Article

Valuation of Goodwill for an Engineering Firm

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Abstract: The concept of valuing personal and enterprise goodwill is a study in the art of quantifying subjective values. Sellers strive to maximize goodwill, while buyers strive to minimize goodwill. No persons are denying the existence of goodwill; rather, the debate is centered around the value of that goodwill. This paper seeks to define a holistic approach to fairly quantifying the value of goodwill for an engineering firm. The Graph Model for Conflict Resolution (GMCR), a decision tool grounded in game theory, is used to illustrate the inherent conflict around setting an accurate goodwill value and the inherent negotiation between buyers and sellers.

Keywords: goodwill; enterprise goodwill; personal goodwill; corporate finance; game theory

1. Introduction

What is goodwill? That is a very simple, three-word question, but it can get accountants arguing quickly. The Oxford Dictionary (2022) defines goodwill as the established reputation of a business regarded as a quantifiable asset. Of course, accountants would define it as the excess price paid for a business over the net book value of its tangible assets, but what does all that mean to an engineer who owns a firm?

Goodwill, as defined and clarified in the statement of Financial Accounting Standard (SFAS) #142, is an intangible asset that is part of the purchase of one company by another. It also represents the value that can give the acquiring company a competitive advantage. Marshall et al. (2023) describe a goodwill definition as the portion of the purchase price that is higher than the sum of the net fair value of all of the assets purchased in the acquisition and the liabilities assumed in the process. The value of a company's name, brand reputation, loyal customer base, solid customer service, good employee relations, and proprietary technology represent aspects of goodwill. This value is why one company may pay a premium for another. According to Berg (2022), as of year-end 2021, total goodwill assets for the S&P 500 rose to USD 3.77 trillion, a five-year high. In addition, the report found that the average S&P 500 firm has USD 8.5 billion in goodwill on their balance sheet.

Investopedia Corporate Finance (2023) explains the understanding of goodwill. The value of goodwill typically arises in the acquisition of a company. The amount that the acquiring company pays for the target company that is over and above the target's net assets at fair value usually accounts for the value of the target's goodwill. If the acquiring company pays less than the target's book value, it gains negative goodwill. This means that it purchased the company at a bargain in a distress sale. Goodwill is recorded as an intangible asset on the acquiring company's balance sheet under the long-term assets account. Goodwill is considered an intangible, non-current asset because it is not a physical asset like buildings or equipment. Kenton et al. (2023) note that, under the generally accepted accounting principles (GAAP) and the International Financial Reporting Standards (IFRS), companies are required to evaluate the value of goodwill on their financial statements at least once a year and record any impairments.

The process for calculating goodwill is fairly straightforward in principle, but the value can be quite complex in practice. To determine goodwill with a simple formula, take the purchase price of a company and subtract the net fair market value of identifiable assets and liabilities.

$$\text{Goodwill} = P - (A - L)$$

where:

P = Purchase price of the target company
A = Fair market value of assets
L = Fair market value of liabilities

Negotiating a value for goodwill is a conflict between two decision makers, the buyer and seller. Determining a fair value of goodwill will impact whether a sale is completed and what the health of the future company looks like. Game theory methods have been applied to numerous economic, environmental, and political conflicts and, in this paper, will be applied to the determination of goodwill. Goodwill is certainly controversial with respect to assigning the value of it. Ratiu and Tudor (2013) write that the debate surrounding goodwill has been raging since the 19th century. They note that the value of goodwill is subject to debate and interpretation by different entities. Today, there are multiple methods for valuing goodwill and showing it on the accounting books as an asset.

Marshall et al. (2023) describe various controversies of competing approaches to goodwill calculation among accountants. One reason for this is that goodwill involves factoring in estimates of future cash flows and other considerations that are not known at the time of the acquisition. While normally, this may not be a significant issue, it can become one when accountants look for ways to compare reported assets or net income between different companies (some that have previously acquired other firms and some that have not).

Notwithstanding the classification of goodwill as an asset, it is further deconstructed as an intangible asset. All of the assets of a business are either tangible or intangible. Tangible assets are physical items and include things like cash, real estate, equipment, vehicles, or other goods. Conversely, intangible assets cannot be touched, held, or looked at. Engineering is a service-oriented business, and Majdi (2012) notes that service businesses typically derive the bulk of the business value from intangible assets rather than assets. According to Majdi (2012), intangible assets that add value to a service-oriented business can include things such as its trained workforce, client files, trade names, certificates of need, and goodwill.

