 | 17.36 | -13.56 | 583,434,640 | 817,443,590 | 379,064,130 | 102,509,150 | 4.69 | 28.63 | 49.88 | 34.30 |

**Table 1.** Cont'd.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 36 | 4904 | 13.49 | -22.9 | 712,962,020 | 853,603,490 | 513,414,790 | 101,607,470 | 3.09 | 16.48 | 47.17 | 39.20 |
| 37 | 6265 | 11.72 | -15.76 | 14,093,160 | 26,892,370 | 119,705,220 | 1,551,360 | 1.68 | 47.59 | 103.23 | 294.72 |
| 38 | 6115 | 20.25 | 2.77 | 32,900,210 | 49,376,510 | 57,598,790 | 6,330,110 | 4.5 | 33.37 | 57.87 | 77.50 |
| 39 | 3452 | 23.31 | -62.21 | 68,028,510 | 196,592,300 | 135,881,130 | 12,134,340 | 12.07 | 65.40 | 43.41 | 55.63 |
| 40 | 3008 | 29.41 | -33.17 | 119,307,700 | 137,519,570 | 55,196,010 | 32,423,030 | 24.92 | 13.24 | 93.43 | 34.09 |
| 41 | 2354 | 14.35 | -47.34 | 371,124,310 | 704,250,750 | 1,190,964,120 | 62,029,290 | 7.32 | 47.30 | 55.91 | 116.08 |
| 42 | 2377 | 9.13 | -17.45 | 257,001,840 | 515,644,440 | 977,730,510 | 22,696,340 | 2.25 | 50.16 | 47.92 | 128.96 |
| 43 | 6244 | 16.89 | -56.39 | 138,474,630 | 206,963,270 | 228,593,050 | 23,023,550 | 9.23 | 33.09 | 51.45 | 72.65 |
| 44 | 2395 | 19.99 | -26.16 | 115,424,110 | 141,184,580 | 122,756,660 | 25,566,380 | 5.13 | 18.25 | 71.76 | 57.71 |
| 45 | 2337 | 12.37 | -4.97 | 369,390,680 | 428,102,650 | 232,577,380 | 45,146,040 | 1.45 | 13.71 | 41.91 | 34.78 |
| 46 | 6192 | 23.87 | -7.19 | 21,431,200 | 36,058,680 | 41,564,960 | 4,911,440 | 5.58 | 40.57 | 60.44 | 80.59 |
| 47 | 8081 | 19.28 | -12.43 | 34,114,250 | 40,848,580 | 33,235,240 | 5,419,660 | 7.38 | 16.49 | 54.48 | 51.49 |
| 48 | 2451 | 16.19 | -11.31 | 144,196,890 | 177,448,870 | 333,160,150 | 22,470,370 | 5.72 | 18.74 | 66.86 | 110.38 |
| 49 | 5483 | 25.52 | -57.39 | 73,740,850 | 182,410,580 | 94,106,260 | 17,225,790 | 8.03 | 59.57 | 49.66 | 43.26 |
| 50 | 6286 | 33.37 | -35.14 | 41,235,240 | 53,232,280 | 68,087,670 | 13,433,420 | 10.05 | 22.54 | 101.55 | 86.14 |

ranking methods may produce diverse results. Here therefore, arises an issue of how to handle the disagreement between the results using different ranking methods. To deal with this issue, varied ranking methods may bring out disparate yet equally useful implications, so that they can complement each other, in order to offer more profound information for decision makers.

## DISCUSSION

From the presentation of methodology and practical illustration, some implications for improving decision-making procedures can be derived. Firstly, the ways or aspects of measuring company performance can be roughly divided into financial analysis (for example, financial ratio analysis) and non-financial analysis (for example, efficiency evaluation analysis), as well as a combination of both. A company ranking denotes a kind of reputation ranking, no matter whether it is based on financial analysis or non-financial analysis. Thus, the Taiwan InfoTech 100 based on financial analysis is considered as a reputation ranking which can affect decision-making of both internal and external stakeholders of the company.

Secondly, financial analysis is traditionally considered as a suitable tool for assessing a company's financial and economic situation and guiding the decision-making processes of companies and financial markets (Castro and Chousa, 2006). Financial ratio analysis based on the DuPont ratio model is useful in enabling us to understand a company's operating efficiency, asset use efficiency, and financial leverage. It should be noted, however, that the Taiwan InfoTech 100 ranks companies, partly using financial ratios or elements of the DuPont ratio model, as well as using a subjective weighting, which adds a 50% weight on the evaluation criterion "total revenues". Once other financial ratios or elements of the DuPont ratio model were used, then the ranking order changes. This demonstrates that different evaluation criteria or weightings may generate diverse results.

