Measuring the Effects of Firm Promotion Expenditures on Green Industry Sales[1]

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Abstract

This paper measures the effectiveness of green industry firms' promotion and advertising expenditures in enhancing sales. Specifically the paper addresses the following three questions: 1) Are promotion and advertising expenditures effective in increasing sales of green industry firms? 2) What are the types of promotion and advertising efforts that have the highest returns for their investment? 3) How does the answer to these two questions change depending on the size of the firm? In order to answer these questions, a model was specified to measure the increase in sales for green industry firms as a result of promotion activities and the associated elasticities of promotion were used to calculate a benefit cost ratio. The returns to promotion expenditures differed depending on media used and also by firm size with ranges from not significant to $7.5 returns per every $1 allocated to promotion and advertising.

Index words: green industry, marketing practices, promotion, advertising, benefit cost ratio, return on investment.

Significance to the Nursery Industry

Understanding the overall relationship between promotion/advertising expenditures and sales revenue is crucial to effectively competing and prospering in today's increasingly competitive horticulture products marketplace. Additionally, findings about the differences in the effectiveness of promotion expenditures by type (e.g., internet, print publications, TV advertising) and by firm size will help the green industry representatives to efficiently allocate their resources for marketing practices.

Introduction

The interest in promotion effectiveness and its impact on grower revenues has recently escalated as a result of the economic recession that has negatively influenced almost all subsectors of the U.S. green industry. The major concern confronting green industry growers is whether or not the promotion expenditures will be justified by increased sales. The research literature is abundant with studies investigating the benefits of generic promotion of commodities such as lamb (24), flowers (3), citrus (23), apples (18), orange juice (6), milk (20, 22), pecan (16), and meat (4) to name only a few. Supported by industry-funded promotions (checkoff programs), generic advertising plays a major role in facilitating the flow of information throughout the supply chain (21).

Nevertheless, in comparison to the generic advertising literature, the effects of branded or individual firm advertisement has received minimal attention (7, 10, 11, 15). Brand advertising is utilized to promote a firm's brand, build brand loyalty, reduce its demand elasticity, and increase products' market share by attracting consumers who might not be satisfied with their current brand, and thus are more likely to be persuaded (8). It provides relatively less information about a product-specific bundle of characteristics and is designed to build brand loyalty by targeting consumers who lack information about their own preferred characteristics. Most brand advertising research efforts report positive own-advertising and negative cross-advertising elasticity estimates (7).

In contrast, generic advertising is a cooperative effort by a group of suppliers and is designed to expand a product's market by promoting the product's characteristics to consumers who lack that information (8). Regardless of the type (generic, branding or mandatory labeling), the information provided throughout different segments of the supply chain is a critical component of final demand and can inform or reinforce prior knowledge of product attributes (21).

Thompson and Eiler (20) investigated the economic impact and the determinants of milk advertising effectiveness by incorporating controls for supply side feedbacks. The results supported the basic positive relationship between advertising expenditures and sales. Although some of the determinants investigated in the study were applicable to only the milk industry, the results can be generalized to the markets for which advertising elasticity estimates are not readily available. Additionally, the study found that the impact of the price elasticity of supply on the economic effectiveness of advertising is relatively insignificant.

Ward and Dixon (22) investigated the impact of national and regional generic milk advertising and found a statistically significant positive relationship between fluid milk advertising expenditures and consumption levels. Shifts in consumption responses to advertising were linked to underlying changes in consumer preferences for dairy products. The results showed that the increase in consumption from advertising is mostly due to a national campaign rather than regional promotion programs. Nevertheless, the study

[1]Received for publication January 9, 2012; in revised form February 29, 2012. This research was supported in part by a grant from **The Horticulture Research Institute, 1200 G Street NW, Suite 800, Washington, DC 20005**. The National Nursery Survey was conducted under the auspices of the *Green Industry Research Consortium*, a group of Land Grant University horticulturists and economists, organized as multi-state project S-1051 under USDA-NIFA.

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emphasized that the results were not fully generalizable to other commodities. Among other factors, the characteristics of a commodity, end-user knowledge, quality, and frequency were identified as major conditions influencing the effectiveness of advertising programs.