To see the concept of goodwill in action, one needs to look no further than to social media. Elon Musk's 2022 attempt at a leveraged buyout of Twitter shows the value of goodwill in such a transaction. Seligson (2022) explains in a Washington Post article that at the date of the attempted buyout, the equity portion of the Twitter deal was USD 7.1 billion. Considering that the total value of the buyout was reported to be USD 44 billion, it is evident that the goodwill portion of the offer was USD $36.9 billion, or approximately 84% of the total. Seligson (2022) also notes in the article that historically, the equity portion of leveraged buyouts have been in the 45–50% range.

Goodwill is not the same as other intangible assets. Goodwill is a premium paid over fair value during a transaction and cannot be bought or sold independently. Meanwhile, other intangible assets include the likes of licenses or patents that can be bought or sold independently. Goodwill has an indefinite life, while other intangibles have a definite useful life. Kim (2018) elaborated an example from 2017 when Amazon Inc. (AMZN) bought Whole Foods Market Inc. for USD 13.7 billion. That amounted to Amazon paying a whopping USD 9 billion more than the value of Whole Foods' net assets. That amount was recorded as the intangible asset goodwill on Amazon's books.

Marshall et al. (2023) states, unlike other assets that have a discernible useful life, goodwill is not amortized or depreciated but is instead periodically tested for goodwill impairment. If the goodwill is thought to be impaired, the value of goodwill must be written off, reducing the company's earnings. An example of goodwill in accounting involves impairments. Impairment of an asset occurs when the market value of the asset drops below historical cost. This can occur as the result of an adverse event such as declining cash flows, increased competitive environment, or economic depression, among many others. If a company assesses that acquired net assets fall below the book value or if the amount of goodwill was overstated, then the company must impair or perform a write-down on the value of the asset on the balance sheet. The impairment expense is calculated as the difference between the current market value and the purchase price of the intangible asset. The impairment results in a decrease in the goodwill account on the balance sheet. The expense is also recognized as a loss on the income statement, which directly reduces net income for the year. In turn, earnings per share (EPS) and the company's stock price are also negatively affected.

Another current illustration of the valuation of goodwill is a 2023 backlash towards Anheuser Busch following their marketing support for social media activist Dylan Mulvaney. In the first two weeks of April, multiple news sources reported a loss of USD 5 billion in value for the stock of Anheuser Busch InBev S.A. This is a prime example of an intangible asset's loss of value, which means it is a loss of goodwill value. There are two types of goodwill: enterprise goodwill and personal goodwill. Enterprise goodwill is typically associated with the engineering firm, and Fargher (2018) writes that it can include the branding of the business, established business systems, business locations, supplier and associate affiliations, corporate memory, and customer retention. Unlike personal goodwill, enterprise goodwill is transferrable during a transaction that sells the firm. Personal goodwill is defined as the reputation, skills, abilities, education, or credentials of an individual. Fargher (2018) contends that personal goodwill is essentially the net present value of the future earning capacity of the individual.