Thirdly, the empirical study employs the super-efficiency DEA model and the GE scoring method as ranking tools to arrive at company rankings. The results of these two supplementary analyses illustrate that varied ranking methods can produce dissimilar results. To sum up, theresults of this empirical study support the notion that different ranking methods and criteria or weightings really bring out divergent results.

Hence, a sturdy decision-making procedure should not depend merely on a company ranking. Especially, there is need to carefully consider the meaning and impact of a company ranking, when it is generated by subjective weightings. More importantly, supplementary analyses are needed, in addition to consideration of an original reported company ranking, if a better informed decision-makings was to be arrived at. Hence, decision-makers can employ the proposed ranking tools to

**Table 2.** Data and efficiency scores for Taiwan InfoTech (51-100).

| Rank | Company code | ROE (%) | Shareholder return (%) | Equity (NT$ million) | Total Assets (NT$ million) | Total Revenues (NT$ million) | Net income (NT$ million) | EPS (NT$) | Debt Ratio (%) | DEA Score (%) | GE Score (%) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 51 | 3227 | 27.22 | -15.44 | 50,252,980 | 62,820,200 | 48,048,710 | 13,596,970 | 11.01 | 20.01 | 85.77 | 54.43 |
| 52 | 2474 | 15.72 | -19.57 | 294,537,370 | 357,880,680 | 37,514,490 | 43,463,840 | 7.25 | 17.70 | 48.13 | 12.40 |
| 53 | 2362 | 12.71 | -26.62 | 69,318,180 | 109,695,210 | 157,846,500 | 8,762,060 | 1.48 | 36.81 | 45.63 | 92.80 |
| 54 | 8099 | 18.91 | -9.15 | 9,679,760 | 16,429,920 | 35,585,470 | 1,755,000 | 2.61 | 41.08 | 66.51 | 142.55 |
| 55 | 2325 | 9.85 | -12.33 | 593,141,210 | 723,105,780 | 604,744,680 | 63,135,300 | 2.03 | 17.97 | 39.91 | 50.66 |
| 56 | 3376 | 23.23 | -15.99 | 56,812,460 | 84,588,630 | 35,866,160 | 11,856,130 | 9.57 | 32.84 | 55.89 | 33.67 |
| 57 | 3015 | 13.61 | -15.58 | 47,443,280 | 93,801,410 | 145,051,390 | 6,319,720 | 2.9 | 49.42 | 47.80 | 106.75 |
| 58 | 2312 | 0.51 | -20.08 | 190,574,940 | 288,287,270 | 226,000,580 | 1,056,920 | 0.07 | 33.89 | 17.61 | 47.28 |
| 59 | 2392 | 10.89 | -27.13 | 180,096,500 | 300,793,620 | 431,350,490 | 18,953,020 | 4.33 | 40.13 | 41.50 | 93.34 |
| 60 | 8046 | 17.96 | -36.98 | 355,146,110 | 398,949,460 | 372,988,130 | 66,472,100 | 10.86 | 10.98 | 67.25 | 58.21 |
| 61 | 5471 | 24.83 | -27.53 | 30,175,360 | 34,547,280 | 38,527,820 | 7,383,480 | 4.43 | 12.65 | 85.12 | 70.85 |
| 62 | 5371 | 12.69 | -17.55 | 186,321,020 | 296,128,170 | 400,672,010 | 23,184,490 | 3.2 | 37.08 | 43.96 | 87.60 |
