ACCOUNTING FOR COMPANY REPUTATION: VARIATIONS ON THE GOLD STANDARD

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ABSTRACT

A recent paper by Gold (2003) presents a system-dynamic-based approach to the design of business simulations. In it, he argues that the focus of simulation design efforts have mostly been carried out at the subsystem level, developing independent algorithms that follow inconsistent logic, and therefore do not lend themselves to integration into a single, dynamically interactive model. To address this, he draws on the economic theory of the firm to develop and test a system of interacting algorithms that gives equal emphasis to both demand and supply factors. Most important, it provides a common, theoretically anchored platform for integrating potentially conflicting functional algorithms. This paper tests the robustness of this approach by using Gold's model as a vehicle for simulating the effects of company reputation, a phenomenon that has emerged from a totally different (management and marketing) research tradition.

INTRODUCTION

In a recent paper presented at the annual conference of the Association for Business Simulation and Experiential Learning, Gold (2003) presents a comprehensive, system-dynamic-based model for developing simulation games. In presenting his rationale, he draws on Goosen's (1981) call for developing a less intuitive, more scientific approach to simulation design and development. He suggests that developers responded to Goosen's challenge by focusing on issues relating to the design of subsystems rather than the overall structure and interactive structure of the game. For instance, the work published on simulation algorithms between 1982 and 1988 focused on issues of demand, marketing, and finance (Gold and Pray 2001). The focus then shifted to the supply side of the model, following the lead of Thavikulwat (1989).

Gold's thesis is that, notwithstanding the contribution made by the more systematic and scientific approach to the development of simulation algorithms, the efforts lacked a unified theoretical base. Rather, as Goosen, Jensen, and Wells (1999) point out, the efforts have reflected the individual biases and disciplinary conventions of the various researchers. This, in turn, has tended to create conflicting theories and procedures, thus inhibiting the integration of functional subsystem designs into larger systems of simulation algorithms.

In order to address this problem, Gold suggests a systems level design based on the well-accepted economic theory of the firm. Implicit in his approach is the establishment of a standard platform – a kind of "Gold standard," as it were -- from which future simulations may be constructed, simply by modifying the individual components of the model required to address the specific phenomena being modeled. For instance, if gamers were interested in modeling the effect of *company reputation*, they would only need to identify those variables within Gold's model that would be affected by reputational considerations, and make the appropriate adjustments.

The purpose of this paper will be to put the "Gold standard" to the test by addressing the particular issue of company reputation. The phenomenon of company reputation is particularly interesting in itself, as suggested by Cannon and Schwaiger (2003). However, it also provides an excellent test for the "Gold standard." First, it addresses a phenomenon that is posited to have a pervasive influence on virtually every aspect of a firm's performance, affecting multiple, interactive aspects of the simulation model. Second, it has emerged from a totally different research tradition (management and marketing), with virtually no effort to integrate it into the economic theory of the firm.

THE CONCEPT OF COMPANY REPUTATION

While *corporate reputation* has grown up in the management-strategy rather than the marketing tradition (Fombrun and Shanley 1990), Cannon and Schwaiger (2003) argue that it is closely aligned to the marketing concept of *brand equity* (Aaker 1991, 1996). The difference is only in the entity in which the equity is invested. We will use the term *company reputation* to represent the more marketing-oriented notion of *reputation* as the equity invested in the overall name of the enterprise. Whereas *corporate reputation* connotes an application to large, corporate entities, *company reputation* suggests that the concept can be applied to any organization, regardless of its size or complexity.

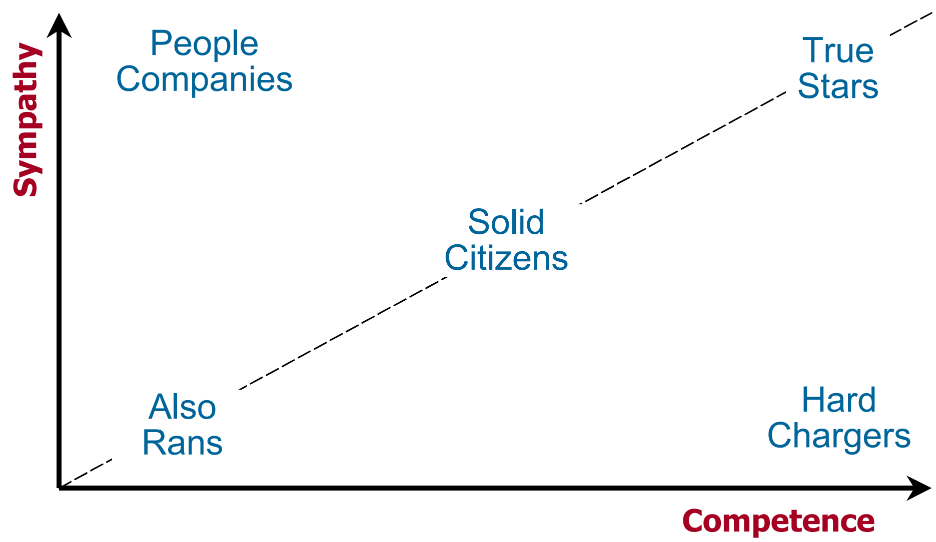
Company reputation represents an extension of traditional marketing theory to the supply as well as the demand elements of the firm. This is consistent with the view of marketing as the study of directed social exchange (Bagozzi 1975), or in economic terms, transactions (Williamson 1975). Indeed, the value of *company reputation*, or *company brand equity*, can be seen in its ability to facilitate marketing exchanges, or lower

