

An operations management perspective on adopting customer-relations management (CRM) software

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(Received 14 February 2011; final version received 8 August 2011)

Enterprise resource planning (ERP) systems are made up of software that chiefly support individual functional areas (e.g., operations management practices and policies), but seeks to share information to support organisation-wide integration goals. In this paper we examine the influences of operations management (OM) customer focus policies and practices, as well as software vendor capabilities in supporting OM, on ERP reasons for adoption of software and vendor selection of customer relations management (CRM) systems. An empirical study utilising structural equation modeling (SEM) is used to determine if an OM customer focus affects the adoption of CRM. The results show that collaboration between OM and marketing managers in the acquisition of CRM software improves business performance and supports the prior research that advocates the need for closer integration of these two functional areas. The results also show that OM reasons for adoption of CRM can have a moderating effect on business performance as well.

Keywords: supply chain management; enterprise resource planning (ERP); customer relations management software (CRP); empirical study; operations management

1. Introduction

Song *et al.* (1997, 2000) have shown that marketing's external orientation to customers and manufacturing's internal orientation to efficiencies and production capacity can lead to opposing functional perspectives. Also, Maltz and Kohli (2000) and Song *et al.* (1997) have shown that the differing goals of manufacturing and marketing occupy different 'thought worlds' that can lead to conflict and misunderstandings. Yet Hsu and Chen (2004) and Swink and Song (2007) have demonstrated that in situations where manufacturing and marketing orientations are integrated, it can lead to improved business performance. Many areas of joint manufacturing and marketing integration efforts, such as enterprise resource planning systems (ERP) software selection, have yet to be explored.

ERP systems are a collection of software applications used to support business functions (Hallikainen *et al.* 2009). A substantial body of literature exists touting the successes of ERP in achieving business performance improvements and its ability to support manufacturing or operations management (OM) functions (Karimi *et al.* 2009), such as supply-chain management (Stratman 2007), inventory management (Goeke and Faley 2009), master/production scheduling, and capacity planning (Oztemel and Polat 2007). According to Stratman (2007), the selection of ERP software can only provide a competitive advantage if the firm adopts software, which incorporates its strategic plans and supports internal functions. Stratman (2007) went on to discuss OM function supporting software, particularly as it relates to external market and supply-chain performance. One important example of such external market software is customer-relations management (CRM) software. Jain (2005) suggests that the capability of CRM to profile customers is as important as the other four Ps of marketing (i.e. product, price, promotion, and place). Payne and Frow (2006) view the purpose of CRM as the efficient and effective acquisition and retention of customers through selective initiating, building and maintenance of appropriate relationships that will lead to enhanced profitability. For the purposes of this study, we will limit our discussion of CRM to software technology that is incorporated into ERP systems.

If ERP systems are to reach full potential for OM managers, an adopter must take a holistic view of the organisation by integrating all functional areas. This is consistent with Hill (1990) who suggests OM managers focus efforts on collaborative relationships with vendors engendering trust and cooperation rather than merely optimising resource utilisation. Chan (2005) found a clear connection between CRM and its ability to enhance the OM value

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chain, suggesting OM activities, such as delivery supply-chain functions, are supported by CRM systems. On the other hand, failure to consider OM functions in the adoption of CRM can also have negative consequences. Lam (2005), for example, found organisations that failed to consider functions like OM in their integration and selection of CRM software did not achieve desired business objectives and experienced less than desirable results.

The research above suggests OM managers should be supportive of the adoption of CRM software, despite its marketing focus. This study explores CRM adoption from an OM perspective.

The objectives of this study are summarised in the following research questions:

- (1) Are the OM customer focus policies and practices related to reasons for CRM adoption?
- (2) Do the relationship capabilities supporting OM activities offered by vendors influence CRM adoption?
- (3) Will OM reasons for CRM adoption leading to reasons for CRM vendor selection also lead to improved business performance?
- (4) Are reasons for CRM vendor selection and OM reasons for CRM adoption moderating factors in generating CRM business performance?