Capps et al. (6) investigated the role of generic and branded advertising in stimulating the demand for Florida orange juice using structural and time series models. The results revealed that generic advertising significantly influenced the demand for orange juice, but the effects from branded advertising were found to be statistically insignificant. The generic advertising elasticity was estimated to be in the 0.011 to 0.019 range. As a result of generic advertising campaigns, the consumption of orange juice increased by 3.31–7.67%. In terms of revenue contribution, every dollar spent in generic advertising increased retail revenue by $5.75 to $13.32 over the period covered in their analysis.

The effectiveness of state level commodity promotion programs was investigated in Williams et al. (23) and Moore et al. (16). Williams et al. (23) found that state level citrus promotion efforts in Texas were effective in enhancing shipments of Texas grapefruit but not oranges and that the benefits of the promotion efforts exceeded the costs, at least for grapefruit. The benefit-cost analysis indicated that for every dollar spent on promotions, the return to the Texas grapefruit industry at the packinghouse level was $28 in additional revenues. Moore et al. (16) analyzed promotion returns for pecans in Texas and showed a 35:1 benefit cost ratio. Although the increased sales were not attributable to the size of the benefit (as pointed out by the authors), the study reported about a 5% increase in pecan sales.

The effectiveness of both branded and generic advertising has been widely investigated to gain understanding about not only firm- or industry-level sales, but also for export promotion evaluation purposes. Richards et al. (18) investigated the possibility of U.S. export promotion programs' spillover effects on rival exporting countries' market shares. In general when a promotional program is focused on generic effects more than branded effects, then all participating countries tend to benefit equally. Richards et al. (18) found a statistically significant positive relationship between promotion and price inelasticity. In other words, the spillover effects from both generic and branded promotion tend to be stronger when the demand for a rival exporter's product is more inelastic.

As it pertains to the U.S. green industry specifically, the literature focusing on promotion and advertising is limited to only a few studies, namely Arbindra and Ward (3), Ort et al. (17), Safley et al. (19), and Campbell and Hall (5). Arbindra and Ward (3) investigated the distributional impact of both generic and brand advertising by three major retail outlet types — florists, supermarkets, and other retail outlets. The study combined data on PromoFlor activities (a generic flower promotion program implemented and terminated in the 1990s) and household-level expenditures on flower purchases. By using household flower expenditure allocation as a determinant of relative market shares among the three major outlet types, the study found that generic promotion effects of fresh-cut flower sales were positive and 'outlet neutral.' However, the distributional effects from brand advertising showed increased market share for florists.

The effectiveness of advertising and promotional programs at the independent garden center level was investigated in Ort et al. (17), with a follow up validation study by Safley et al. (19). According to Ort et al. (17), on average 91.6% of the survey participants stated that their shopping decision was influenced by advertising. Three major factors mentioned by the remaining respondents were the convenient location (35%), plant quality (15%) and plant selection (14.5%). Among those customers who responded to an advertisement, newspaper advertisement (66.9%), newsletter (17.7%), radio advertisement (6.5%), and newspaper insert (4%) were identified as the top four categories. However, in the context of total survey population, these respondent groups represented small segments, 5.6, 1.5, 0.5, and 0.3%, respectively. Safley et al. (19) found relatively high response rates for the newspaper advertisement category (91.4% of those who responded to an advertisement, or 53.2% of the general survey population). Rates for the newsletter and radio advertisement categories were found to be 4.9 and 1.2% respectively (or 2.9 and 0.7% of the total survey population).

Campbell and Hall (5) examined the effect of individual firm level advertising on plant category sales. Results indicated a positive own-advertising elasticity for a majority of plant categories and insignificant elasticities for several of the plant categories. The largest own-elasticity effects tended to be associated with categories that are highly distinguishable (i.e. roses) with non-significant effects associated with the more common plant categories (i.e. bedding plants, foliage, and flowering pots).

The green industry promotion efforts do not exactly fall within the definition of generic or brand advertising. Green industry firms allocate promotion expenditures to increase overall sales of their own products combined, and not specifically a particular brand. In that sense firms allocate promotion expenditures to maximize their own profits. The objective of this paper is to measure the effectiveness of green industry firms' promotion and advertising expenditures in enhancing sales. Specifically the paper will focus on answering the following three questions: 1) Are promotion and advertising expenditures effective in increasing sales of green industry firms? 2) What are the types of promotion and advertising efforts that have the highest returns for their investment? 3) How do the answers to these two questions change, depending on the size of the firm? In order to answer these questions, a model will be specified to measure the increase in sales for green industry firms as a result of promotion activities and the associated elasticities of promotion will be used to calculate a benefit cost ratio (BCR).