Best Paper Award Recipient 2004 - Simulation Track transaction costs with all the firm's existing and potential stakeholders.

Company reputation is especially important in today's highly competitive marketing environment. Companies have traditionally been able to sustain high profit margins, facilitated by strategies of product differentiation and market segmentation. However, today, companies are having a hard time differentiating their products, even with large research and development budgets. Any innovation is quickly copied by the competition. Similarly, any company that is successful in identifying and exploiting underserved segments is also copied. To address this situation, marketers are turning to a strategy of relationship marketing, where they rely on lower transaction costs rather than perceived product superiority to win customer support. Cannon and Schwaiger extend this concept to transactions with a broad range of stakeholders, from customers to employees to government regulators.

The concept of lower transaction costs has immediate implications for simulation design. The general design principle is simple: A strength of a company's reputation will lower transaction costs by some percentage, the actual amount of which would depend on the industry, the nature of the transaction, and the specific characteristics of the stakeholder.

Exhibit 1:
Classifying a Company's Reputational Position



From Hugh M. Cannon and Manfred Schwaiger. "Incorporating 'Company Reputation' into Total Enterprise Simulations," *Developments in Simulation and Experience Learning*, volume 30 (2003), p. 292. Reprinted in The Bernie Keys Library, 4th edition [Available from http://ABSEL.org]

Stakeholder characteristics presents a particularly important design concept in *company reputation*. Most discussions of *corporate,* or *company, reputation* see it as a uni-dimensional construct, derived from a number of financial, management, customer-oriented, and ethical drivers (Fombrun and Shanley 1990). However, Cannon and Schwaiger (2003) present evidence of two separate dimensions – *sympathy* and *competence* – relating to the more human aspects of a company versus its market performance. If there are two dimensions of reputation, we would expect corresponding differences in stakeholder preference, some preferring companies that show greater *sympathy*, and others preferring companies with greater *competence*. Exhibit 1 portrays this concept, suggesting five general reputational positions, the impact of which is likely to vary, depending on stakeholder preference.

We can conceive of a two-dimensional reputational index, where a company is rated from "0" to "1" on each of the two dimensions, where "1" is the highest conceivable index, and "0" the lowest. In this manner, every company can be mapped into some position of the matrix shown in Exhibit 1. The strength of the reputational effect on a given variable with respect to a given market segment would be

$$R_{ijk} = RC_i \, RIC_{jjk} + RS_i \, RIS_{jjk} \qquad (1)$$

Where

R_{ijk} = effective reputational value of firm i for segment j and stakeholder group k
RC_i = perceived reputation for *competence* of firm I
RIC_{jjk} = relative value of *competence* for segment j and stakeholder group k
RS_i = perceived reputation for *sympathy* of firm I
RIS_{jjk} = relative value of *sympathy* for segment j and stakeholder group k (equal to 1- RIC_{jjk})

We will follow the common assumption in the literature that perceived reputation is constant across stakeholder types and segments, or groups, within each type. By contrast, the relative value of *competence* and *sympathy* will vary by both stakeholder type and group. For instance, we would expect that government regulators (one type of stakeholder) would tend to favor companies with a relatively high reputation for *sympathy*, while investors (another type of stakeholder) would tend to place more value on *competence*. However, among government regulators, there will be a group, or segment, of those who place relatively more value on *competence*. Similarly, among investors, there will be those who place relatively more value on *sympathy*. The combined value of the two attributes is constrained to equal 1.0, thus preserving the "0" to "1" scale for R_{ijk}.

The issue of segmentation is somewhat problematic in the context of multiple stakeholders. The economic theory of the firm only addresses consumer and labor markets. While it can be modified to accommodate a broader range of stakeholders, these stakeholders would generally not reflect the same segmentation structure as consumer markets. This suggests that a game would need a different segmentation scheme for each type of stakeholder, where the segments differ in their relative preference for *sympathy* versus *competence* in their response to *company reputation*. In Gold's model, some of the variables require reference to both consumer and stakeholder segments simultaneously. Therefore, we will use the index "j" to represent consumer segments and "k" to represent segments, or groups, within other stakeholder types. (In order to avoid confusion, we will use the term "segments" to represent consumer segments and "groups" to represent segments within other stakeholder types).