The remainder of this paper is organised in the following sections. Section 2 of this paper discusses the theoretical underpinnings and hypotheses addressed in this research. Section 3 describes the research methodology employed, and Section 4 states the results of the study. In Section 5, the paper's implications are discussed, while Section 6 describes its limitations.

2. Theoretical foundations for variables, constructs, and hypothesis development

The literature on operations management's shared goal with marketing of customer focus suggests a common purpose. According to Tarokh and Sekhavat (2006), since the early 1960s, the field of marketing has moved from product to customer focus. To help in that transition, CRM systems were introduced in the early 1970s as an efficient business technique. Fundamental to OM during the same period has been lean/Japanese management and quality control with guiding principles of maintaining customer focus and the enhancing the customer value chain (Schonberger 1982, Schniederjans *et al.* 2010, pp. 83–84). From these principles have come a variety of OM customer-oriented practices (e.g. creating value) and policies (e.g. customer satisfaction) to encourage OM understanding of customer needs (Hume 1994, Murakoshi 1994, Eklof 1998). Eklof (1998), for example, reported the need for customer satisfaction to be measured and included in policy decision-making. Major firms like K-Mart have created customer satisfaction policies to guide internal service operations (Hume 1994). Hsu and Chen (2004) used contingency theory and socio-technical theory (i.e. impacts of technology on organisational processes and culture) to explain and prove the benefits that ERP system implementation can have in integrating manufacturing and marketing for improved business performance. Swink and Song (2007) found positive consequences of a joint orientation of manufacturing and marketing in new product development. They found that if manufacturing and marketing could be successfully integrated for a common purpose, companies would benefit by enhancing their competitive advantage and increasing their return on investment. Generalising the results of these latter studies suggests that a common goal, such as a customer focus, which manufacturing and marketing share, might lead to successful business performance.

Based on prior research, we hypothesise the relationships depicted in Figure 1. We believe OM policies and practices focusing on the customer and vendor-client perceived capacity for relationships are related to reasons for CRM adoption. We propose that OM reasons for adoption will lead to the selection of a CRM vendor, which in turn should lead to successful CRM business performance.

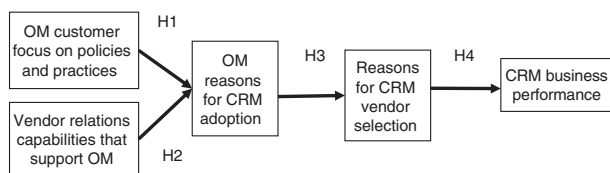


Figure 1. Conceptual model depicting the OM perspective of CRM adoption.

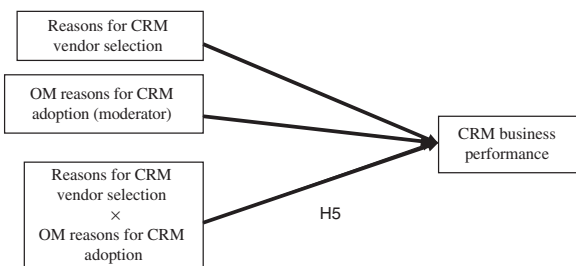


Figure 2. Moderating factor (Hypothesis H5).

As an extension of the model in Figure 1, we will also explore the moderating effect of OM reasons for CRM adoption on reasons for CRM vendor selection. Reinartz *et al.* (2004) has shown there is a moderating effect on business performance when a firm does not align its business performance objectives with business processes supported by CRM. The CRM moderating factor model is presented in Figure 2. We believe OM reasons for CRM adoption have a moderating effect on CRM business performance.

2.1 OM customer focus on policies and practices and OM reasons for CRM adoption

The variable, *OM customer focus policies and practices*, in Figure 1 refers to managerial perceptions of competitive value creation for customers through CRM. Particular to OM, the perception is that CRM will lead to competitive advantages in customer service and service quality. For OM, CRM will point out OM resource deficiencies and constraints (Sinkula 1994) and promote technology innovation (D'Aveni 1994). CRM supports OM by aiding choices in production/service resource configurations that are guided by an understanding of customer needs and market trends obtained via CRM technology. As Grant (1995) has pointed out, identifying resource deficiencies and resource constraints that do not match market needs is a key dynamic capability of CRM that can support OM functions.

