

The long-term sustenance of sustainability practices in MNCs: A dynamic capabilities perspective of the role of R&D and internationalization

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The Long-Term Sustenance of Sustainability Practices in MNCs: A Dynamic Capabilities Perspective of the Role of R&D and Internationalization

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Abstract What allows MNCs to maintain their sustainability practices over the long-term? This is an important but under-examined question. To address this question, we investigate both the development and sustenance of sustainability practices. We use the dynamic capabilities perspective, rooted in resource-based view literature, as the theoretical basis. We argue that MNCs that simultaneously pursue both higher R&D intensity and higher internationalization are more capable of developing and maintaining sustainability practices. We test our hypotheses using longitudinal panel data from 1989 to 2009. Results suggest that MNCs that have a combination of both high R&D intensity and high internationalization are (i) likely to develop more sustainability practices and (ii) are likely to maintain more of those practices over a long-term. As a corollary, MNCs that have a combination of both low R&D and low internationalization usually (i) end up developing little or no sustainability practices and (ii) find it difficult to sustain whatever little sustainability practices they might have developed.

Keywords Corporate social responsibility · Sustainability practices · R&D · Innovation · Multinational · Internationalization · Dynamic capabilities · Resource-based view

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Introduction

Sustainability practices involve the “adoption of a long-term focus and a more inclusive set of responsibilities” that have a beneficial impact on “the ecosystems, societies, and environments of the future” (Ameer and Othman 2012, p. 61). Sustainability practices allow “long-term value creation” by helping firms to “develop opportunities and manage economic, environmental, and social risks” (Lopez et al. 2007, p. 289). For many multinational corporations (MNCs), developing sustainability practices to accommodate stakeholders’ social and environmental expectations has become crucial (Delgado-Ceballos et al. 2011). Various foreign stakeholders—non-governmental organizations (NGOs), industry associations, and governments—have become increasingly proactive in highlighting a host of social and environmental concerns (Marcus and Fremeth 2009). They expect MNCs to adhere to the numerous socio-environmental regulations and standards that vary across regions. These regulations and standards in foreign markets function as the thresholds, not just for initial entry, but also for continuance of MNCs’ operations in the future.

Dependence on foreign markets makes MNCs vulnerable to the dissatisfaction of foreign stakeholders. After all, MNCs tend to be more visible in foreign countries. Any failure to meet the expectations of concerned stakeholders tends to be given wide publicity, which damages the MNCs’ reputation, increases various liabilities of foreignness, and ultimately makes business operations in foreign countries difficult. Consequently, the mounting pressure from key stakeholders, at both home and abroad, have fundamentally changed the business landscape. The movement toward sustainability has become imperative for MNCs.

There has been considerable research on the sustainability practices of MNCs (de Lange 2010). Much of this

research, however, is underlined by a static view that exclusively focuses on the initial development of practices that are socially or environmentally beneficial. Little emphasis, however, has been given to how MNCs would maintain the sustainability practices over time. Although there is a definite need for the initial development of sustainable practices, the sustainability practices initiated by MNCs may be in danger of being abandoned over time. This abandonment tendency is largely due to the perception of a trade-off between a firm's financial objectives and its sustainability practices. As suggested by prior studies, managers seem convinced that "the combination of environmentally and competitively sound improvements is very difficult to implement" (Klassen and Whybark 1999, p. 599). They fear that "the more environment-friendly they become, the more the effort will erode their competitiveness" (Nidumolu et al. 2009, p. 57). Hence, it is critical to uncover factors that help MNCs maintain various sustainable practices over a long-term to ensure a substantive and continuous progress in sustainability.

The purpose of this study is to examine how sustainability practices can be both developed and sustained (maintained over the long term) by MNCs. Drawing on the resource-based view literature, we rely on the dynamic capabilities perspective of the firm as the theoretical basis of our study (Luo 2000; Sapienza et al. 2006; Teece et al. 1997). In particular, we focus our attention on the combined influences of two organizational attributes that, as suggested by prior literature, are of strategic importance to MNCs: (i) Research and development (R&D) and (ii) internationalization (Hitt et al. 2006; Sapienza et al. 2006). R&D intensity is defined as R&D spending per employee within an MNC, which is a general indicator of the MNC's intellectual capital and innovative capabilities. Level of internationalization is defined as the extent to which MNCs depend on foreign markets rather than domestic markets for sales. We argue that, the strong innovation capabilities associated with intensive R&D and the strong market-orientation capabilities associated with high level of internationalization, when combined, can help MNCs not only develop but also maintain sustainability practices over the long-term.

This study offers important contributions to the literature. First, it expands the scope of the sustainability research by going beyond the traditional focus on the initial development of sustainability practices to the relatively under-examined issue of sustaining the sustainability practices over the long-term. Given that sustainability practices developed in the past can easily disappear over time, it is important to understand what factors would ensure that the sustainability practices perpetuate into the future—so that progress is continuous rather than temporary. Second, the findings highlight the interaction between R&D and internationalization, thus extending the corporate

social responsibility (CSR) and sustainability literature that has traditionally focused on the independent influences of R&D and internationalization. Finally, our findings expand the traditional resource-based view by highlighting an alignment between MNCs' core strategies and sustainability practices.

Theory and hypotheses

Sustainability practices represent a holistic, balanced, and long-term approach to conducting business with potential to have a net positive impact on ecological systems, social systems, economic systems, and various stakeholders. In coming sections, we develop hypotheses regarding the combined influence of R&D intensity and internationalization on (i) the development of sustainability practices and (ii) the long-term sustenance (maintenance) of sustainability practices in MNCs. We utilize the dynamic capabilities perspective as the theoretical underpinning (Teece 2007; Teece et al. 1997).

Dynamic capabilities

Dynamic capabilities refers to an organization's ability to create or maintain value by building and deploying its competencies over time in a manner that maximizes the organization's fit with the changing requirements in the external environment (Luo 2000; Teece et al. 1997). Importantly, the dynamic capabilities perspective introduces longitudinal and evolutionary arguments into the traditional resource-based view. The dynamic capabilities literature has highlighted the importance of innovation capabilities (e.g., from R&D) as well as market-orientation capabilities (e.g., from internationalization) in order to maximize the congruence of an organization with the demands of its various stakeholders over time (Hart 1997; Husted and Allen 2007; Luo 2000; Padgett and Galan 2010; Sapienza et al. 2006).