In the remaining sections of this paper, we will address two key issues: First, how do we model the effects of company reputation? That is, given the reputational index described in equation 1, how will it effect the various performance aspects of a simulated firm? Second, how do we derive a reputational index from company decisions? This addresses the underlying purpose of the modeling company reputation, which is to enable game-players to consider it's effects when formulating their decision-making strategy.

KEY ISSUE I: MODELING THE EFFECTS OF COMPANY REPUTATION

Cannon and Schwaiger (2003) argue that *company reputation* benefits a company by lower transaction costs with its various stakeholders. Specifically, they list a number of areas in which this might benefit a firm's performance, as suggested in the following list. We will address each of them areas in subsequent sections.

:

- *Lower costs for customer acquisition and retention* (customer stakeholders)
- *Lower distribution costs* (distributor stakeholders)
- *Lower supplier prices* (supplier stakeholders)
- *Lower cost of employee acquisition and retention* (employee stakeholders)
- *Lower cost of capital* (investor stakeholders).
- *Lower costs of lobbying and government relations* (governmental stakeholders)
- *More positive word-of-mouth advertising* (general public)
- *Lower cost of advertising and promotion* (all stakeholders)
- *Reduced risk of litigation* (all stakeholders)

CUSTOMER ACQUISITION AND RETENTION

Customer stakeholders are the easiest to address. Gold suggests that a firm's market share is a function of a firm's price (p_{ij}), marketing expenditures (m_{ij}) and the difference between actual product attributes and the ideal for segment i (d_{ij}). The effect of *reputation* can be handled in two ways. One would be to treat *reputation* as a product attribute, incorporating it into the calculation of d_{ij}. On the surface, this would appear to make sense, especially when we view reputation in terms of a positioning map, as illustrated in Exhibit 1. However, reputation does not lend itself to an "ideal position." The more you have, the better. To illustrate, consider two companies, one with a perfect 1.0 reputation on both *sympathy* and *competence* (a "true star" in the parlance of Exhibit 1) and another with a 1.0 reputation on *sympathy* and a 0.0 on *competence*. Now, consider a stakeholder group who places all its value on *sympathy* as opposed to *competence*. The stakeholder group does not place a negative value on *competence*, only a zero value. Therefore, members of the group should rate the two companies as having the same quality of reputation, even though they occupy very different positions on the reputational map, presumably corresponding to two different ideal points. The "product attribute" approach would yield a misleading result.

The second, and better, way of addressing *company reputation* would be to use it as a kind of marketing "intensifier," allowing it increase the effective marketing expenditures. This can be accomplished in Gold's model by substituting effective marketing expenditures (em_{ij}) for m_{ij}, using equations (2) and (3):

$$em_{ij} = (1 + ar\, RI_{ij})\, m_{ij} \tag{2}$$

$$RI_{ij} = (R_{ij} - R_j) \tag{3}$$

Where

RI_{ij} = Effective reputational impact on segment j for firm I

R_j = average effective reputational value for all firms competing in segment j

ar = Scaling parameter representing the relative impact reputation can have on effective marketing expenditures

Note that reputational impact (RI_{ij}) is based on the value of a company's reputation, as compared to other companies competing in the same segment. This provides a strategic component to the game, where decision makers are rewarded for focusing on segments in which they are likely to have a reputational advantage. Thus, if the firm has positioned itself as a "people company," it will do best to not only focus on segments that value *sympathy* rather than *competence*, but also to look for segments where the major competitors are relatively weak along the *sympathy* dimension.

We assume that the impact of reputation will help determine market share, but not the overall demand for the industry. Therefore, it figures only in the firm's demand algorithm. The scaling parameter (ar) will depend on the relative importance of reputation in the overall marketing effectiveness of the firm. A value of "1.0" would mean that a company whose reputation is twice the industry average would double its effective marketing budget. In practice, variations in ratings of company reputation would never yield an RI_{ij} as high as 100%, and generally not above 20%. A scaling value (ar) of 1.0 would not be unrealistic.

DISTRIBUTION COSTS

Gold's model does not make any specific provision for distribution costs. As a rule, distributors would be compensated by margins taken after paying the manufacturer wholesale prices. Additional promotional incentives and sales costs would be considered marketing expenditures (m_{ij}), suggesting that the effect of *company reputation* on distribution stakeholders would be incorporated the estimate of effective marketing expenditures (em_{ij}).

Again, a scaling value (ar) of 1.0 appears to be reasonable. However, in the case of a new product, company reputation might play an important role in winning initial distribution acceptance, in which case the value of the scaling parameter might be higher. In the absence of any empirical evidence, we would estimate that it could be as high as 1.20.