Although most sources indicate that enterprise goodwill is alienable and personal goodwill is not, Wood (2004) points out that when a willing seller is involved in the transfer of goodwill during a transaction, personal goodwill is also transferrable, most notably by the willing seller agreeing to a transition period. This transition period ultimately involves the transfer of assets via personal goodwill. Following the logic of Majdi (2012), it can be noted that an engineer's technical skills and abilities, as well as their reputation, make up the value of their personal goodwill. Further, as a value to an engineering firm, a person's professional credentials, education, and licensing status increase the value of personal goodwill. As noted previously, goodwill is certainly an intangible asset that is essentially a premium price that a purchaser pays for an enterprise's book value. As noted by Majdi (2012), goodwill is an asset that only arises during the transfer or sale of the enterprise. When considering the valuation of an engineering firm, the bulk of the value is placed in the goodwill of both the company and the key people. The firm makes no tangible widgets, so the intrinsic value of the reputations of the partners and the company is a key component of the firm's value. Figure 1 shows a simple model of some of the tangible and intangible assets for a typical engineering firm that was adapted from the research of Wheeler and Davies (2004):
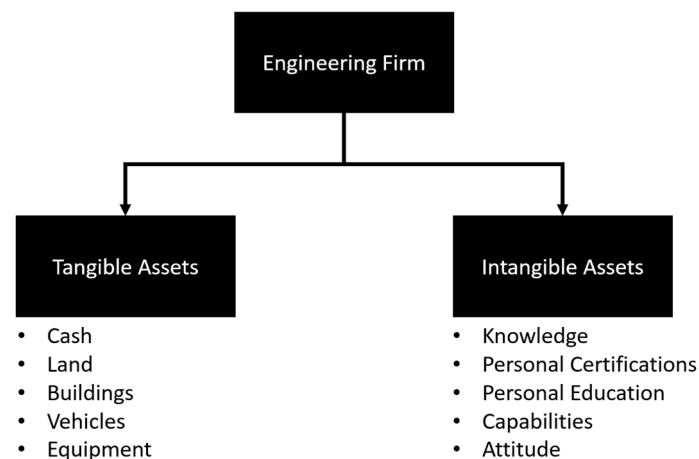
Figure 1. Assets of a Typical Engineering Firm.

2. Transferring Goodwill

There are two types of goodwill transfer to be considered. Those types of transference are related but serve different purposes. First, there is the transfer of goodwill related to the retirement or buyout of a managing partner. In that case, the goodwill is transferred back to the company or to the remaining people at the firm. The other type of goodwill transfer is from the partnership or management of the company to an outside entity in the case of a purchase. In the case of an outside purchase, the conventional wisdom is that the purchaser desires to minimize goodwill, which also means minimizing the premium cost of the purchase.

As described by Marshall et al. (2023), goodwill is difficult to price, and negative goodwill can occur when an acquirer purchases a company for less than its fair market value. This usually occurs when the target company cannot or will not negotiate a fair price for its acquisition. Negative goodwill is usually seen in distressed sales and is recorded as income on the acquirer's income statement. There is also the risk that a previously successful company could face insolvency. When this happens, investors deduct goodwill from their determinations of residual equity. The reason for this is that, at the point of insolvency, the goodwill the company previously enjoyed has no resale value.

Bean (2012) notes that when acquiring companies pay very little for a business, then their expectation is that there is a cost associated with the expected loss of repeat customers. In this case, the logic is that there is a high degree of personal goodwill. Conversely, Bean (2012) notes that if the seller is unlikely to siphon away business, then the goodwill is mostly enterprise goodwill. As an interesting aside, there are a few States that consider business goodwill to be a marital asset for the purposes of quantifying the dissolution of a marriage, but personal goodwill is not considered a marital asset. Based on the research of Bean (2012), Table 1 illustrates the basic factors that can be used to decide whether goodwill is personal or enterprise goodwill.

Conventional wisdom dictates that noncompete agreements are unenforceable for licensed professionals such as professional engineers; therefore, many businesses choose not to utilize them. The theory that noncompete agreements are unenforceable has been tested in courts for multiple types of licensed professionals. This theory has even been codified into law by some States, such as Pennsylvania.

Steier (2001) notes that there are four different modes of transferring social capital or goodwill. These are unplanned or sudden succession, rushed succession, natural immersion, and planned succession. Unplanned succession includes things like the death or some other sudden incapacitation of the principal partner. Rushed succession involves an unforeseen event, such as a terminal illness, which would necessitate speeding up the transition of management. Neither of these are optimal for succession planning purposes, but they do occur. Natural immersion involves involving the upcoming managers in the day-to-day

operations, long-term training, and strategy of the enterprise. Natural immersion is related to planned succession but could be a longer-term exercise without a formal plan. During a planned succession, the enterprise has an approved plan for passing along the management operations. Unlike natural immersion, because planned succession utilizes a formal plan, all of the small topics that might not come up every day can be incorporated into the plan and addressed. Within an engineering firm, another aspect of succession planning is legitimacy. When the upcoming managers are inserted into the management structure, the various experiences and licensing requirements allow a degree of gravitas that assists with legitimacy. From this perspective, the legitimacy of the upcoming managers is conferred via the succession plan, but also earned by virtue of experiences at the enterprise. Technical competence for managers of engineering firms is of utmost importance. Managers must be seen as a technical resource as well as a manager in order to attain legitimacy.