Methods and Materials

The theoretical framework for this study is based on the premise that a firm allocates its inputs, including promotion and advertising expenditures, to maximize its profits. Firm i produces k products, and both the price and quantity of all products (P_i,Q_i, for i = 1 to k) are jointly endogenous and determined by the firm's promotion and advertising expenditures (1). Firm i profit function is:

$$\pi_i = P_i,Q_i(p,A_i) - C_i(Q_i(p_i)) - b_i - A_i \qquad (1)$$

where π_i are profits; price (P_i) times quantity (Q_i) of all goods equals total revenue (TR_i); C_i are total variable costs; b_i is the cost of fixed inputs; and A_i is promotion and advertising expenditures for firm i. Each firm will choose an amount of promotion and advertising expenditures (A_i) to maximize its profits. This model assumes that there are no generic

promotion expenditures, as is the case in the green industry. Hence the first order condition partial derivative of profits with respect to promotion is:

$$\frac{\partial \pi_i}{\partial A_i} = Q_i \frac{\partial P_i}{\partial A_i} = 1 \quad (2)$$

According to the necessary condition for profit maximization, a firm will continue to spend in promotion and advertising until the marginal revenue of advertising equals the marginal cost of advertising. Since the marginal cost of advertising expenditures is $1, equation 2 shows that a firm should continue to increase advertising and promotion expenditures if the marginal revenue of promotion is more than 1. Profits are maximized when an additional $1 spent on advertising and promotion generates $1 in revenues. After reaching that level, if a firm continues to spend more in promotions, then the returns would be less than the cost of the promotion. This framework assumes that there are diminishing returns to promotion expenditures to total revenue:

$$\partial TR_i / \partial A_i > 0, \text{ and } \partial^2 TR_i / \partial A_i^2 < 0 \quad (3)$$

The data for the empirical analysis were obtained from a survey of green industry firms by the Green Industry Research Consortium conducted in 2009 (13). The survey consisted of a stratified random sample of 17,019 green industry firms in all 50 states of the United States A total of 3,044 firms responded to the survey for an effective response rate of 17.9 percent.

Under the theoretical framework described above, an econometric model was specified that is consistent with equation 3 as follows:

$$S_i = f\,(YRS_i, T_i, TS_i, D_i, A_{ij}, REG_i) \quad (4)$$

where S = total yearly sales; YRS = years in operation; T = technology use; TS = number of trade shows attended; D = dummy for published price discounts; A = promotion expenditures; and REG = regions. The subscript *i* represents each firm and the estimation was performed by firm size category in terms of yearly sales: small firms [$10,000–$250,000], medium firms [$250,000–$1 million (M)], large firms [$1M–$5M], very large firms [$5M or more]; Technology use (T) is measured as an index from 1 to 12 given the use of computerized functions of the firm; A is total advertising expenditures by category *j*, where *j* is AINT for internet promotions; APM for printed materials — including yellow pages, gardening publications, catalogs, trade journals, and newsletters; and AMASS for mass promotion and advertising—including radio, television, billboards, and tradeshows; REG represents regional differences. A complete list of states within each region can be found in Hodges et al. (14). Firms with sales of less than $10,000 were not included in the analysis, as the purpose of this paper is to examine commercial operations (as opposed to hobby farms). The USDA definition was adopted as described by Andrade and Hinson (2) and used by Campbell and Hall (5)

In order to satisfy diminishing returns to promotion expenditures as described in equation 3, the model assumes that the relationship between sales and promotion expenditures is linear in logarithms. However, since many firms do not allocate expenditures in all three promotion categories, and hence all those firms with zero expenditures in a category would have to be dropped out of the analysis because the log of zero is not defined, in order to avoid this problem, a square root transformation of the promotion data is used as previously implemented by Williams et al. (23) and Moore et al. (16). The parameters of the econometric model are estimated as:

$$LN(S)_i = \alpha_i + \beta_1 LN(YRS)_i + \beta_2 LN(T)_i + \beta_3 TS_i + \beta_4 D_i + \varphi_1\sqrt{(AINT)} + \varphi_2\sqrt{(APM)} + \varphi_3\sqrt{(AMASS)} + \sum_{k=2}^{8} \phi_k REG_k + \varepsilon_i \quad (5)$$

where the variable names and their corresponding definitions are presented in Table 1.