SUPPLIER PRICES

Presumably, company reputation would make a company more desirable to suppliers in two ways. Both are derived from the notion that suppliers would naturally pursue a client with a good reputation because of the prestige it adds to their client list. This would reduce their own marketing costs in winning other clients. The effect of reputation would be reflected, first, in lower prices, as suppliers seek to win and hold the company as a client. Second, it would be reflected in lower administrative costs, resulting from decreases in the normal "friction" that accompanies tepid supplier enthusiasm. Gold's model contains a price-of-materials (P_m) variable. It does not include a variable representing the administrative costs associated with the purchasing process. Notwithstanding the conceptual distinction between the two effects, both can be addressed by simply adjusting the price of materials to reflect the impact of company reputation, creating an effective price (EP_m), as shown in equation (4).

$$EP_m = \sum_j \left[(M_{ijk} / \sum_k M_{ijk}) \, P_m / (1 + br\, RI_{ijk}) \right] \qquad (4)$$

$$RI_{ijk} = (R_{ijk} - R_{jk}) \qquad (5)$$

Where

M_{ijk} = Amount of materials supplied by supplier group k for use by firm i in products for segment j
RI_{ijk} = Effective reputational impact on stakeholder group k for segment j and firm i
R_{jk} = Average effective reputational value for all firms on stakeholder group k for segment j
br = scaling parameter representing the relative impact reputation can have on the price of materials

To illustrate, we posit two groups of supplier stakeholders (k), each varying in their relative preference for *sympathy* versus *competence* in company reputation. Equation (4) represents a weighted average effective price of materials delivered by supplier groups (k) for use for products sold in the various segments (j). For each segment and supplier-group combination, the price of materials (P_m) is discounted, dividing it by the reputational impact (RI_{ijk}). Thus, if RI_{ijk} is 20% above the average for companies in the industry, the discounted price would be (1 / 1.2 =) 83% of the original.

Developing two supplier groups provides an interesting opportunity for modelers to address the emerging trend for companies to choose business partners (clients, in this case) who reflect their own company values. For instance, a supplier might offer price concessions to a high-reputation company in an effort to be associated with a company that is known for its responsiveness to social issues.

Note that reputational impact (RI_{ijk}) is based on the value of a company's reputation compared to other companies using the same suppliers. As with consumer segments, this provides a strategic component to the game. Players are rewarded for focusing on suppliers for which they are likely to have a reputational advantage. A company should obviously seek out suppliers who share their reputational orientation. But the advantage of doing this decreases as other companies with a similar reputational orientation do the same. Even if most suppliers are looking for clients with high reputations for *competence*, if most of the companies using these suppliers are high along the *competence* dimension, a company with a strong reputation for *sympathy* might be able to secure better price concessions by working with the smaller number of suppliers who are positively disposed toward *sympathetic* clients.

The scaling parameter (br) is analogous to the consumer scaling parameter (ar). It depends on the relative importance of reputation in the overall price of materials for the firm. A value of “1.0” would mean that a company whose reputation is twice the industry average would effectively cut its price in half. This would virtually never happen. We noted earlier, RI_{ij} might get as high as 20%. Generally, we would expect supplier prices to be less responsive to reputational influence than consumer sales. This is because most of the variation in industrial prices is driven by such factors as purchase volume, volume guarantees, and the overall competitiveness of the industry. A reasonable range of values for the scaling parameter (br) might be between .05 and .25.

EMPLOYEE ACQUISITION AND RETENTION

If company suppliers might have differing preferences for a company’s reputation regarding *sympathy* versus *competence*, this would generally be much more true for employees. A person’s employer speaks a great deal about the person. The model assumes that employee acquisition and retention can ultimately be translated into a dollar value. That is, if the wages are high enough, a company can hire and retain anyone. However, a person will make major wage concessions to work for a company whose reputation is compatible with his or her self-image, values, and lifestyle. This will be reflected in a lower cost of labor.

Gold includes the cost of labor (P_l) in his cost equation. Following the same basic pattern used in addressing suppliers, we can adjust labor costs to derive an effective price of labor (EP_l) as shown in equation (6).

COST OF CAPITAL

Gold’s cost of capital (P_k) parallels the cost of materials and labor. It too can be easily adapted to address company reputation, as suggested in equation (7).

$$EP_l = \sum_j [L_{ijk} / \sum_k L_{ijk} P_l / (1 + cr\, RI_{ijk})] \qquad (6)$$

Where

L_{ijk} = Amount of labor supplied by labor group k for use by firm I in products for segment j
cr = scaling parameter representing the relative impact reputation can have on the price of labor

The scaling parameter (cr) is directly analogous to parameters “ar” and “br” used in equations (2) and (4). We suggest a value of 1.00. However, in cases where the simulation seeks to emphasize the role of value congruency in the labor market, the value might be set as high as 1.20.

$$EP_k = \sum_j [K_{ijk} / \sum_k K_{ijk} P_k / (1 + dr\, RI_{ijk})] \qquad (7)$$

Where

K_{ijk} = Capital equipment and facilities acquired by firm i, financed by investor types k in service of products for segment j.
dr = scaling parameter representing the relative impact reputation can have on the cost of capital.