Table 1. Allocation of Goodwill.

Factor	Enterprise Goodwill	Personal Goodwill
Repeat Customers	Appeals to clients through location, convenience, price, or other company-specific factors. This includes unique or "boutique" services.	Appeals to clients by establishing personal relationships with the owner or partners. Many options exist for the same services.
Recommendations or Referrals	Referrals are based on proximity or organizational affiliations. Some referral relationships may be contractually defined, such as in the case of sales representatives.	Referrals are based on the skills and reputation of the owner or partners. Typically, there is no formal contract for referrals.
Organizational Structure	General services are sought by new clients. Profits are distributed based on Ownership.	Customer type or specific services are sought by the clients. Profits are distributed based on income productivity.
Management Strengths	Income is generated from multiple producers, and it would be secure even if any owner or partner left.	Income is primarily dependent upon one owner or partner. Income would disappear or be significantly damaged if that partner left.
Noncompete/ Employment Agreements	Employment or noncompete agreements exist between the partners and the business.	No agreements exist.

Optimal succession planning is a combination of natural immersion, which incorporates technical competence and intrinsic knowledge of the enterprise, coupled with a planned succession. In this spirit, the roles required of an engineering manager, which include technical, managerial, and stewardship duties, are all incorporated into the succession plan and the immersion of the upcoming manager.

3. Valuing Goodwill

Cathro (1996) notes that accountants tend to treat goodwill as a balancing account. As alluded to above, the value allocated to goodwill is essentially the premium cost associated with the purchase of an enterprise. Goodwill is indeed an unusual asset because it cannot be sold or dealt with on its own, and it can only be transferred. Further, personal goodwill cannot be transferred wholly; it can be partially transferred with a plan.

Numerous approaches have been proposed to quantify goodwill. Although the approaches vary, goodwill, from a purchase price perspective, is still simply the difference between the net book value of the enterprise and the purchase price. Essentially, it is a premium on the price. Irving and Betancourt (2019) show that 20.3% of the total assets is the composite value of goodwill for 442 companies in the S&P 500. When broken down

by the SIC Code, a company operating in the engineering services industry (SIC 8711) can expect the mean value of goodwill to be 32.8% of the value of the asset.

Berg (2022) notes that, although the Financial Accounting Standards Board (FASB) recently ended an effort to overhaul the accounting for goodwill, the topic remains front and center for corporate reporting professionals, financial analysts, investors, regulators, and standard setters. According to a 2021 CFA Institute report, investors want even more information in financial disclosures to help them assess acquisition performance. Marshall et al. (2023) states that evaluating goodwill is a challenging but critical skill for many investors. After all, when reading a company's balance sheet, it can be very difficult to tell whether the goodwill it claims to hold is in fact justified. For example, a company might claim that its goodwill is based on the brand recognition and customer loyalty of the company it acquired. When analyzing a company's balance sheet, investors will therefore scrutinize what is behind its stated goodwill in order to determine whether that goodwill may need to be written off in the future. In some cases, the opposite can also occur, with investors believing that the true value of a company's goodwill is greater than that stated on its balance sheet.

The best approach to valuing enterprise goodwill is a Tobit model linear regression analysis of the multiple variables that contribute to goodwill. Since none of the variables should have a value of less than zero dollars, a censored regression model, like the Tobit model, is completely appropriate. This value from the censored regression analysis can then be compared to the quantitative estimate that would be calculated as a percentage of the assets and is based on the SIC code for engineering. This top-down versus bottom-up approach should give the best approximation of the most reasonable value of goodwill.

Equation (1) below is a derivation of the formula offered by Bugeja and Loyeung (2015). The derivation is necessary to remove specific factors related to the finance laws in Australia.

$$GW = \alpha_i + \beta_1 BLEV + \beta_2 BONUS + \beta_3 MONITORING + \beta_4 RELSIZE + \beta_5 TOEHOLD$$
$$+ \beta_6 FRIENDLY + \beta_7 PREMIUM + \beta_8 SAMEIND + \beta_9 PAYCASH + \beta_{10} TGWDV + \beta_{11} TPPEDV \quad (1)$$
$$+ \beta_{12} TIIADV + \beta_{13} TMB + \beta_{14} BMB + \varepsilon_i$$

The variables for Equation (1), as detailed by Bugeja and Loyeung (2015), are described in Table 2, below:

Table 2. Variables Used in Equation (1).