| 63 | 6170 | 14.34 | 6.6 | 12,293,640 | 25,145,360 | 42,590,830 | 1,674,310 | 2.05 | 51.11 | 50.74 | 117.75 |
| 64 | 6125 | 17.87 | -30.34 | 43,599,780 | 91,226,350 | 52,834,580 | 7,348,800 | 4.88 | 52.21 | 37.39 | 44.46 |
| 65 | 2313 | 0.92 | -15.66 | 163,516,610 | 277,536,960 | 187,008,890 | 1,473,530 | 0.12 | 41.08 | 15.14 | 42.59 |
| 66 | 2485 | 26.35 | -34.36 | 62,911,760 | 82,690,510 | 96,496,380 | 15,543,540 | 4.89 | 23.92 | 77.38 | 76.80 |
| 67 | 3042 | 17.72 | -33.33 | 56,253,140 | 80,912,460 | 65,473,400 | 9,518,170 | 3.56 | 30.48 | 49.56 | 54.54 |
| 68 | 2345 | 6.46 | -18.82 | 65,497,570 | 92,122,730 | 150,897,840 | 4,087,870 | 0.75 | 28.90 | 41.39 | 98.09 |
| 69 | 3034 | 19.73 | -32.28 | 183,595,630 | 256,953,640 | 261,762,100 | 35,325,180 | 6.18 | 28.55 | 58.87 | 67.28 |
| 70 | 3389 | 12.01 | -3.18 | 7,118,260 | 17,200,390 | 53,446,650 | 783,800 | 1.42 | 58.62 | 75.27 | 221.92 |
| 71 | 6285 | 12.21 | -34.08 | 59,680,370 | 104,907,730 | 176,283,770 | 7,216,450 | 3.11 | 43.11 | 48.13 | 111.11 |
| 72 | 2301 | 7.4 | -17.08 | 577,904,090 | 1,047,124,770 | 1,244,616,480 | 44,194,330 | 2.01 | 44.81 | 32.77 | 79.03 |
| 73 | 6152 | 10 | 12.58 | 21,846,870 | 30,214,060 | 45,141,610 | 2,113,380 | 1.62 | 27.69 | 43.59 | 90.56 |
| 74 | 3323 | 19.78 | -30.64 | 20,740,430 | 56,284,090 | 87,550,050 | 3,866,210 | 4.61 | 63.15 | 57.01 | 118.06 |
| 75 | 2393 | 13.56 | -36.24 | 97,750,550 | 163,144,590 | 110,427,010 | 13,584,080 | 3.73 | 40.08 | 36.57 | 47.39 |
| 76 | 3367 | 16.44 | -40.31 | 133,919,240 | 191,497,320 | 625,662,180 | 21,940,990 | 4.29 | 30.07 | 87.72 | 198.51 |
| 77 | 2331 | 1.45 | -17.02 | 221,373,590 | 338,710,950 | 699,714,990 | 3,236,930 | 0.27 | 34.64 | 46.41 | 125.15 |
| 78 | 2347 | 12.11 | -33.52 | 278,034,000 | 487,363,330 | 474,328,030 | 32,927,690 | 2.73 | 42.95 | 36.23 | 66.05 |
| 79 | 2441 | 16.66 | -22.45 | 96,807,830 | 106,330,190 | 83,338,770 | 16,088,280 | 3.1 | 8.96 | 60.19 | 48.90 |
| 80 | 8016 | 16.64 | -48.65 | 25,987,120 | 35,606,690 | 64,019,130 | 4,720,760 | 4.2 | 27.02 | 67.73 | 111.35 |
| 81 | 8131 | 12.1 | -37.17 | 78,902,710 | 151,806,770 | 101,772,300 | 10,142,440 | 2.29 | 48.02 | 32.33 | 48.33 |
| 82 | 6281 | 18.86 | -33.86 | 24,776,810 | 43,636,770 | 139,544,120 | 4,701,000 | 3.56 | 43.22 | 86.11 | 210.12 |
| 83 | 1785 | 11.68 | -47.88 | 67,039,010 | 109,184,840 | 189,312,000 | 7,635,770 | 3.14 | 38.60 | 48.36 | 111.42 |
| 84 | 6176 | 9.6 | 1.33 | 133,360,070 | 150,260,250 | 95,876,020 | 12,555,930 | 3.13 | 11.25 | 36.01 | 38.19 |
| 85 | 2314 | 6.72 | -20.73 | 50,884,540 | 78,396,580 | 76,210,260 | 3,542,230 | 0.85 | 35.09 | 28.30 | 61.52 |