The scaling parameter (dr) is directly analogous to parameters “ar”, “br”, and “cr”, used in equations (2), (4), and (5). Again, we suggest a value of 1.00. As in the case of labor costs, however, in cases where the simulation seeks to emphasize the role of value congruency in the capital market, the value might be set as high as 1.20.

COST OF LOBBYING AND GOVERNMENT RELATIONS

While Gold’s model does not account for lobbying or government regulations, such factors would not be hard to address. For instance, we might conceive of a model where simulated events could be announced that would have a negative effect on the firm’s performance. Game players might be sent a notice that the Environmental Protection Agency was taking a hard line on waste disposal practices, and that many of the practices that had been condoned over the years were now subject to potential penalties (E_k). The likelihood of the penalties being imposed (P_k) might be dependent on any number of factors, such as investments in environmentally sound practices, updating equipment to more pollution-free models, and governmental lobbying. The expected cost of Government action (EE_k), then, is the cost adjusted by the probability of occurrence. *Company reputation* would act to lessen the probability of a negative event happening, as suggested by equations (8) and (9).

$$EE_k = E_k \, EP_k \tag{8}$$
$$EP_k = P_k / (1 + er \, RI_{ik}) \tag{9}$$

Where

E_k = cost of Government action
P_k = probability of Governmental action k taking effect
EP_k = effective, or adjusted, probability of Government action k taking effect
RI_{ik} = effective reputational impact on the probability of Governmental action k taking effect
er = scaling parameter representing the relative impact reputation can have on the probability of Government action

The actual financial consequences of any Governmental actions might be addressed in two ways: First, the firm might choose to set aside contingency funds, thus lowering profits by the expected value of the loss (EE_k). Second, the game could impose periodic costs, based on the probability that event "k" would occur. Either approach would reduce profit by EE_k, as determined by equation (8) and would utilize *company reputation* in the same manner.

WORD-OF-MOUTH ADVERTISING

Gold's model does not make any specific provision for word-of-mouth advertising. However, in the absence of any specific algorithm to simulate word-of-mouth advertising, its effect would be incorporated in the estimate of effective marketing expenditures (em_{ij}), as discussed in equation (2).

COST OF ADVERTISING AND PROMOTION

The notion that *company reputation* might lower the cost of advertising and promotion again grows out of the logic of equation (2). Reputation acts as a kind of marketing budget multiplier, producing better results for the same expenditure of marketing funds.

RISK OF LITIGATION

Risk of litigation can be handled in the same manner as Government regulation, which was described in our discussion of equations (8) and (9). Litigation would constitute an "event," just as a saw with Governmental penalties.

KEY ISSUE 2: DERIVING A REPUTATIONAL INDEX FROM COMPANY DECISIONS

Our discussion so far presumes that a simulated company already has a *company reputation*. But, for the simulation to make sense, the reputation must be earned by the simulated decisions of the company. Exhibit 2 presents a structural analysis of the survey items from which Cannon and Schwaiger (2003) developed their reputational model, indicating the actual survey items from which the various reputational characteristics (*attractiveness*, *responsibility*, *quality*, and *performance*) were derived. These reputational characteristics, in turn, are what drive a company's reputation for *sympathy* and *competence*.
From Hugh M. Cannon and Manfred Schwaiger. "Incorporating 'Company Reputation' into Total Enterprise Simulations," *Developments in Simulation and Experience Learning*, volume 30 (2003), p. 291. Reprinted in The Bernie Keys Library, 4th edition [Available from http://ABSEL.org]

Exhibit 2 suggests a number of items that might be used in designing operational indices of *company reputation*. In the following section, we will develop a method for addressing *attractiveness*, *responsibility*, *quality*, and *performance* through Gold-standard compatible game decisions, thus demonstrating the viability of Gold's standardized model. This will also provide an operational model for incorporating company reputation into an enterprise simulation.