Technology and Process Innovation Capabilities from R&D

R&D provides a base for strong innovation capabilities to make pro-sustainability improvements in products and processes (Hart 1997; Nidumolu et al. 2009; Padgett and Galan 2010). For instance, innovative technologies and processes can facilitate the redesign of manufacturing to eliminate contaminating waste, increase the efficiency of energy consumption, and help incorporate eco-friendly attributes into products and services. However, R&D may prove ineffective without complementary market-orientation capabilities. R&D benefits from complementary market-orientation capabilities in order to deliver innovations that can satisfy the

demands of customers and stakeholders spread across the global marketplace (Chakrabarty et al. 2008; Green et al. 2007; Teece et al. 1997).

Market-Orientation Capabilities from Internationalization

A high level of internationalization allows MNCs to keep track of the changing dynamics of the global business environment, providing opportunities to re-allocate resources, transfer relevant knowledge, and hedge their bets across countries through arbitrage (Lu and Beamish 2004; Luo 2000). MNCs accumulate market-orientation capabilities during the process of expanding and diversifying into markets (Chakrabarty et al. 2008; Green et al. 2007). Capability accumulation is accomplished through the MNCs' exposure to international consumers, non-governmental organizations (NGOs), and international governmental organizations (IGOs) (Grant 1996; Sapienza et al. 2006).

Synergy Between Capabilities

Consider the following four scenarios:

- (1) *When both R&D and internationalization levels are high:* In this scenario, an MNC's ability to develop and maintain sustainability practices would be high. This is because of the following reasons. (a) The MNC learns from stakeholders in foreign markets who have environmental, social, and economic concerns that are different from those in domestic markets. (b) R&D allows reconfiguration in resource allocations and processes in response to demands of various stakeholders. (c) Sustainability practices are built using new knowledge and new technologies—derived from a combination of R&D and the learning gained from international experiences of the MNC.
- (2) *When both R&D and internationalization are low:* In this scenario, an MNC's ability to develop and maintain sustainability practices would be low. This is because of the following reasons. (a) Foreign markets are seen as a marginal extension to the dominant domestic market, exposure to world's concerns is limited, and most stakeholders are from domestic markets. (b) The firm relies on traditional knowledge, past practices, and old technologies; it sells conventional products and services. (c) There is less motivation to change old habits.
- (3) *When R&D is high but internationalization is low:* In this scenario, an MNC's ability to develop and maintain sustainability practices would be moderate. This is because (a) high skills and knowledge are derived from R&D, but these are applicable largely to the already well-known domestic markets and

stakeholders, and (b) knowledge about needs of international stakeholders is very limited—R&D efforts are oblivious to various problems facing the world.

- (4) *When R&D is low but internationalization is high:* In this scenario, an MNC's ability to develop and maintain sustainability practices would be moderate. This is because though exposure to the world's concerns is high, the lack of R&D implies that these concerns can be addressed only by use of traditional knowledge, past practices, and old technologies. Lack of R&D prevents MNC from addressing the novel demands of international stakeholders, despite the MNC being aware of them.

Consequently, we argue that MNCs with high levels of both R&D and internationalization are best positioned to achieve a strategic synergy that facilitates development and sustenance of sustainable practices.

Development of Sustainability Practices by MNCs

In the light of synergy effect discussed above, two capabilities accumulated from internationalization are of importance. First, is market orientation, arising from the knowledge about the demands of international markets and the expectations of foreign stakeholders (Grant 1996). Accumulated knowledge about the preferences of foreign stakeholders helps managers channel investments toward R&D efforts that help develop sustainability practices (Busch and Hoffmann 2009; Nidumolu et al. 2009). From their international experiences, MNCs obtain a better grasp of the social/environmental rules, norms, and preferences from stakeholders such as governments, NGOs, and local consumers (Sapienza et al. 2006). Because foreign consumers can be environment-sensitive and because policies of foreign governments can be stringent on sustainability issues, highly internationalized MNCs would have a keener understanding of sustainability related trends and can accurately ascertain the most needed and relevant sustainable practices. The broader exposure to stakeholders raises the visibility of sustainability concerns during the strategic decision-making process, thereby steering MNCs to invest more resources into sustainability practices.

Second, is technological and process innovation, involving the capability of MNCs to reconfigure resource allocation and processes in accordance with changes in the environment (Sapienza et al. 2006). Expanding business activities abroad exposes an MNC to uncertainties and risks arising from new markets, requiring the continual development of new capabilities and processes (Hitt et al. 2006; Lu and Beamish 2004). MNCs that have to frequently engage with various foreign stakeholders would be

compelled to acquire the competence to dynamically reconfigure processes and resources in response to the external demands (Sapienza et al. 2006; Teece 2007; Whitten et al. 2010). R&D-based reconfiguration capabilities would prove useful for responding to the demands, and allow the development of various sustainability practices to a larger extent, in quicker time, with better targeting, and at lesser cost (Hart 1997; Nidumolu et al. 2009; Teece 2007; Teece et al. 1997).

In sum, we argue that the development of sustainability practices in MNCs is positively influenced by the interaction between R&D intensity and internationalization.

Hypothesis 1 An MNC is more likely to develop sustainability practices when both its R&D intensity and internationalization are simultaneously high.

Long-Term Sustenance of Sustainability Practices by MNCs

There are obstacles to the long-term continuity of sustainable practices. One obstacle is that MNCs may be myopic, that is, impatient or intolerant toward investments in sustainability practices that do not give instant returns (Klassen and Whybark 1999). Another obstacle arises from the tension between a firm's sustainability practices and the competitive pressures it faces. This may be, for instance, due to higher costs or due to unwillingness of customers to pay a higher price for sustainable products/services (Nidumolu et al. 2009). Hence, there is a threat that sustainability practices developed by MNCs may be transient or temporary—the adopters (i.e., MNCs) may not be able to maintain the practices over a long time.