Results and Discussion

The parameters of equation 5 were estimated in Time Series Processor (TSP) version 4.5 (12). The estimation procedure uses the ordinary least squares (OLS) estimator assuming a double log functional form for years in operation (YRS) and technology use (T); a semilog functional form for the number of trade shows attended per year (TS), published discounts (D) and regional differences (REG); and a square root functional form for the promotion coefficients. The parameter estimates for equation 5 by firm size are presented in Table 2.

The double log coefficients of YRS and T can be interpreted as the elasticity of sales with respect to a change in the number of years in operation and technology used. As expected, as years of operation and technology use increase, there is an increase in sales; however, the increase is not consistent across firm sizes. For instance, a 1% increase in the years of operation of a firm results in a 0.57% and 0.25% increase in sales for small- and medium-sized firms, respectively. The magnitude is in line (0.31%) with that found by Campbell and Hall (5). What our results also show is that larger firms do not benefit, from an increased sales perspective, from having been in business for longer periods as denoted by the insignificant elasticities. A reason for this could be that as firms increase in size, they also increase in efficiency, thereby minimizing any experience gain from which smaller firms may benefit.

Table 1. Description of all variables used in the green industry sales model.

Variable	Description
LN(S)	Total yearly sales
LN(YRS)	Number of years the firm has been in operation
LN(T)	Number of computerized operations index (1-12)
TS	Number of trade shows attended in a year
D	Dummy for published price discounts (= 1 if yes, and 0 otherwise)
SQRT(AINT)	Internet promotions and advertising
SQRT(APM)	Promotions using printed materials
SQRT(AMASS)	Promotions using mass media
REG2	Pacific
REG3	Midwest
REG4	Appalachian
REG5	Northeast
REG6	Southcentral
REG7	Mountain
REG8	Great plains

With respect to technology use, we anticipated that increased technology use would lead to increased sales. Results indicated that an increased technology index had varying effects depending on firm size. For instance, small and large firms realized no impact from an increased use of technology; however, very large firms actually experienced a negative effect of 4.88%. This is contrary to the 1.70% increase associated with a 1% increase in the index associated with medium firms. The reasons for the inconsistency across firm sizes could be the result of efficiencies associated with some firms not being large enough or outgrowing large scale use of technologies.

When examining the impact of trade shows on sales, we again see that the effect on sales is dependent on size. Since trade show is modeled as a semilog coefficient, it can be interpreted as the percentage change in sales with a 1 unit increase on trade shows. Thereby, for every additional trade show attended, sales increase by 1.77 and 4.37% for medium and very large firms, respectively. However, just as with the technology index, we do not see a consistent impact across the other firm sizes, such that small and large firms see no impact for increased trade show attendance. This implies that some firms do not benefit from attending a large number of trade shows. The reason that very large firms may gain sales is that they could be benefiting from brand recognition that allows them to generate sales over all the 'noise' at the trade show or they are well positioned to attract sales after the trade show based on their attendance. Just as very large firms are probably benefiting from their brand recognition, small firms might be lost in the shuffle of the trade show, thereby experiencing no effect on sales for an increasing number of shows.

According to economic theory, promotion and advertising are expected to increase sales (9), which should generate positive coefficients. As hypothesized, all the promotion coefficients have the appropriate positive sign. The promotion parameter estimates from the statistical analysis are used to calculate the elasticity of promotion for each promotion and advertising category. Given the square root functional form of the promotion coefficients, the promotion parameter would be interpreted as:

$$\varphi_j = \frac{2\sqrt{A_j}}{S} \times \frac{\partial S}{\partial A_j} \quad (6)$$

And the associated elasticity will be calculated as:

$$e_{\varphi_j} = \varphi_j \times \frac{\sqrt{A_j}}{2} \quad (7)$$

Table 2. Parameter estimates for green industry sales. Dependent variable is the LN(Sales).