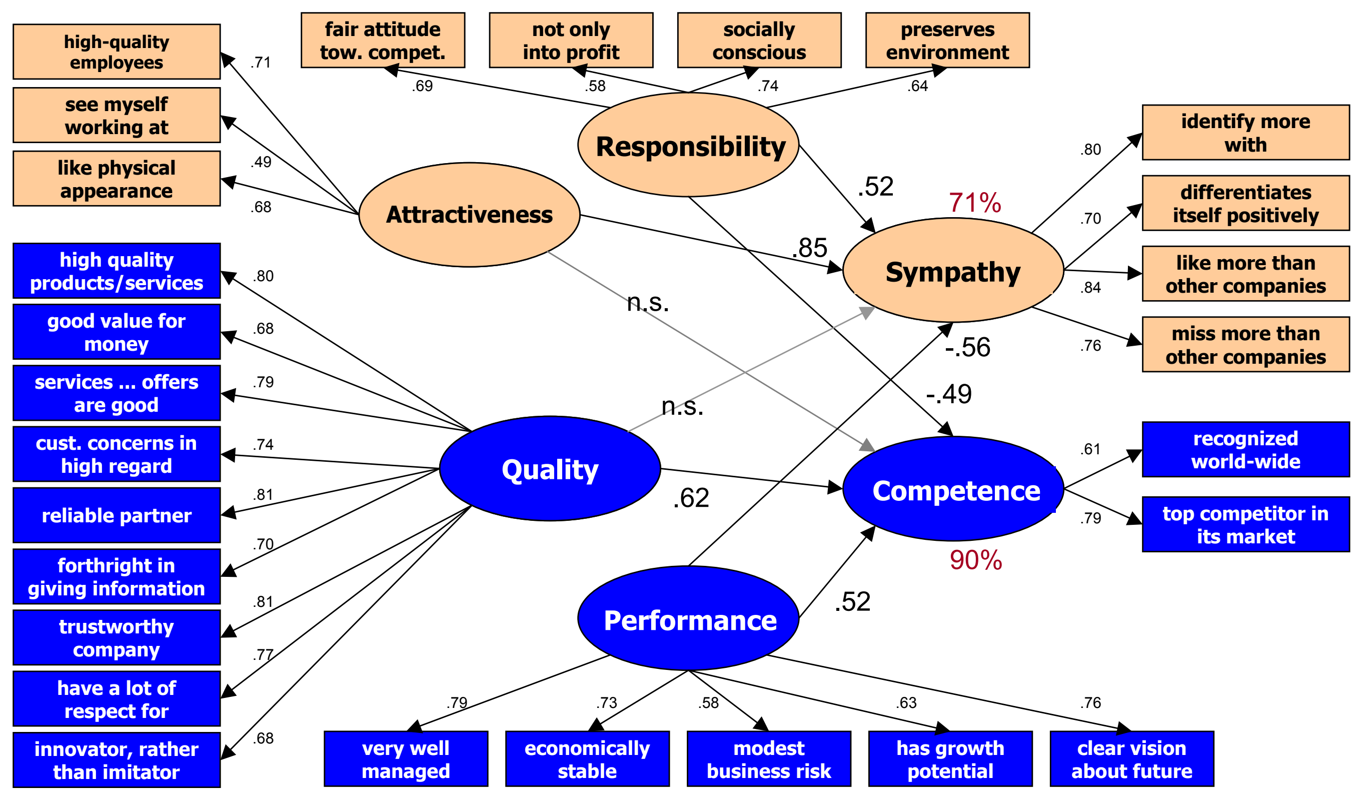
For convenience, we will rate reputation on a five-point scale, with a value of three representing the average reputation for companies within the industry. We may treat the actual reputation for *sympathy* (RS_i) and *competence* (RC_i), introduced in equation (1), as averages of *attractiveness* and *responsibility*, *quality* and *performance*, respectively. This is show in equations (10) and (11).

$$RS_i = a \, (RA_i + RR_i)/2 + (1 - a) \, RS_{i,t-1} \tag{10}$$
$$RC_i = a \, (RQ_i + RP_i)/2 + (1 - a) \, RC_{i,t-1} \tag{11}$$

Where

RA_i = *attractiveness* rating of company i on a five-point scale
RR_i = *responsibility* rating of company i on a five-point scale
RQ_i = *quality* rating of company i on a five-point scale
RP_i = *performance* rating of company i on a five-point scale
a = parameter representing the lagged effect of prior reputation

Exhibit 2:
A Structural Analysis of Company Reputation



ATTRACTIVENESS

In general, the *attractiveness* factor appears to be the degree to which a company provides an attractive place to work. Exhibit 2 suggests that these might be a function of such things as *turnover, employee quality,* and *work environment*. To address these items, we may create a new category of variable cost -- employee training and maintenance (TM_i) – expressed as a percentage of the price of labor (P_l). This would result in a modification of equation (6), as shown in equation (12).

$$EP_l = (1 + TM_i) \sum_j \left[L_{ijk} / \sum_k L_{ijk} P_l / (1 + cr\, RI_{ijk}) \right] \qquad (12)$$

Where

EP_l = cost of labor from equation (6), adjusted to reflect the cost of employee training and maintenance used to manipulate company *attractiveness*
TM_i = employee training and maintenance expenditure ($-fr < TM_i < fr$)
fr = parameter denoting the allowed range of TM_i

A reasonable percentage of price range (fr) for TM_i would likely be somewhere between 0% and 10%, depending on the industry and company strategy. A negative training and maintenance means that a company would provide below average training and support, exploiting the cheapest possible labor in order to achieve lower wages. This, of course, would have a negative effect on both the effective cost of labor (EP_l) and the *attractiveness* (RA_i) of the company.