We argue that the technological and market-orientation capabilities gained from R&D intensity and internationalization can help the sustainability practices to persist into the future. These capabilities extend positive path-dependency features—anchoring MNCs on a persistent trajectory of sustainability endeavors (Teece et al. 1997). First, with the repeated deployment of technological and market-orientation capabilities, the costs of the associated infrastructure and assets would decrease over time, whereas the benefits from the sustainability practices would increase over time (Helfat 1997). Consequently, over time, the sustainability practices would become financially viable. Second, the repeated deployment of technological and market-orientation capabilities would involve a “learning by doing” process wherein MNCs continuously polish and renew their skills, technologies, and knowledge (Teece et al. 1997). Such frequent reconfiguration exercises typically lead to the MNC becoming more flexible and agile (Teece et al. 1997; Whitten et al. 2010). As the utilization of technological and market-orientation capabilities is

intensified, the synergistic interactions between these capabilities will perpetuate over time. With high levels of R&D and internationalization, the learning-by-doing would become an ongoing process of knowledge and capability accumulation, leading to the long-term sustenance of sustainability practices.

In sum, MNCs that have a combination of both high R&D intensity and high internationalization are likely to maintain more of their sustainability practices over a long-term. That is, the interaction between the extent of past sustainability practices, R&D intensity, and internationalization would positively influence the extent of future sustainability practices.

Hypothesis 2 When both R&D intensity and internationalization are simultaneously high, sustainability practices developed by the MNC are more likely to be sustained over the long-term.

Methods

Sample and Procedure

We use longitudinal panel data to test the hypotheses. The sample is created by merging information from three databases: Kinder, Lydenberg, and Domini (KLD) database, Compustat fundamentals database, and Compustat segments database. Consistent with the purpose of this study, only MNCs are considered for the sample. The geographic segments file in the Compustat segments database is used to identify firms that are MNCs. A firm is considered as an MNC in a given year if it reports data for one or more non-domestic segments and has foreign sales greater than zero in that year. Our reliance on the USA centric databases meant that all the MNCs in our sample were headquartered in the USA.

Development of Sustainability Practices by MNCs

The dependent variable (sustainability practices from KLD) is lagged ahead of independent variables (R&D intensity from Compustat fundamentals and internationalization from Compustat segments) by 1 year. Data obtained from KLD for the dependent variable is from 1990 to 2009. Corresponding data for independent variables, lagged behind by 1 year, is from 1989 to 2008. The merged dataset has a sample size of 6,744 firm-years observations (includes 1,128 firms, with each firm having at least 2 years of data) and covers the period of 1989 to 2009. The MNCs in the sample are distributed across a variety of industries, with 61.8 % from the manufacturing industry, 15.1 % from the services industry, and the remaining 23.1 % from various other industries. The

MNCs in the sample are, on average, large mature firms (with an average of 6.7 billion \$ in total assets, 5.3 billion \$ in sales, 0.16 billion \$ in R&D expenses, 21.1 thousand employees, 26.2 years as a publicly listed firm, and presence in 3.6 countries; where the dollar values are adjusted for inflation with 2000 as the base year). Importantly, 26.7 % of the MNCs did not develop any sort of sustainability practices. The remaining 73.3 % of MNCs developed sustainability practices, in varying degrees.

Long-Term Sustenance of Sustainability Practices by MNCs

To test the sustenance hypotheses, we include sustainability practices as the third-independent variable (besides R&D intensity and internationalization), while simultaneously retaining sustainability practices as the dependent variable (albeit lagged ahead by several years, such as by 3 or 6 years). It is not uncommon to test the conditions under which a variable is influenced by its own value in previous periods (Kennedy 2003). Whenever “a lagged value of the dependent variable appears as a regressor in an estimating relationship, we have the case of autoregression” (Kennedy 2003, pp. 163–164). This autoregression approach is commonly used to test the persistence or lag effect of certain phenomenon in finance and economic literatures (Chen 2007; Li 2001; Verdelhan 2010). We estimate the model and report the results on two samples—one with a lag of 3 years and the other with a lag of 6 years. Note that regression results are found to be similar even if we use samples with alternative lag periods, such as with lags of 2, 4, 5, and 7 years, which suggests that our results are robust across various time frames.

The two samples are drawn from the same sample described in the earlier section. However, the sample sizes become much smaller with longer lag periods between the dependent variable (sustainability practices in year $Y + N$, where $N = 3$ and 6 years) and the independent variables (sustainability practices, R&D intensity, and internationalization in year Y). This is because the number of MNCs for which longitudinal data is available goes down as the lag becomes longer. For the dependent variable being lagged ahead of independent variables by 3 years, the sample size narrows down to 3,548 firm-years observations (includes 657 firms, with each firm having at least 4 years of data) and covers the period of 1991 to 2009. Data for the independent variables are from 1991 to 2006, and data for the dependent variable is from 1994 to 2009. For the dependent variable being lagged ahead of independent variables by 6 years, the sample size narrows down to 1,544 firm-years observations (includes 287 firms, with each firm having at least 7 years of data) and covers the period of 1991 to 2009. Data for the independent variables

are from 1991 to 2003, and data for the dependent variable is from 1997 to 2009.

Measures: Dependent and Independent Variables

Sustainability Practices

Sustainability practices of MNCs are measured as a continuous variable—the total number of organizational strengths that are regarded by stakeholders as positive indicators of corporate social responsibility. Specifically, it is the sum of the number of positive practices across six sustainability-related areas: environment, community, employee relations, diversity, governance, and product technology. The six major areas cover the MNCs’ relationships with broad array of key stakeholders, aligning closely with the conceptual comprehensiveness of our central construct: sustainability practices. The data is obtained from the KLD database. KLD counts a practice only if it is highly substantial and notable. KLD’s stringent criteria makes it tough for firms to achieve high KLD ratings. The ratings are not constant—they change over time. This allows us to test whether sustainable practices are being maintained over time. Overall, the KLD data suit our conceptualization of sustainability practices.

R&D Intensity

R&D intensity is measured as the ratio of R&D spending to the number of employees, in thousands of dollars per employee. R&D per employee is a strong indicator of an MNC’s intellectual capital and innovation. Results of hypotheses tests are found to be very similar with alternative measures of R&D intensity—such as the ratio of R&D spending to total assets.

Internationalization

Internationalization is measured as the ratio of foreign sales to total sales. It indicates the extent to which an MNC’s business comes from foreign versus domestic markets. Results of hypotheses tests were found to be very similar with alternative measures of internationalization—such as the entropy or the herfindahl measures of international diversification.

Measures: Control Variables

The control variables included in the regressions are as follows: firm dummies, industry dummies, size, profitability, market valuation, and debt. Longitudinal panel data needed to calculate the control variables are obtained from Compustat fundamentals.