Variable	Description
GW	The dollar value of the purchase price allocated to goodwill and scaled by the value of the deal
BLEV	Bidder firm leverage, which measures the ratio of debt to equity for the financial year prior to the acquisition. The purpose of this variable controls for the incentive of firms to allocate the purchase price to the tangible assets included in debt covenant ratios.
BONUS	Controls for the influence of CEO bonus plans that are based on accounting earnings.
MONITORING	Controls for the strength of the monitoring system to curb managerial opportunism. Use a zero if no controls are in place.
RELSIZE	The relative size of the target to the bidder, measured using the natural logarithm of the target firm to the bidding firm
TOEHOLD	Control for equity ownership of the bidder in the target at the date of the takeover announcement
FRIENDLY	Friendly takeovers are denoted by a ONE when the initial board recommendation is acceptance; use a zero otherwise.

Table 2. *Cont.*

Variable	Description
PREMIUM	The offer price minus the target stock price two months prior to the announcement.
SAMEIND	Set equal to one for firms with the same SIC code; use a zero otherwise
PAYCASH	For takeovers in which the transaction is in cash, use a ONE; use a zero otherwise
TGWDV	Amount of existing goodwill on the target balance sheet
TPPEDV	Target firm's net property and equipment
TIIADV	Target firm's recognized identifiable intangible assets
TMB	Target firm's market-to-book value ratio 2 months before the announcement
BMB	Bidding firm's market-to-book value ratio 2 months before the announcement

Essentially, the combination of a quantitative style analysis, such as the Tobit regression, coupled with a qualitative analysis, such as a mean percentage derived from a SIC code, allows a more holistic view of the value of goodwill. That approach incorporates a degree of what psychologists call the paradox of choice, which juxtaposes the classic should-could value of goodwill. In that scheme, the Tobit analysis examines what a bidder COULD pay for goodwill and compares it to what the bidder SHOULD pay for goodwill to find a reasonable value that is closer to the true value.

Once the overall value of goodwill is established, the exercise turns to the concept of separating personal goodwill from enterprise goodwill. Schmidt (2023) suggests the use of a multiplicative multi-attribute model to analyze the fraction of goodwill attributed to a person. The approach derives from judicial decisions where attorneys attempted to value personal goodwill in the case of dissolution of marriage. In this approach, several qualities or attributes are used to help quantify subjective allocations.

In the model, attributes are given a subjective utility value from one to five for both the importance of the attribute and the existence of the attribute. Table 3 shows a proposed approach with variables.

Table 3. Personal Goodwill Attributes.

Variable	Importance Utility	Existence Utility	Multiplicative Utility
Ability, Skills, and Judgment	5	5	25
Work Habits	5	5	25
Age and Health	5	4	20
Licensing	5	4	20
Education	4	4	16
Personal Reputation	4	5	20
Inbound Referrals	5	5	25
Closeness of Business Contacts	3	3	9
Important Personal Nature	3	2	6
Media and Marketing	2	3	6

Once the attributes are quantified, the percentage of goodwill that can be applied to the owner or partner is estimated. There is an inherent problem with utilizing an equation to solve for the value of goodwill. Essentially, the equation only yields a starting point for the negotiation for the initial value of goodwill, but the ultimate value of goodwill is still not determined. There is no equation that can easily account for the complexities of human behavior. One needs only consider the concept of a "motivated seller" or the "motivated buyer". Further, there are additional variables, such as market conditions, that muddy the

water when considering a simple equation. As such, the application of game theory can be brought to bear to yield the result.