Equation (12) determines the cost of implementing a program to achieve company *attractiveness*. However, we still need to establish the level of *attractiveness* the program achieves (RA_i). As we have noted, a game player may actual decrease *attractiveness* by cutting labor costs, in order to achieve higher profits. Of course, there is a limit to how much a manager can squeeze out of labor, suggesting a lower limit for TM_i. Theoretically, there is no corresponding upper limit. Added expenditures for TM_i would simply reach diminishing returns as they approached a maximum effective expenditure, ceasing to increase *attractivenss*. In practice, a similar effect can be achieved by simply constraining TM_i to an effective range ($-fr < TM_i < fr$), such as plus or minus 10% of price. Taking this approach, the impact on *sympathy* can be represented adequately by equation (13). If the maximum value of TM_i (i.e. the value of fr) is 10%, and the company invests 5% of labor costs on training and maintenance, the company will realize half of the possible increase in *attractiveness* relative to the average firm (defined as having a *attractiveness* of 3), or an *attractiveness* value (RA_i) 4 out of 5.

$$RA_i = 3 + 2\,(TM_i / fr) \tag{13}$$

Where

RA_i = company i's *attractiveness* on a five-point scale

RESPONSIBILITY

The *responsibility* characteristic appears to address issues of ethics and social responsibility, including issues such as *monopolistic abuses*, *taking advantage opportunities for short-term profit at the expense of long-term benefit to multiple stakeholders*, *social consciousness (corporate philanthropy and citizenship)*, and *environmental consciousness*. Halpin and Biggs (2000) suggest that a simulation might present students with a series of incidents, providing specific response alternatives, the selection of which provides quantitative input into the actual simulation algorithm. This is illustrated in equations (14) and (15). Equation (14) represents the total effect of the company's decisions on its reputation for *responsibility* (RR_i), while equation (15) represents the monetized cost of these decisions.

$$RR_i = \Sigma\, RV_{ik} / n \tag{14}$$
$$EC_i = \Sigma\, EC_{ik} \tag{15}$$

Where

RR_i = company i's *responsibility* on a five-point scale
RV_k = *responsibility* value of incident k for company i (also on a five-point scale, but weighted so that incidents with values between "4" and "5" or "1" and "2" count as incidents)
n = total number of incidents players must address, adjusted upward to account for incidents counted twice due to their *responsibility* values
EC_{ik} = monetized cost to company i of incident k, treated as a fixed cost in Gold's model

Note that the *responsibility* value of an incident (RV_k) is not dependent on the incident itself, but on the decision game players make to deal with the incident. This assumes that all incidents are equal in merit and significant enough to merit players' careful consideration. (Incidents of varying importance could be developed as a means of testing players' ability to assess the degree of environmental opportunity or threat, but we have not addressed this possibility here). The double counting of high- or low-value incident decisions reflects the assumption that incidents representing very high or very low levels of *social responsibility* are likely to stand out and have more influence on a company's reputation than ones that do not.

The monetized, or economic, cost of incident decisions must be established by the game designer, providing an opportunity for strategic trade-offs between *responsibility* and short-term profit. The amount and nature of these costs must be explained in the incident descriptions presented to the players, following the pattern illustrated by Halpern and Biggs. The amount may include intangible as well as tangible costs, including things such as risks associated with outcome uncertainty, inefficiencies created by the development of new work procedures, and confusion coming from potentially mixed cultural signals within the organization. Incidents may also involve positive benefits as well (even beyond those accruing from a better *company reputation*). These might include such things as long-term increases in productivity dues to healthier work procedures, the elimination of mixed cultural signals, and so forth. While these monetized costs can be associated with real monetary costs (and benefits), they are accounted for in a separate EC_i variable because there is no convenient place to put them elsewhere in Gold's model.