Firm Dummies

The regressions used are one-way fixed effects regressions, which automatically generate dummies for each firm. By using each firm as its own control, the regression controls for all stable characteristics of the firms and uses only within-firm variation to estimate the regression coefficients. Further, single digit SIC codes are included as industry dummies, to control for changes in industry classification.

Size

Given the resources they can leverage, larger MNCs are likely to have a wider influence on the environment, community, and other stakeholders. Hence, we control for MNC size, measured as log (total assets), with total assets being in millions of dollars.

Profitability

The literature on the association between profitability and sustainability practices has yielded mixed results, with some suggesting a positive association and others suggesting otherwise. Hence, we controlled for MNC profitability, measured as the gross profit margin (ratio of income to net sales).

Market Valuation

A high value of Tobin's Q is an indicator of market overvaluation, that is, the capital markets have positive expectations about future growth prospects of the MNC. MNCs with such positive reputation in the capital markets might be more inclined to adopt sustainability practices. Hence, we control for market valuation, measured as the simple Tobin's Q .

Debt

Under debt burden, a firm tends to put high priority on short-term earnings and divest resources from business or practices that are less likely to generate financial returns. Subsequently, MNCs with a heavy debt burden might find it harder to afford sustainability practices. Hence, we control for the MNC's debt ratio, which is the ratio of total debt liabilities to total assets.

Results

Given the use of panel data in this study, we use one-way fixed effect regression models to test the hypotheses. Furthermore, all the variables are standardized before entering into the regression equations to avoid multicollinearity problems and to obtain standardized parameter estimates.

Development of Sustainability Practices by MNCs

Table 1 provides the descriptive statistics and correlations of all the variables in the model. Table 2 provides the regression results with sustainability practices as the dependent variable, which is lagged ahead of the independent variables by 1 year. The independent variables are hierarchically entered in the following steps: the control variables (model A1); the two independent variables (entered separately in models A2 and A3 and together in model A4); and the two-way interaction effect (model A5).

Hypothesis 1 suggests that an MNC is more likely to develop sustainability practices when both its R&D intensity and internationalization are higher. Consistent with hypothesis 1, the two-way interaction between R&D intensity and internationalization is significant ($\beta = 0.046$, $p < 0.001$). The R^2 of the final model suggests that the independent variables explain 77.82 % of the variance in sustainability practices, and the corresponding F test indicates a good fit ($F = 32.77$, $p < 0.001$).

For illustration purposes, Fig. 1 provides the interaction plot with internationalization on the x axis and R&D intensity as the moderator. The moderator variable is continuous, but only the lines representing \pm one standard deviation are plotted for ease of visualization. The slope for the effect of internationalization on sustainability practices is stronger when R&D intensity is high (simple slope = 2.770), and weaker when R&D intensity is low (simple slope = 1.906).

Long-Term Sustenance of Sustainability Practices by MNCs

Table 3 provides the regression results with the dependent variable being sustainability practices in year $Y + N$ (where $N = 3$ and 6 years) and with the independent variables being sustainability practices, R&D intensity, and internationalization in year Y . Models B1 through B4 correspond to the sample with a 3-year lag and models C1 to C4 correspond to the sample with a 6-year lag. The independent variables are hierarchically entered in steps: the control variables (model B1/C1), the three independent variables (model B2/C2), the two-way interactions (model B3/C3), and the three-way interaction (model B4/C4).

Hypothesis 2 suggests that when an MNC's R&D intensity and internationalization are higher, the sustainability practices developed by the MNC (in year Y) are more likely to be sustained over the long-term (into year $Y + N$, where $N = 3, 6$). Consistent with hypothesis 2, the three-way interaction between past sustainability practices, R&D intensity, and internationalization is significant for both the 3-year lag sample ($\beta = 0.031$, $p < 0.05$) and the 6-year lag sample ($\beta = 0.091$, $p < 0.001$). The two-way interactions corresponding to hypothesis 2 are also significant. The

Table 1 Development of sustainability practices by MNCs: descriptive statistics and correlations

Variables	Mean	SD	1	2	3	4	5	6	7	8
<i>Dependent variable (year Y)</i>										
1. Sustainability practices ^a	1.72	2.29	1							
<i>Control variables (year Y - 1)</i>										
2. Size	7.48	1.62	0.47	1						
3. Profitability	0.39	0.25	0.08	-0.08	1					
4. Market valuation	2.04	1.81	0.07	-0.10	0.26	1				
5. Debt	0.18	0.16	-0.04	0.18	-0.11	-0.19	1			
<i>Independent variables (year Y - 1)</i>										
6. R&D intensity	14.59	33.42	0.07	-0.17	0.12	0.19	-0.18	1		
7. Internationalization (FSTS)	0.39	0.25	0.07	-0.05	0.14	0.01	-0.10	0.25	1	
8. International diversification (Herfindahl)	0.51	0.22	0.11	0.04	0.13	0.00	-0.10	0.19	0.73	1
9. International diversification (Entropy)	0.99	0.52	0.09	0.02	0.10	-0.01	-0.08	0.19	0.69	0.95

Sample size = 6,744 firm-years (includes 1,128 firms, with each firm having at least 2 years of data). Data covers the period of 1989 to 2009. Dependent variable is lagged ahead of independent variables by 1 year. Hence, data for independent variables is from 1989 to 2008, whereas data for dependent variable is from 1990 to 2009. All dollar values are adjusted for inflation with 2000 as base year. Sample contains MNCs only, where a firm is categorized as an MNC if it reports data for one or more non-domestic segments and has foreign sales greater than zero that year. Note that basic correlations fail to take into account the longitudinal/panel nature of data, and can therefore be misleading; hence, the literature suggests using fixed-effects regressions, rather than correlations, to test hypotheses

^a *Sustainability practices* include organizational practices that are major strengths with regard to the *environment* (environmentally beneficial products/services, pollution prevention programs, recycling, clean energy, communication on environmental issues, property/plant/equipment maintenance, etc.), the *community* (charitable giving, support for non-profit, international charity, support for housing, support for education, relations with indigenous people, human rights, volunteer programs, etc.), *employee relations* (employee involvement, retirement benefits program, health and safety programs, cash profit sharing program, union relations, avoiding layoffs, etc.), *diversity* (women, minorities, and disabled hold or get promoted to positions such as CEO, board of directors, and other positions of responsibility, and benefit from progressive policies regarding employment and work/life balance), *governance* (transparency, accountability, socially responsible investing, avoiding excessive compensation to top management, etc.), and *product technology* (product and services are of high quality, innovative, benefit the economically disadvantaged, and result in social benefits)

two-way interaction between past sustainability practices and R&D intensity is significant for both the 3-year lag sample ($\beta = 0.081$, $p < 0.001$) and the 6-year lag sample ($\beta = 0.093$, $p < 0.001$). The two-way interaction between sustainability practices and internationalization is significant for both the 3-year lag sample ($\beta = 0.054$, $p < 0.001$) and the 6-year lag sample ($\beta = 0.058$, $p < 0.01$).