	Small *$10K–$250K*		Medium *$250K–$1M*	
Variable	**Coef**	**Std. error**	**Coef**	**Std. error**
Intercept	10.8456***	0.0677	12.8820***	0.0566
LN(YRS)	0.0057***	0.0016	0.0025***	0.0009
LN(T)	0.0164	0.0121	0.0170**	0.0080
TS	0.0024	0.0107	0.0177**	0.0090
D	–0.0002	0.0072	–0.0009	0.0046
SQRT(AINT)	0.0035***	0.0010	0.0012**	0.0005
SQRT(APM)	0.0043***	0.0007	0.0007***	0.0002
SQRT(AMASS)	0.0043***	0.0006	0.0005*	0.0003
REG2	0.0639	0.0765	–0.0259	0.0497
REG3	0.0230	0.0635	0.0016	0.0520
REG4	–0.0205	0.0808	–0.0530	0.0533
REG5	–0.0509	0.0608	–0.0896**	0.0456
REG6	0.0430	0.0995	–0.0744	0.0698
REG7	–0.1282	0.1245	–0.0908	0.0803
REG8	–0.0167	0.1421	0.3008**	0.1378
	Large *$1–$5M*		**Very Large** *$5M or more*	
Variable	**Coef**	**Std. error**	**Coef**	**Std. error**
Intercept	14.2464***	0.0817	16.5481***	0.2221
LN(YRS)	0.0013	0.0011	–0.0006	0.0029
LN(T)	0.0107	0.0094	–0.0488*	0.0280
TS	0.0033	0.0037	0.0437**	0.0177
D	0.0013	0.0044	–0.0608**	0.0246
SQRT(AINT)	0.0001	0.0002	0.0002	0.0003
SQRT(APM)	0.0005***	0.0002	0.0000	0.0002
SQRT(AMASS)	0.0007***	0.0002	0.0004***	0.0001
REG2	0.0588	0.0646	–0.1021	0.1540
REG3	0.0991	0.0716	0.0927	0.1950
REG4	–0.0107	0.0686	–0.1256	0.2313
REG5	–0.0426	0.0628	–0.1933	0.1807
REG6	–0.1130	0.0964	0.7133**	0.2974
REG7	0.0080	0.0963	–0.2416	0.2418
REG8	–0.0975	0.1714	–0.1639	0.4515

*P-value ≤ 0.1, ** P-value ≤ 0.05, *** P-value ≤ 0.01

Table 3. Estimated elasticities and benefit cost ratio for promotion coefficients.

Firm size	Elasticity			Benefit cost ratio		
	Internet	Printed materials	Mass	Internet	Printed materials	Mass
Small ($10K–$250K)	0.0538	0.1072	0.1162	5.9	4.5	4.2
Medium ($250K–$1M)	0.0253	0.0395	0.0236	7.5	1.5	1.7
Large ($1M–$5 M)	*	0.0511	0.0571	*	2.4	4.4
Very Large ($5 M +)	*	*	0.1922	*	*	5.8
All firms combined	*	0.1625	0.2854	*	6.3	10.2

*Promotional expenditures were found to have no statistically significant effect on green industry sales.

The promotion elasticities are presented in Table 3. For small firms, a 100% increase on internet promotion and advertising expenditures increases sales 5.38%. Similarly, a 100% increase on promotion expenditures on printed materials and mass media increase sales 10.72 and 11.62%, respectively. Medium firm sales increase 2.53, 3.95 and 2.36% with a 100% increase in promotion expenditures on internet, printed materials and mass media, respectively. The positive impacts most likely are the result of small and medium firms capitalizing on new customers that find them through online, printed materials, or mass media; firms that do not advertise in these mediums do not reach these consumers.

On the other hand, internet promotions and advertising had no statistically significant effect on large and very large firms. This could be caused by a number of factors, notably that larger firms potentially have more sales directly to large purchasers (e.g. chain stores) or that internet expenditures are so small compared to the large volume of sales. The regression coefficients, and subsequently elasticities for printed materials and mass media promotions, were significant for all firm sizes, except for printed materials for very large firms. A 100% increase in expenditures on printed materials and mass media increases sales 5.11 and 5.71%, respectively. For very large firms, both internet and printed materials provided insignificant impacts to sales most likely due to the types (and volumes) of consumers within their clientele. A significant effect was found on very large firms for mass media such that a 100% increase in mass media promotions increases sales 19.22%.