QUALITY

The *quality* characteristic is much easier to address than either *attractiveness* or *responsibility*. It represents a company's tendency to act in a manner consistent with the "marketing concept" – the notion that success derives from a systematic focus on customer needs. A simulation might create an index of *quality* by using measures such as *quality of products and services*, *value, customer service*, *reliability*, *forthrightness*, *trustworthiness* and *innovation.* However, the easiest way to address the quality issue as we have defined linking it to the degree to which the company's products address consumer needs – i.e. the difference between the actual and ideal product attributes for company i in segment j (d_{ij}). Rather than addressing price (P_{ij}) as a factor in "value" (i.e. looking at d_{ij} fit relative to price), we would treat price as another attribute. This allows for the economic anomalies associated with symbolic pricing. Based on this approach, *quality* (RQ_i) is reflected in equation (16).

$$RQ_i = 3+2\Sigma\,(d_i - d_{ij}) \,/\, |d_j - d_{ij}|_{max} \tag{16}$$

Where

RQ_i = company i's *quality* value on a five-point scale
d_{ij} = difference between ideal and actual product attributes for company i in segment j, as postulated in Gold's model
d_j = average difference between ideal and product attributes for all brands in segment j
$|d_j - d_{ij}|_{max}$ = maximum absolute difference between d_j and d_{ij}

The effect of equation (16) is to adjust the average *quality* value of 3 up or down, depending on whether the average difference between company i's brands and segment ideals is less or greater than the average for all brands. In order to ensure that RQ_i fits to a five-point scale, we compare each $d_i - d_{ij}$ difference to the maximum difference found among all the companies and segments. Equation (16) awards this one a *quality* value (RQ_i) of five, or if it involves a brand that is below the industry average, a value of one.

PERFORMANCE

Performance represents the overall manner in which a company manages its business. Measures of this might include *quality of management*, *sales and earnings stability*, *forecasting accuracy*, *low risk*, and *clear vision (as judged by the game administrator)*. Gold provides a host of different measures of performance in his model. We will use two indices, both based on Gold's net income per share after tax ($NIPS_i$). The first measure is the average $NIPS_i$ over time compared with that of other firms in the industry ($RNIPS_{i,av}$). The second is the relative variability in net income per share after tax over time ($RNIPS_{i,var}$). These are reflected in equations (17), (18) and (19).

$$RP_i = (RNIPS_{i,av} + RNIPS_{i,var}) \tag{17}$$
$$RNIPS_{i,av} = 3+2\Sigma\,(NIPS_{i,av} - NIPS_{av}) \,/\, |NIPS_{i,av} - NIPS_{av}|_{max} \tag{18}$$
$$RNIPS_{i,var} = 3+2\Sigma\,(NIPS_{i,var} - NIPS_{var}) \,/\, |NIPS_{i,var} - NIPS_{var}|_{max} \tag{19}$$

Where

$RNIPS_{i,av}$ = company i's average net income per share after taxes, as compared to other firms over all periods of the game
$RNIPS_{i,var}$ = variance in company i's average net income per share after taxes, as compared to other firms over all periods of the game
$|NIPS_{i,av} - NIPS_{av}|_{max}$ = maximum absolute difference between $NIPS_{i,av}$ and $NIPS_{av}$
$|NIPS_{i,var} - NIPS_{var}|_{max}$ = maximum absolute difference between $NIPS_{i,var}$ and $NIPS_{var}$

SUMMARY AND CONCLUSIONS

The development and basic testing of the reputational model appears to support the "Gold standard." That is, Gold's theory-of-the-firm simulation model does appear modifiable to accommodate the effects of *company reputation*. Of course, the devil is in the details. For instance, the parameters of the model must be carefully tested to ensure that the cost/benefit trade-off between actions required to build company reputation and reputational payoff are realistic. But, of course, attention to this kind of trade-off is an essential part of every simulation design. The good news is that the task is feasible, thus opening the door for integrating subsystem designs that would have otherwise been interesting, but of little use to the progress of the discipline. Following the "Gold standard" metaphor, working backward from a standard model promises to increase the efficiency of business simulation design.

The second benefit of his project relates to company reputation itself. Although the major purpose of this paper was to investigate the viability of a standard, theory-of-the-firm-based simulation platform for modeling a phenomenon that arises from another discipline and associated literature, operationally incorporating *company reputation* into an enterprise simulation is not insignificant. The literature on simulation and gaming appears to have neglected the movement toward more relationship-oriented market transactions, having given little attention to modern concepts such as *relationship marketing*, *brand equity*, and *company reputation* (Cannon and Schwaiger 2003). This paper addresses the problem head-on.

Finally, the process of reconciling non-economic concepts with a standard economic model inevitably points to new areas for research. Having noted that all the major needs of the *company reputation* model can be addressed in some component of Gold's model, we have nevertheless pointed out a number of areas where the model can be improved. For instance, the model would lend itself to a more detailed accounting of distribution effects, word of mouth advertising, advertising and promotional costs, and costs associated with litigation risk, as well as a more rigorous accounting of the factors leading to the development of *company reputation*. Again, the message is twofold: First, there is room for improvement in the modeling of company reputation. Second, there is room for developing subsystem models in general, linked to an economic theory-of-the-firm model to ensure compatibility.

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