The variable, *OM reasons for CRM adoption*, in Figure 1 refers to reasons why CRM software is adopted by a firm. The literature abounds with reasons for adopting CRM, including OM reasons. Jain *et al.* (2003) suggested OM policies and practices, which are focused on service flexibility and product innovation, could be greatly enhanced by CRM if implemented correctly. Further documenting the role of CRM in supporting OM functions, Peltier *et al.* (2009) found operations flexibility can benefit through CRM adoption. Their research also revealed that CRM permitted firms to identify OM resource candidates for improved alignment to better serve customers.

There is considerable literature supporting the existence of a construct between the two variables (i.e. OM customer focus policies and practices and OM reasons for CRM adoption). Day and Van den Bulte (2002) found the ability of the organisation to create and maintain relationships with its most valuable customers through CRM is a sustainable basis for a competitive advantage. Bentum and Stone (2006) found organisational culture and policies must be in place to make CRM successful. In a survey of over one thousand firms, Chen *et al.* (2009) developed a construct that connects a policy of customer focus to CRM business performance and the value of its adoption. They showed firms that adopt a customer focus are aided by and motivated to acquire CRM. Daghfous and Barkhi (2009) found OM factors, such as enhancing total quality management and supply-chain management, motivate the adoption of CRM in the customer focused hotel industry.

Based on prior research we would expect firms with an OM customer-focused policy would favour adopting CRM software for OM reasons. Thus, we propose the following hypothesis:

H1: OM customer focus policies and practices positively influence OM reasons for CRM adoption.

2.2 Vendor relations capabilities that support OM and OM reasons for CRM adoption

The variable, *vendor relations capabilities that support OM*, refers to the ability of the client organisation to develop and manage its relationships with key CRM vendors, in order to deal effectively with the interaction among these relations to secure benefits and to renew the resources for the process of CRM (Jayachandran *et al.* 2005). This variable involves important OM perceptions of trust, loyalty, and serviceability between client firms and their vendors. Bland (2008) suggested that integrating CRM with the Internet supports communication between the customer and OM back office operations. Wilson *et al.* (2002), on the other hand, found that social networking capability (i.e. the ability to develop and maintain vendor relations), if not carefully selected to achieve a firm's objectives, would limit success of CRM implementations. Reinartz *et al.* (2004) empirically determined the importance of vendor relations for OM reasons of achieving economic performance. Jayachandran *et al.* (2005) empirically showed good vendor relations can lead to OM outcomes of improved service and improved inventory management.

Based on the prior research, we would expect a positive relationship between vendor relations capabilities supporting OM and OM reasons for CRM adoption. Thus, we propose the following hypothesis:

H2: Vendor relations capabilities that support OM positively influence the OM reasons for CRM adoption.

2.3 OM reasons for CRM adoption and reasons for CRM vendor selection

The variable, *reasons for CRM vendor selection*, involves the selection process and criteria used to select vendors and their CRM software (Ayag and Özdemir 2007). Kuiper and Tipton (1998) identified three components of successful vendor selection: the software has features/functions matching an organisation's needs, the vendor is trustworthy, and the vendor has the ability to deploy a deliverable system well suited to business operations.

Focusing on the construct of OM reasons for CRM adoption that lead to reasons for CRM vendor selection, Stratman (2007) empirically found CRM employed within ERP systems provides specific functionality, which enhances customer satisfaction and in turn generates improved market performance. Hartman *et al.* (2009) found a positive relationship between OM adoption factors, such as quality management, and CRM. Kim and Lee (2009) found CRM can be used to identify customers for termination, thus allowing a more efficient reallocation of OM resources to better serve more profitable customers. Ko *et al.* (2008) found that the more a firm perceived itself as adopting a CRM strategy, the greater was the extent to which it uses CRM technologies, including OM support functions. They also found that a firm's characteristics (e.g. an OM orientation) significantly influenced its perception of CRM benefits.