The R^2 of the final models suggest that the independent variables explain 84.98 % of the variance in sustainability practices in the 3-year lag sample and 85.42 % of the variance in sustainability practices in the 6-year lag sample, and the corresponding F tests indicate a good fit.

Figure 2 provides the interaction plots that help interpret the three-way interaction suggested in Hypothesis 2. For ease of interpretation of the three-way interaction, we plot the two-way interactions between two-independent variables at a time, with the third independent variable being held constant at the mean. The moderator variables are continuous, but only the lines representing \pm one standard deviation are plotted for ease of visualization.

The plots in the first row of Fig. 2 suggest that when an MNC's R&D intensity is higher (holding internationalization constant at its mean), sustainability practices developed by the MNC (in year Y) are more likely to be sustained over

the long-term (into year $Y + N$, where $N = 3, 6$). The slope for the influence of sustainability practices in year Y on sustainability practices in year $Y + N$ is stronger when R&D intensity is high (simple slope = 0.526, 0.412 for $N = 3, 6$) and is weaker when R&D intensity is low (simple slope = 0.272, 0.089 for $N = 3, 6$).

The plots in the second row of Fig. 2 suggest that when an MNC's internationalization is higher (holding R&D intensity constant at its mean), sustainability practices developed by the MNC (in year Y) are more likely to be sustained over the long-term (into year $Y + N$, where $N = 3, 6$). The slope for the influence of sustainability practices in year Y on sustainability practices in year $Y + N$ is stronger when internationalization is high (simple slope = 0.486, 0.357 for $N = 3, 6$) and is weaker when internationalization is low (simple slope = 0.294, 0.113 for $N = 3, 6$).

Other Interesting Effects

A substantial effect of firm size is present in the testing of both hypotheses, which eclipses the relatively trivial contributions of some of the other controls. However, the fact that our independent variables as well as the interaction

Table 2 Development of sustainability practices by MNCs: interaction between R&D intensity and internationalization

	A. Sustainability practices as dependent variable (year Y), Standardized parameter estimates β				
	A1 Control variables	A2 Independent variable	A3 Independent variable	A4 Independent variables	A5 Interaction
Intercept	-0.241	-0.293	-0.499*	-0.484*	-0.473 [†]
<i>Control variables (year Y - 1)</i>					
Firm & industry dummies	✓	✓	✓	✓	✓
Size	0.499***	0.477***	0.387***	0.371***	0.376***
Profitability	0.009	0.007	0.007	0.008	0.007
Market valuation	0.005	0.005	0.005	0.004	0.006
Debt	-0.002	-0.001	-0.005	-0.001	-0.000
<i>Independent variables (year Y - 1)</i>					
R&D Intensity		0.115***		0.110***	0.099***
Internationalization			0.263***	0.240***	0.235***
Internationalization ²				0.034**	0.029*
<i>Interaction</i>					
R&D Intensity × internationalization					0.043***
R ²	0.7686***	0.7704***	0.7760***	0.7777***	0.7782***
F value	10.38	10.29	10.81	10.77	10.80
P value	<0.001	<0.001	<0.001	<0.001	<0.001
ΔR^2		0.0018***	0.0074***	0.0091***	0.0005***
Wald χ^2		43.73	185.68	237.30	12.77
P value		<0.001	<0.001	<0.001	<0.001

Sample size = 6,744 firm-years (includes 1,128 firms, with each firm having at least 2 years of data). Dependent variable is lagged ahead of independent variables by 1 year. Data covers the period of 1989 to 2009. Data for independent variables are from 1989 to 2008, whereas data for dependent variable is from 1990 to 2009

All variables are centered and standardized. Plot of the residuals against the predicted value did not indicate any evidence of heteroskedasticity problems. ΔR^2 and corresponding Wald tests for models A2, A3, and A4 are with respect to model A1, and for model A5 with respect to model A4. Maximum variance inflation factor (VIF) = 1.83, suggesting no evidence of multicollinearity problems. All dollar values are adjusted for inflation with 2000 as base year. Sample contains MNCs only, where a firm is categorized as an MNC if it reports data for one or more non-domestic segments and has foreign sales greater than zero that year

*** $p \leq 0.001$, ** $p \leq 0.01$, * $p \leq 0.05$, [†] $p \leq 0.10$ (conservative two-tailed tests)

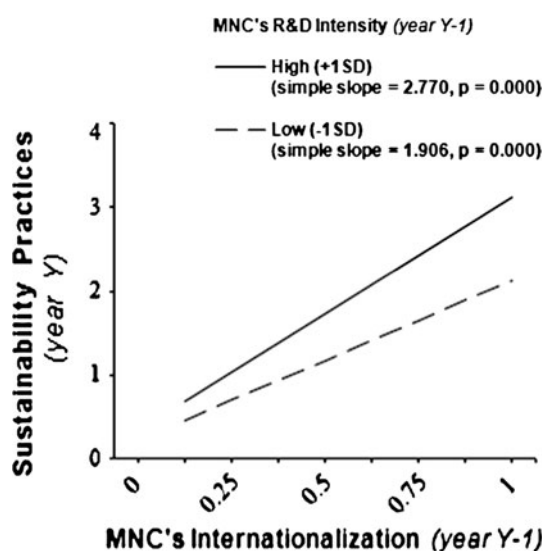


Fig. 1 Development of sustainability practices by MNCs: two-way interaction between R&D intensity and internationalization

terms remain strongly significant, regardless of the overwhelming shadow of firm size, is important. It shows that R&D and internationalization capture additional and significant variance in the dependent variables, beyond the variance captured by firm size. The pattern in our results (significant effect of size, significant effect of some of the other controls, and significant effects of R&D and internationalization) suggest that the results are conservative and robust.