A model with all firms was also estimated for the three promotion and advertising categories. For all firms, a 100% increase in promotion and advertising expenditures in printed materials and mass media increase sales 16.25 and 28.54%, respectively. When aggregated to all firms, internet promotions had no statistically significant effects on green industry sales. Internet promotion expenditures are likely small compared to average sales of all firms combined and therefore may not show a statistically significant impact in increasing sales.

Benefit cost analysis. The previous section shows that most promotion and advertising expenditures were effective in increasing green industry sales. In general, in order for larger firms to have statistically significant effects of promotion expenditures on green industry sales, they had to have larger expenditures. Internet and printed materials may be a small expenditure for large firms as a percentage of sales, hence they did not show any significant effects on sales. The elasticities were used to calculate a sales benefit cost ratio (BCR). The BCR is an important statistic that shows how much additional sales are generated per every $1 expenditure on each promotion and advertising category. The BCR is calculated as:

$$BCR = \frac{e_{\varphi_j} \times S}{A_j} \quad (8)$$

The BCR ranges from 0 (not significant effects on sales) to 7.5 depending on the firm size and promotion type. For small firms, internet generates the highest BCR at 5.9:1 which implies that for every $1 expended $5.9 in sales is brought in. In comparison, mass media only brings in $4.2 for every $1 expended. As discussed above, the reason for this difference could be that the internet gives small firms the ability to target a wide variety of consumers. The $1.7 difference between internet and mass media could result in the internet being a better means for small firms to bring in customers given they are better able to compete against larger-sized firms that might have more resources for mass media. In regards to printed media for small firms the BCR is higher ($4.5 vs $4.2) for printed materials compared to mass media. This could be the result of printed materials being more easily targeted to a wide group of consumers in a way that is more direct than mass media.

When looking at medium firms, we again see significant BCRs for each promotion/advertising regime. With regard to internet, we see the highest BCR of $7.5, noticeably higher than the $1.5 and $1.7 for printed materials and mass media, respectively. The exact reason for this wide a discrepancy is unknown; however, our theory is that the medium-sized firm could have a different clientele than the smaller or larger firms. For instance, small firms may be building relationships with its customers in order to create loyalty, while the larger firms are focusing more on volume consumers. To this end, the internet fills the void by allowing the medium-sized firms to transition to new clientele in a more cost effective manner than the other marketing media allow.

As a firm grows, mass media begins to play a more prominent role. For large firms the BCR for mass media almost doubles that of printed materials while quadrupling that of internet promotions. Again, we believe that as the firm gets larger the internet volume is only a small part of overall sales given the changing clientele of the firm. With respect to very large firms, mass media is the only significant medium at $5.8. When examining the aggregate model including all firms, sales increased $6.3 and $10.2 for every $1 spent on printed materials and mass media promotions, while changes in internet sales are insignificant.

As the green industry continues to adapt and survive through the weakened economy, firms must take advantage of cost effective mechanisms to increase sales. This research shows several factors that impact sales; however, in several cases the impacts are not consistent across firm sizes. With respect to years in operation, we see that smaller firms increase sales as they get older, but there is a size point whereby increasing age is not beneficial. Furthermore, for technology use we see that only medium firms receive a benefit while very large firms have lower sales as the technology index increases. Similar to the use of technology, increased trade show attendance also increases sales but only for medium and very large firms. From these findings, it appears to be evident that for some characteristics a firm can gain efficiencies with increasing size; however, for other characteristics the efficiencies disappear as the firm size increases.

As expected, we found significantly positive effects of advertising/promotion on sales. Of key interest is that for smaller firms, the mechanisms for building relationships (e.g. internet and printed material) have significant and often larger effects compared to the larger firms for which mass media tends to be more cost effective. Does this mean large firms should only do mass media and smaller firms should stick with internet and printed material? The answer is no given that firms need to take advantage of various types of media. However, firms should be aware of the effects of the different advantages/disadvantages of various marketing strategies and focus their efforts based on the clientele being targeted.

As a result of this research green industry firms have a clearer image of not only how their firm characteristics influence sales, but also, and perhaps more importantly, there is clear evidence that advertising/promotion can be effective. The caveat is that some mediums work better than others dependent on firm size. For this reason, green industry firms should evaluate their strategies based on whom they are targeting and the resources they have at their disposal.

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