Based on prior research, we would expect a positive relationship between OM reasons for CRM adoption and reasons for CRM vendor selection. Thus, we propose the following hypothesis:

H3: OM reasons for CRM adoption positively influence reasons for CRM vendor selection.

2.4 CRM vendor selection and CRM business performance

The variable, *CRM business performance*, is defined in the context of perceived satisfaction with CRM outcomes. Extending from ERP based measures (Ho 2007), the criteria used in measuring CRM business performance vary substantially from objective to subjective. Jain *et al.* (2003), having reviewed CRM literature, found references to CRM business performance was measured in terms of increased sales, profits, new customers, cost reductions, and reductions in service time. Their study used survey interview methods to obtain perceived satisfaction with CRM software in terms of behavioural criteria, including attitudes, quality perceptions, reliability, communication, customisation, retention, and satisfaction audit capability. Other researchers who used perceived satisfaction with CRM as a business performance measure include Hendricks *et al.* (2007) and Chang (2007). Srinivasan and Moorman (2005), for example, empirically showed investments in CRM can have impressive effects on customer satisfaction. These studies demonstrate that objective and subjective measures can be combined to accurately measure business performance in CRM research. These studies are relevant to this paper because we are using perceived objective and subjective measures to assess business performance.

The research supporting the proposed construct between vendor selection and business performance in a CRM context includes Reinartz *et al.* (2004), who empirically showed the relationship of the CRM vendor with both objective and subjective CRM performance outcomes. Their research demonstrated there was a moderately positive association between perceptual and objective company performance.

Based on the prior research we would expect a positive relationship between reasons for CRM vendor selection and CRM business performance. Thus, we propose following hypothesis:

H4: Reasons for CRM vendor selection will positively influence CRM business performance.

2.5 OM reasons for CRM adoption and the moderating effect on reasons for CRM vendor selection and CRM business performance

Reinartz and Kumar (2000) recommend that CRM research stress the importance of moderating effects on business performance. Combining CRM with research related to OM functions, such as supply-chain management, has empirically shown the importance of considering moderating effects (Niraj *et al.* 2001). As Reinartz *et al.* (2004) suggests, facilitators, such as organisational design and information technology resources, may affect or modify the performance of relationship activities. They went on to suggest CRM technology was a moderator in allowing CRM to deliver economic performance. Forza and Salvador (2008) showed that complexity in the CRM adoption can impact or moderate the potential impact of CRM business performance.

Based on the prior research we would expect OM reasons for adoption to have a moderating effect on reasons for CRM vendor selection and business performance. Thus, we propose the following hypothesis:

H5: OM reasons for CRM adoption have a moderating effect on CRM vendor selection and CRM business performance.

3. Methodology

3.1 Variables and measurement

This study uses a two-part research design in order to increase the reliability and validity of the data collected. Part one involves constructing a questionnaire. This process began with reviewing and analysing previous literature, and then moved on to develop the theoretical framework. These steps were reported in Sections 1 and 2. The following step involved constructing the questionnaire.

Our research model included five constructs: OM policy (for CRM), relational network, CRM adoption, vendor selection, and business performance. The OM policy construct consisted of 15 items adopted from prior research (Day 1994, Day 2000). The relational network construct had 17 items, likewise adopted from prior studies Churchill (1979) and Reinartz and Kumar (2000). To support operations managers using marketing items in the questionnaire, two focus groups of experts were used (Churchill 1979). The two groups of experts consisted of OM and marketing faculty and OM and marketing practitioners who judgementally reviewed the appropriateness of the items. They confirmed the appropriateness of marketing oriented items to aid in measuring customer focused OM practices and policies. We adapted CRM adoption measures, which employed used in the work of Chau and Tam (1997) and Son and Benbasat (2007). Items for vendor selection were adopted from Chang (2007). All opinion responses in our research study were adapted from previous studies and measured on a seven-point Likert scale.