Other studies have considered the main effect of internationalization in both linear and curvilinear forms (Lu and Beamish 2004). It is, therefore, important to account for the possible curvilinear impact of internationalization on sustainability. Hence, we included a squared term internationalization² in all models. Consistent with the literature, this curvilinear term is usually significant. Notably, our original interaction hypotheses remain significant in the presence of the internationalization² term. This indicates that our hypotheses capture additional and significant

Table 3 Long-term sustenance of sustainability practices (after 3 and 6 years) by MNCs: interaction of current sustainability practices, R&D, and internationalization

	B. Sustainability practices after 3 years as dependent variable (year $Y + 3$), standardized parameter estimates β				C. Sustainability practices after 6 years as dependent variable (year $Y + 6$), standardized parameter estimates β			
	B1	B2	B3	B4	C1	C2	C3	C4
Intercept	0.238	0.088	0.092	0.085	-0.958*	-0.967*	-0.964*	-0.999*
<i>Control variables (year Y)</i>								
Firm & industry dummies	✓	✓	✓	✓	✓	✓	✓	✓
Size	0.691***	0.395***	0.376***	0.380***	0.601***	0.409***	0.390***	0.378***
Profitability	0.038	0.017	0.015	0.017	0.061	0.033	0.030	0.036
Market valuation	0.009	0.032*	0.039**	0.040**	0.110***	0.105***	0.102***	0.101**
Debt	-0.026	-0.009	-0.008	-0.009	0.049 [†]	0.040 [†]	0.045 [†]	0.048 [†]
<i>Independent variables (year Y)</i>								
Sustainability practices		0.357***	0.310***	0.306***		0.193***	0.138***	0.128***
R&D intensity		0.034*	0.002	0.002		0.090**	0.052	0.051
Internationalization		0.091***	0.089***	0.084***		0.150***	0.149***	0.136***
Internationalization ²		0.052**	0.034*	0.032*		0.053 **	0.030	0.027
<i>Two-way interactions</i>								
Sustainability practices × R&D intensity			0.077***	0.057**			0.089***	0.047 [†]
Sustainability practices × internationalization			0.052***	0.044**			0.057**	0.039 [†]
R&D intensity × internationalization			0.002	0.001			0.021	0.023
<i>Three-way Interaction</i>								
Sustainability practices × R&D × internationalization				0.030*				0.090***
R^2	0.8167***	0.8472***	0.8498***	0.8500***	0.8354***	0.8480***	0.8524***	0.8543***
F value, P value	11.41, <0.001	3.21, <0.001	3.27, <0.001	3.28, <0.001	12.27, <0.001	5.41, <0.001	5.48, <0.001	5.47, <0.001
ΔR^2		0.0305***	0.0026***	0.0002*		0.0126***	0.0044***	0.0019***
Wald χ^2 , P value		575.82, <0.001	49.59, <0.001	3.89, 0.048		111.68, <0.001	29.98, <0.001	16.10, <0.001

For models B1–B4: Sample size = 3,548 firm-years (includes 657 firms, with each firm having at least 4 years of data). Dependent variable is lagged ahead of independent variables by 3 years. Data covers the period of 1991 to 2009. Data for independent variables are from 1991 to 2006, whereas data for dependent variable is from 1994 to 2009

For models C1–C4: Sample size = 1544 firm-years (includes 287 firms, with each firm having at least 7 years of data). Dependent variable is lagged ahead of independent variables by 6 years. Data covers the period of 1991 to 2009. Data for independent variables are from 1991 to 2003, whereas data for dependent variable is from 1997 to 2009

All variables are centered and standardized. Plot of the residuals against the predicted value did not indicate any evidence of heteroskedasticity problems. Maximum variance inflation factor (VIF) = 1.97, suggesting no evidence of multicollinearity problems. All dollar values are adjusted for inflation with 2000 as base year. Sample contains MNCs only, where a firm is categorized as an MNC if it reports data for one or more non-domestic segments and has foreign sales greater than zero that year. Internationalization is measured as ratio of foreign sales to total sales

*** $p \leq 0.001$, ** $p \leq 0.01$, * $p \leq 0.05$, [†] $p \leq 0.10$

variance in the dependent variables, beyond the variance captured by internationalization².

Further, in the presence of the hypothesized interaction terms, the internationalization² retains its significance when the lag is 3 years ($p < 0.05$, in steps B3 and B4 in Table 3), but loses its significance when the lag is 6 years ($p > 0.10$, in steps C3 and C4 in Table 3). This suggests that an extended lag weakens the curvilinear influence of the internationalization² term. In contrast to the squared term, the linear term of internationalization retains its

significance, indicating that the linear term is a better candidate for testing long-term lag effects.

On a related note, there is a weakening of the autoregression effect (of past sustainability practices in year Y on future sustainability practices in years $Y + 3$ and $Y + 6$) as the lag is increased from 3 to 6 years. This weakening is visible in the standardized effect sizes in Table 3 (effect sizes for sustainability practices independent variable are lower in steps C1–C4 than in steps B1–B4). Hence, as time progresses, it gets more difficult to sustain sustainability