Goodwill is the premium price to be paid during the purchase, for an engineering firm. The sale, when distilled down to its most basic form, involves how to define the solution as a zero-sum non-cooperative game that involves two parties. Any increase in the value of goodwill is a benefit to the seller and a loss to the buyer. Conversely, a decrease in the value of goodwill is a loss to the seller and a gain to the buyer. Game-theoretic approaches to multiple-entity conflicts, such as wars, negotiations, firm purchases, or marketplace positioning, typically rely on rational strategies where all involved organizations work to maximize their own value or utility (1993), which combines the graph model with game theory. Fang et al. (1993); Fraser and Hipel (1984); Howard (1971); Nash (1950, 1951) described, by applying the Nash Stability solution concepts, it is possible to determine which states are stable for each decision-maker (DM) in a game and thus are equilibria or likely outcomes to the conflict. States that are stable for a given DM can be thought of as outcomes that a DM does not find advantageous to change. For example, if a salesperson is selling an item for USD 1000 and a buyer offers USD 1000, the salesperson would accept the offer. This outcome is stable for the salesperson because they cannot improve their position by counteroffering or declining the offer. If the buyer also finds the state stable—maybe because they are worried that the salesperson will not accept a lower bid—the state is stable for her as well. As the state is stable for both DMs, and there are no other DMs in the game, it is an equilibrium state or likely outcome. To show how more complicated conflicts can be modeled, GMCR is defined below by Fang et al. (1993).

Models of games or conflicts contain a set of DMs D, states S, moves M, and preferences (>, ~). Fang et al. (1993) stated that game theory provides a basis for the definitions that outline how DMs move between states and how state stabilities and equilibria are calculated. Consider a game of Chicken where 2 DMs drive toward each other to see who will swerve first to avoid the head-on collision. Each DM can swerve away (S) or continue driving straight (D). This means that there are four outcomes or states in the game that can be written as ordered pairs of DM 1 and DM 2's strategies, respectively. States = {(D, D), (S, D), (D, S), (S, S)} If DM 1 controls the first part of the set, then they can move the conflict from state (D, D) to state (S, D) by swerving off the road. This means that state (S, D) is in the DM list of DMs 1 from state (D, D). Going further, the game of Chicken can be drawn as a set of points—representing states connected by arcs or arrows—representing moves. In this case, states (S, D) and (D, D) would be attached by an arc controlled by DM 1, as shown in Figure 2 below.
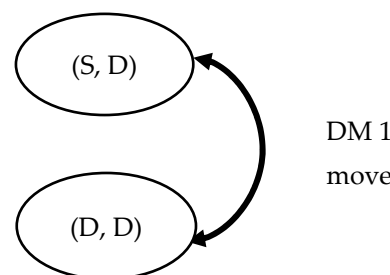

Figure 2. DM 1 Moves in a Chicken Game.

In a game theory model, the unilateral improvement (UI) list is the list of states that are reachable by a DM and are also more preferred. Above, in the game of chicken, state (S, D) is reachable from state (D, D) by DM 1. If state (S, D) is more preferred by DM 1 to state (D, D) by DM 1 because it avoids the collision, then it is a unilateral improvement. In the case of social distancing, we can consider the case where a social distancing requirement is made by a business; however, this is inconvenient to customers who must wait outside to go into stores. In this case a person might decide to ignore the rules and not social distance,

so that they can get their shopping done more quickly. Ignoring the rules would be a unilateral improvement for such a decision-maker.

To utilize a simple, qualitative model game theoretical model, consider two solution concepts. The first, referred to as Nash Stability, concludes that a DM will not move from a state unless they can move to a better, more preferred state. This essentially means that the DM does not have a UI from the state. The second solution concept, called Sequential Stability, states that a DM will not leave a state if the move can be sanctioned by an opponent, leaving them in a worse-off position than where they started.

Nash Stability is when a DM cannot move to a more advantageous state, so they decide to stay where they are. For example, if someone has a job where they make USD 100,000 per year and they are offered a job where they are offered a wage of USD 90,000 per year, the person would likely decide to keep their current job. This is Nash Stability. Sequential stability is the situation where a DM can move from a state to a more advantageous state, but it is possible that another DM can move them to a state that is worse than where they started: for example, if a worker is making USD 100,000 before taxes and is offered a position that pays USD 120,000. However, by moving to this new position, the State government would go from taking USD 15,000 to taking USD 40,000 of their wages. This would reduce their net income from USD 85,000 to USD 80,000, effectively sanctioning the worker from taking the new job. This is Sequential Stability.

Inohara and Hipel (2008a, 2008b) describes the groups of DMs, referred to as coalitions, commonly form during conflicts. A coalition is a group of DMs that agree to work together, making decisions that benefit all members of the coalition. The concept of state stability can be extended to those conflicts or games involving coalitions. A group of DMs working together as a coalition can reach more states; however, they often share fewer states that are preferred from the same starting point. Using information about moves and preferences, the coalition improvement list can be determined. A state will be coalition Nash stable if the coalition cannot move to a state that is more preferred for all coalition members.