**Table 2.** Cont'd.

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 86 | 2365 | 19.24 | -29.86 | 41,141,610 | 60,817,350 | 94,915,480 | 8,486,470 | 3.03 | 32.35 | 66.86 | 101.16 |
| 87 | 2430 | 9.06 | -25.62 | 62,763,890 | 137,432,590 | 308,839,240 | 5,530,890 | 1.75 | 54.33 | 55.00 | 156.34 |
| 88 | 3481 | 5.06 | -53.98 | 964,243,300 | 1,517,032,790 | 1,592,770,110 | 48,509,500 | 1.56 | 36.44 | 27.23 | 65.95 |
| 89 | 2409 | 7.31 | -35.36 | 2,900,589,710 | 5,301,018,840 | 4,219,574,400 | 212,673,860 | 2.5 | 45.28 | 25.50 | 53.85 |
| 90 | 6118 | 3.64 | -26.57 | 9,866,800 | 36,281,560 | 110,317,010 | 355,860 | 0.41 | 72.80 | 89.36 | 238.29 |
| 91 | 8008 | 6.81 | -31.8 | 193,709,090 | 264,609,550 | 315,557,350 | 13,319,180 | 1.53 | 26.79 | 33.70 | 71.60 |
| 92 | 3189 | 12.38 | -28.19 | 178,442,670 | 200,006,060 | 122,149,830 | 21,983,800 | 4.93 | 10.78 | 44.28 | 38.04 |
| 93 | 2489 | 9.35 | -39.01 | 103,685,360 | 280,736,680 | 613,144,700 | 9,647,410 | 1.54 | 63.07 | 54.67 | 161.15 |
| 94 | 2414 | 8.44 | -11.24 | 28,517,830 | 46,830,030 | 120,769,170 | 2,434,550 | 1.15 | 39.10 | 61.62 | 163.00 |
| 95 | 2379 | 5.55 | -35.5 | 152,279,620 | 180,937,570 | 167,444,020 | 8,810,330 | 1.88 | 15.84 | 28.45 | 52.81 |
| 96 | 3037 | 8.58 | -42.7 | 282,244,630 | 503,116,210 | 371,259,460 | 24,264,580 | 2.22 | 43.90 | 26.75 | 50.19 |
| 97 | 3010 | 11.52 | -46.36 | 62,747,300 | 114,106,590 | 174,247,900 | 7,284,770 | 3.21 | 45.01 | 44.78 | 102.28 |
| 98 | 3026 | 9.09 | -34.01 | 73,061,270 | 107,272,240 | 127,774,540 | 6,744,970 | 2.41 | 31.89 | 36.69 | 74.40 |
| 99 | 8299 | 10.8 | -35.64 | 52,638,620 | 73,640,790 | 188,563,140 | 5,539,840 | 4.45 | 28.52 | 65.86 | 153.34 |
| 100 | 2311 | 8.51 | -37.59 | 696,719,940 | 1,239,312,460 | 484,510,170 | 61,600,520 | 1.14 | 43.78 | 21.68 | 28.11 |

reduce the risk of mistaking ordinary companies for celebrity firms (Rindova et al., 2006; Fombrun, 2007).

## IMPLICATIONS AND CONCLUSIONS

Achieving a good company ranking is an effective way of gaining corporate reputation, and a superior corporate reputation enables a company to keep its business competitive. This is primarily because corporate reputation is a means of attracting attention, and thus resources, at a lower cost. Indeed, company rankings can leverage ordinary companies into celebrity firms, and this greatly affects the decision-making procedures of both internal and external company stakeholders. The need to carefully apply information on company ranking is, hence, an important issue. To appropriately handle this issue, people, must be sufficiently aware that diverse evaluation methods, criteria, or weightings may lead to dissimilar results. It is essential that there is need to carefully consider the meanings and impacts of a company ranking, and that supplementary analyses performed.

With regard to the aforementioned issue, this paper suggests using the super-efficiency DEA model and the GE scoring method to implement supplementary analyses. The task of conducting an unartificial company ranking is a problem of the MCDM type. Effectively solving this MCDM problem requires a set of complex factors as multiple evaluation criteria to be considered, as well as applying proper MCDM methods. Among the various available MCDM methods, these two suggested methods have the advantage that, they can be used as ranking tools without the need of subjective judgements – judgments that demand experts to express their opinions in terms of criterion selection and weighting. The author thus uses these methods in the empirical study of the 2009 Taiwan InfoTech 100, which is presented as an application of the proposed methodology. The results of the empirical study support the notion that different evaluation methods and criteria or weightings result in divergent conclusions, and thus, provide some implications for improved decision-making procedures.

This paper is successful in the task of interpreting a company ranking with the proposed methodology, as well as contributing to the extension of practical applications of combining the DEA and the GE in applying company rankings. Importantly, the proposed solution can be further extended and developed as business models, offering a valuable information service which may enable corporate stakeholders to arrive at more sensible decision-making procedures. For example, Google or Yahoo might conduct both a DEA-based ranking and a GE-based ranking, "DEA-InfoTech 100" and "GE-InfoTech 100", as supplementary analyses to be

compared with other available company rankings

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