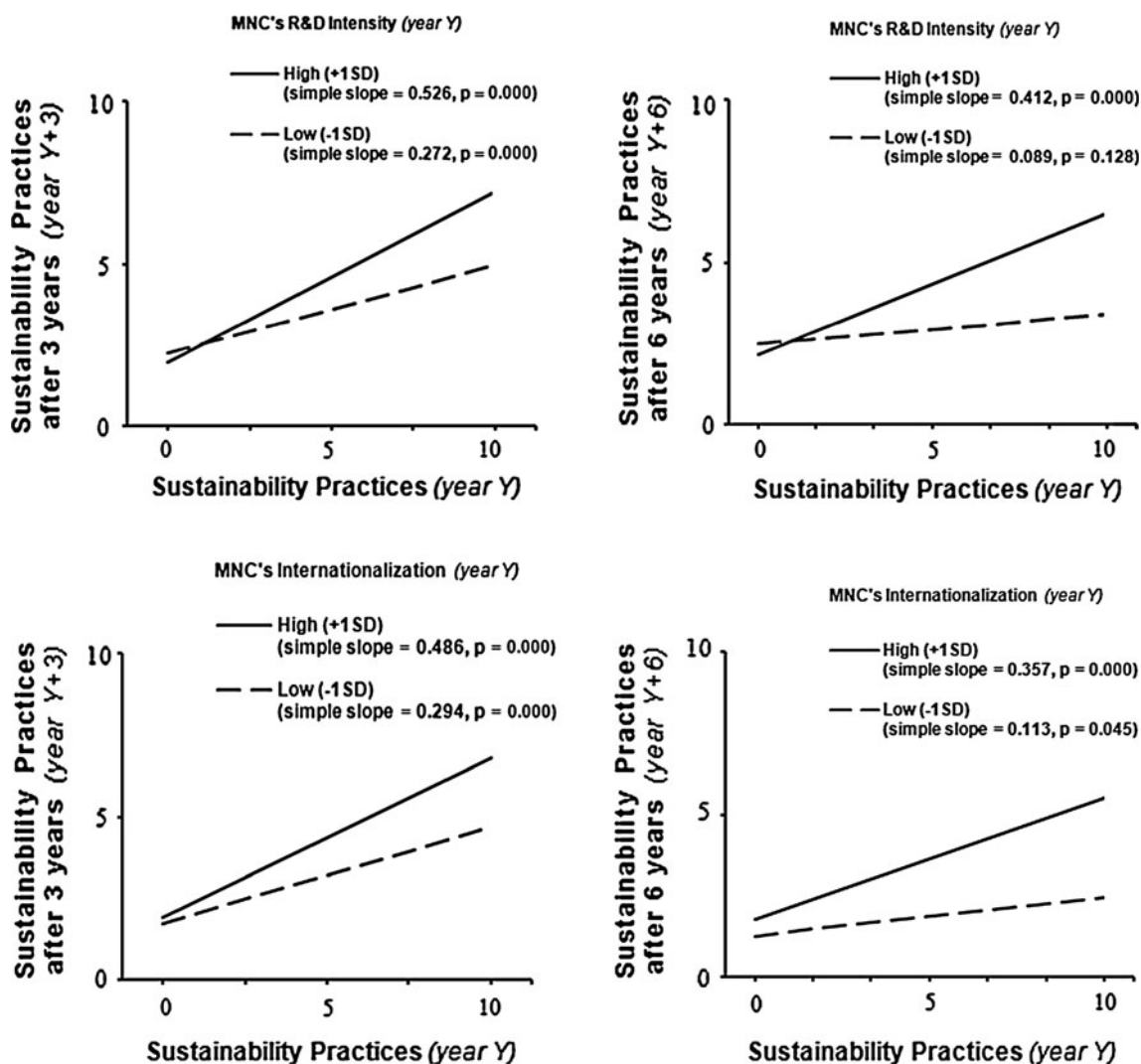


Fig. 2 Long-term sustenance of sustainability practices (after 3 and 6 years) by MNCs: three-way interaction of past sustainability practices, R&D intensity, and internationalization

practices. The antidote, as we argue, is for the MNC to simultaneously pursue high levels of both R&D and internationalization.

Alternative Measures of Internationalization

The literature has used different measures of internationalization. To test whether our results would hold across various measures, we re-test the sustenance hypotheses (with a 6-year time lag) for two alternative measures of internationalization, i.e., international diversification using the Herfindahl measure (in models D3 and D4 in Table 4) and the Entropy measure (in models E3 and E4 in Table 4). For a firm i , the Herfindahl measure is calculated using the formula $[1 - \sum_j (s_{ij}^2)]$ and the entropy measure is calculated using $\sum_j (s_{ij} * \ln(1/s_{ij}))$, where s_{ij} is the share (percentage) of firm i 's

sales from a country j . Both these measures use the share of sales per geographic segment to weigh the extent to which an MNC's sales are diversified across various geographic segments. The results of the two-way interactions (models D3/E3) and three-way interaction (models D4/E4) remain consistent with our original findings (models C3 and C4 of Table 3, respectively). Overall, the additional analyses increase our confidence in the findings.

Discussion

Using the dynamic capabilities perspective, this study examined the combined influence of two attributes of an MNC—R&D intensity and level of internationalization—on the development and sustenance of sustainability practices.

Table 4 Post hoc analyses: long-term sustenance test (6-year lag) using alternative measures of internationalization

	Sustainability practices after 6 years as dependent variable (year $Y + 6$), standardized parameter estimates β							
	With Herfindahl measure of international diversification as independent variable				With entropy measure of international diversification as independent variable			
	D1	D2	D3	D4	E1	E2	E3	E4
Intercept	-0.958*	-1.082**	-1.067**	-1.060**	-0.958*	-1.097**	-1.074**	-1.072**
<i>Control variables (year Y)</i>								
Firm & industry dummies	✓	✓	✓	✓	✓	✓	✓	✓
Size	0.601***	0.398***	0.396***	0.383***	0.601***	0.404***	0.407***	0.396***
Profitability	0.061	0.049	0.050	0.051	0.061	0.056	0.050	0.053
Market valuation	0.110***	0.101***	0.097***	0.092***	0.110***	0.104***	0.099***	0.096***
Debt	0.049 [†]	0.041 [†]	0.045 [†]	0.044 [†]	0.049 [†]	0.044 [†]	0.044 [†]	0.042 [†]
<i>Independent variables (year Y)</i>								
Sustainability practices		0.178***	0.117***	0.095***		0.173***	0.116***	0.109***
R&D intensity		0.078*	0.011	0.022		0.074*	0.011	0.018
International diversification (Note: alternative measures)		0.135***	0.118***	0.100***		0.091**	0.079**	0.069*
International diversification ²		0.075***	0.035 [†]	0.031 [†]		0.041**	0.005	0.006
<i>Two-way interactions</i>								
Sustainability practices × R&D intensity			0.073**	0.011			0.071*	0.037
Sustainability practices × international diversification			0.069***	0.062**			0.070**	0.049**
R&D intensity × international diversification			0.048 [†]	0.028			0.029	0.019
<i>Three-way interaction</i>								
Sustainability practices × R&D × international diversification				0.105***				0.063***
R^2	0.8354***	0.8494***	0.8536***	0.8557***	0.8354***	0.8497***	0.8546***	0.8561***
F value, P value	12.27, <0.001	5.44, <0.001	5.57, <0.001	5.62, <0.001	12.27, <0.001	5.53, <0.001	5.71, <0.001	5.72, <0.001
ΔR^2		0.0140***	0.0042***	0.0021***		0.0143***	0.0049***	0.0021***
Wald χ^2 , P value		115.32, <0.001	36.12, <0.001	17.70, <0.001		118.21, <0.001	41.74, <0.001	12.61, <0.001