Coalition Nash stability considers groups of DMs acting as a unified DM. In this case, the coalition shares a single set of coalition preferences and coalition improvements. Consider the purchase of an established engineering firm. If the purchaser wishes to procure the engineering firm simply for the access to labor, then the goodwill value would be relatively small. On the other hand, if the engineering firm has some sort of critical skill or access to a particular market that the purchasing entity desires, then the value of the goodwill will be greater. A simple table of possible negotiation outcomes is shown below. The seller wishes to push the value of the goodwill up—either to increase the value of the company for shareholders or to hide problems within the company. In Table 4 and Figure 3, a model of this negotiation is given.

The conflict shown in Table 4 and Figure 3 above involves two parties: a buyer and a seller. The buyer has the mutually exclusive options to purchase or not purchase the company, while the seller has the mutually exclusive options to inflate or maintain the value of the goodwill, as illustrated in Table 4. The combinations of each player's decisions give rise to states A, B, C and D. Both the strategy to "buy" on the part of the buyer and to "inflate" on the part of the seller are one-way moves, which means that once the option has been selected, it cannot be undone. The preferences of each of the DMs are reflected by the sets P_{Buyer} and P_{Seller}, which represent, in decreasing order, the preferences of the buyer and seller. For example, the buyer's most preferred state is C, where they purchase the company without an inflated goodwill value, followed by D, where they do not purchase the company, and the goodwill is not inflated. In the graph model shown, the buyer's moves are illustrated by solid arrows, while the seller's moves are dashed arrows.

Table 4. Available States in Buyer–Seller Games.

Decision Maker	Options				
Buyer	Buy	Y	N	Y	N
	Do Not Buy	N	Y	N	Y
Seller	Inflate Goodwill	Y	Y	N	N
	Do Not Inflate Goodwill	N	N	Y	Y
	State ID	A	B	C	D
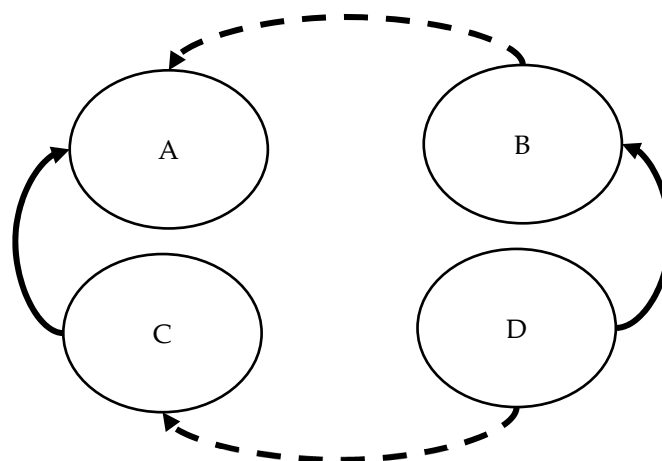
PBuyer = {C, D, B, A}, *PSeller* = {A, C, B, D}

Figure 3. A Simple Two-DM Goodwill Conflict.

If the conflict starts at the status quo where neither DM has purchased or inflated the value of the goodwill, state D, both the buyer, whose moves are represented by the solid arrows, and the seller, whose moves are represented by dashed arrows, have possible moves. If the seller moves the conflict from D to B by inflating the value of the goodwill, the buyer will not move from state B to state A, as it is less preferred. If the buyer moves first and moves the conflict from state D to state C, the seller cannot move the conflict to state D, because the goodwill has already been purchased. In both cases, one of the DMs "wins" while the other is left at a disadvantage. However, in a friendly takeover, where one company is absorbing another, it may be important for a less confrontational approach to be used.

Next, consider the potential movements in a game where the buyer and seller form a true coalition, as shown in Table 5. That means that the buyer and seller are authentic in trying to find outcomes that are advantageous for both themselves and the other. To see how the game may evolve, it is important to generate the coalition improvement list described previously.

Table 5. Coalition Reachable and Improvement Lists.

States	Reachable List	Improvement List
5	6, 9, 10	-
6	5, 9, 10	9
9	5, 6, 10	-
10	5, 6, 9	9

Looking at the set of coalition improvements two states are coalition Nash stable: states A and C. In state A, the business is sold, but the seller inflates the value of the goodwill, while in state C, the business is sold at a lower goodwill value. However, if the

game is assumed to start at the beginning of the one-way moves, then the conflict can be thought of as moving directly from state D to state C.

When evaluating goodwill, it is easy to see that there will be conflict between the parties, but that there will also be cooperation. While the buyer wishes to gain from the goodwill purchase, they may not want to treat it as a valuable commodity. This is the conflict and cooperation between the parties for valuing goodwill. It is intuitive to note that although conflict and cooperation are in a game, they can diverge and cannot be treated separately. Bennett (1995) confirms as such in his writings, as confirmed by Bennett, the game model is simply an analytical tool to guide the participants through the game, or in the case of a sale of an engineering firm, negotiations for the value of goodwill.

Given that Nash Stability and other solution concepts typically only consider rational decisions during a game, the valuation of goodwill must consider irrational decisions related to goodwill, which can be considered by some to be directly associated with the "self-worth" of an individual. In this case, Bennett (1995) postulates that the game theory devolves into Drama Theory. This concept allows the model to incorporate decisions into the model that would appear to be paradoxes of reality. These decisions, which could include irrational threats or promises, are generally discounted in a traditional game theory approach. We also note that each participant in the game acts within their own frame of reference as far as rationality is concerned, and their actions are solely an attempt to persuade the opposing side to join in line with their rationality.

Emotional decision-making can make one appear in the short term to be acting irrationally. When adding these decisions to Game Theory, one relies upon an unwilling threat or promise, and there tends to be pressure to make one conform to other preferences. One need only look at the drama imposed by President Reagan or President Trump during international relations. President Reagan's reputation as the "cowboy" and President Trump's reputation serve to bolster what President Nixon called the "madman theory of deterrence" during complex negotiations.

4. Conclusions

As stated previously, the value of goodwill is subjective and is likely to continue to be debated by accountants and economists going forward. The approach in this paper suggests the best possible path to arriving at a fair and equitable value for goodwill, both personal goodwill and enterprise goodwill, for an engineering firm. The most likely path towards a fair and equitable goodwill value that facilitates cooperation during a friendly takeover is cooperation and coalition building.

Continuing to Investopedia Marshall et al. (2023) further describes, goodwill represents a certain value and potential competitive advantage that may be obtained by one company when it purchases another. It is that amount of the purchase price over and above the amount of the fair market value of the target company's assets minus its liabilities. Goodwill is an intangible asset that can relate to the value of the purchased company's brand reputation, customer service, employee relationships, and intellectual property. While goodwill officially has an indefinite life, impairment tests can be run to determine if its value has changed due to an adverse financial event. If there is a change in value, that amount decreases the goodwill account on the balance sheet and is recognized as a loss on the income statement.

The game theoretical method shows the importance of collaboration in delivering a goodwill outcome that satisfies both buyer and seller. Kilgour et al. (2001) conforms that the ability of coalitions is expected, as it has been illustrated in numerous game theory methodologies. No amount of modeling can account for exact human behavior with regard to negotiating and decision-making. Conventional wisdom notes that the negotiations will continue until the point of indifference. Analysis using Game Theory and Drama Theory can help to determine which decisions are stable. This knowledge can identify improvements to the decisions and indicate whether the counterparts are willing or unwilling, according to Bennett (1995). One can only choose to implement decisions

from an informed perspective, which indicates that negotiating from a point of knowledge can improve the result.

Author Contributions: Conceptualization, J.W. and B.L.; methodology, J.W. and S.W.; validation, J.W., B.L. and S.W.; formal analysis, J.W.; investigation, J.W. and S.W.; resources, J.W. and B.L.; data curation, J.W. and S.W.; writing—original draft preparation, J.W. and B.L.; writing—review and editing, J.W., B.L. and S.W.; visualization, J.W.; supervision, B.L.; project administration, J.W. All authors have read and agreed to the published version of the manuscript.

Data Availability Statement: No new data were created or analyzed in this study. Data sharing does not apply to this article.

Conflicts of Interest: The authors declare no conflicts of interest. John Wade was employed by the company Gulf States Engineering Inc.

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