For models F1–F4 and G1–G4: Sample size = 1,544 firm-years (includes 287 firms, with each firm having at least 7 years of data). Dependent variable is lagged ahead of independent variables by 6 years. Data covers the period of 1991 to 2009. Data for independent variables are from 1991 to 2003, whereas data for dependent variable is from 1997 to 2009

All variables are centered and standardized. Plot of the residuals against the predicted value did not indicate any evidence of heteroskedasticity problems. Maximum variance inflation factor (VIF) = 1.97, suggesting no evidence of multicollinearity problems. All dollar values are adjusted for inflation with 2000 as base year. Sample contains MNCs only, where a firm is categorized as an MNC if it reports data for one or more non-domestic segments and has foreign sales greater than zero that year

*** $p \leq 0.001$, ** $p \leq 0.01$, * $p \leq 0.05$, [†] $p \leq 0.10$

Our results suggest that R&D and internationalization, in synergy, help in the development and the long-term sustenance of sustainability practices in MNCs. The findings offer important implications for sustainability research by (i) emphasizing the long-term sustenance, and not just the development, of sustainability practices and (ii) asserting the interaction between R&D and internationalization.

Theoretical Implications

From Development to Long-Term Sustenance of Sustainability Practices

Our study switches the lens of sustainability research from mere development to the long-term sustenance of

sustainability practices. Although studies on the initial development/adoption of various sustainability practices are undoubtedly valuable, the insights gained from those studies provide very limited assurance on whether the sustainability practices would perpetuate into the future. The results of our hypotheses tests reveal a convergence pattern: the combined influence of R&D and internationalization remain consistently positive on both (i) the development of sustainability practices and (ii) the sustenance of sustainability practices. Such convergent patterns are highly desirable for firms aiming to improve their sustainability practices. After all, it is reassuring to rely on resources and capabilities that have convergent effects than those that have conflicting effects. Perhaps, in future research, attention should be shifted to the alternative possibility of conflicting effects; for example, where certain types of capabilities propel an MNC to initially develop sustainability practices but later hinder the firm in maintaining the same practices.

The Combined Influence of R&D and Internationalization

The literature has examined the independent effects of R&D and internationalization on sustainability practices (Hart 1997; Hunter and Bansal 2007; Padgett and Galan 2010; Wagner 2010). Our study, in contrast, highlights the joint effect of these two variables. That is, one variable functions as the enhancer on the relationship between the other variable and sustainability practices. On the one hand, R&D equips MNCs with technologically innovative capabilities and skills to fulfill the sustainability requirements of foreign markets. On the other hand, MNCs accumulate rich knowledge about the needs of various stakeholders via their internationalization process, which enhances the effectiveness of their R&D. Because of the synergistic interaction, MNCs with both high R&D and high internationalization can develop and maintain sustainability practices over the long-term.

The Alignment Between Core Strategies and Sustainability Practices

A traditional contention of the resource-based view literature is that MNCs would be financially viable when they strongly focus on core profit-generating strategies, and should therefore not be distracted by non-core matters. Unfortunately, there is a danger, wherein this view can be improperly used to suggest an incompatibility between an MNC's core strategies and sustainability practices. After all, R&D and internationalization are often regarded as being among the most important core strategies that an MNC can focus on—to achieve financial profitability (Hitt

et al. 2006). The need for sustainability practices is, in contrast, often labeled as a non-core matter—a distraction from the need to focus on the core profit-generating strategies (Klassen and Whybark 1999; Nidumolu et al. 2009).

Contrary to the perceived incompatibility in the literature, our findings reveal a close association of these two core strategies with the need for sustainability practices. The core strategies of an MNC to intensify R&D and to increase the level of internationalization have a combined positive influence on the MNCs' ability to develop and maintain sustainability practices. R&D allows MNCs to generate innovative technologies and processes, which help MNCs to implement sustainability practices. Internationalization acts a complementary source of market-orientation capabilities (e.g., knowledge about the needs of foreign stakeholders) that help in guiding the R&D toward sustainability practices. Combined together, high R&D intensity and high internationalization provide a positive platform for the development and long-term sustenance of sustainability practices.

Implications for Practice

In the pursuit of sustainability, an MNC's internationalization and R&D intensity need to complement each other. On the one hand, when an MNC's internationalization is exceedingly higher than its R&D capability, the R&D efforts need to catch up quickly to address the sustainability concerns of foreign stakeholders. On the other hand, an MNC that is already strong in R&D but is constrained to its domestic market should substantially increase its international exposure. International exposure provides opportunities for learning from concerned stakeholders in foreign markets. This would unleash the full benefits of R&D and ultimately push forward sustainability practices to the highest possible levels. With simultaneous increase in both R&D and internationalization, MNCs can not only capture higher financial returns but also have a positive impact on the natural environment, society, and economy.

Limitations and Future Research

This study is not exempt from limitation. We examined the effects of two organizational factors—R&D and internationalization—in the sustenance of sustainability practices. Other organizational factors might also have role to play. For instance, strategic decisions regarding the need for continual investment in sustainability practices could be influenced by factors such as ownership structure and organizational culture (Chakrabarty 2009; Chakrabarty and Whitten 2011; Green et al. 2007). External forces (industry structure, institutional pressures, etc.) might also promote or constrain the continuity of sustainability practices (Chakrabarty 2009; Zardkoohi 2011). Hence, in future

research, other factors need to be examined to provide a more comprehensive understanding about how MNCs ensure continuous progress with respect to sustainability.

Conclusion

It is a prevalent view that MNCs can make significant contributions toward sustainable development by initiating investment into social or eco friendly practices. An assumption in this prevalent view is that the sustainability practices will somehow continue to perpetuate long after they are put in place. Our study, however, shows that sustainability practices are unlikely to perpetuate into the future when both R&D and internationalization are low. To progress steadily on the path of sustainability, MNCs should synergistically combine the dual elements of investing in R&D and embracing international expansion into their long-term strategy. Otherwise, the MNCs cannot continue on the path of sustainability for long.

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