The business performance construct is a complex and multi-faceted concept (Chau and Tam 1997). We employed multiple measures (11 items) to assess business performance (Venkatraman 1989, Chau and Tam 1997). In this study, the business performance measures were adapted from Chau and Tam (1997). Although the subjective nature of the data gathered is a limitation of the current study, subjective data are frequently used in this type of research and are considered acceptable (Chau and Tam 1997, Sabherwal and Chan 2001). Firm size and industry effects were controlled using dummy variables (Gujarati 1970).

After assembling a preliminary version of our instrument based on prior literature, we conducted interviews with key employees of various companies. A series of questions addressing key variables of the study were developed. A pilot study of managers in several manufacturing companies in a US Midwestern city was conducted. Managers were asked to examine the degree to which the preliminary questionnaire captured the measured constructs and how easy or difficult the preliminary questionnaire was to complete. Minor adjustments were made based on feedback of the instrument before conducting the survey.

3.2 Sample

The unit of analysis in our study was the firm. An initial sample of firms for inclusion in this study was randomly selected from the 2007 North American Industry Classification System (NAICS) Manual. The surveys were sent to senior executive managers in the selected firms. Senior executives included chief executive officers (CEOs), chief operations officers (COOs), chief information officers (CIOs), and chief marketing officer (CMOs). A total of 800 questionnaires were distributed in a single mailing. From that mailing, 229 were returned. Of the 229 responses, 215 were usable resulting in a response rate of 27%. The 14 unusable responses did not contain sufficient data for further analysis. Table 1 presents the descriptive statistics for our sample, and Table 2 displays correlations.

To examine possible non-response bias, the companies that responded were compared with non-responding companies. Comparison of the distributions of the number of employees and annual sales showed no statistically significant differences at the $p < 0.1$ level (Flynn *et al.* 1994).

3.3 Reliability

Cronbach's alphas were calculated for all constructs and dimensions in the conceptual model (Flynn *et al.* 1990) and used for reliability assessment in this study (Davis 1995). The Cronbach's alpha values for all constructs and

Table 1. Demographic information.

	Number of respondents	Percentage of respondents
Logistics firm profile		
Mining (NAICS 21)	34	16
Utilities (NAICS 22)	35	16
Construction (NAICS 23)	30	14
Manufacturing (NAICS 31–33)	65	30
Transportation and Warehousing (48–49)	51	24
Total	215	100
Number of employees		
< 500	105	49
> 500–1000	77	36
More than 1000	33	15
Annual sales (in millions USD)		
Less than 100	130	60
> 100–500	73	34
> 500–1 billion	12	6
Job position		
Chief Executive Officer	31	14
Chief Information Officer	75	35
Chief Operations Officer	61	28
Chief Marketing Officer	48	22
Total	215	100
Average number of years in current position	5.1	

Table 2. Correlation metrics.

Variables	1	2	3	4	5
1. OM customer focus on policies and practices	1.00				
2. Vendor relations capacities that support OM	0.11	1.00			
3. OM reasons for CRM adoption	0.32*	0.41*	1.00		
4. Reasons for CRM vendor selection	0.09	0.12	0.37*	1.00	
5. CRM business performance	0.07	0.14	0.15	0.36*	1.00
Mean	7.85	6.54	6.57	6.91	7.49
SD	1.32	1.77	1.64	1.61	1.45

Note: * $p < 0.01$.

dimensions in this study (Table 3) exceeded the suggested alpha value of 0.70 rule generally considered as ‘adequate’ for assessing reliability in empirical research (Nunnally 1978). Thus, it is assumed that the scale items used in this research can be considered reliable.

3.4 Validity

In this study overall instrument validity was assessed by evaluating the results of content validity, criterion-related validity, convergent validity, construct validity, and reliability tests (Straub 1989, Boudreau *et al.* 2001). The survey questionnaire used in this study was based on OM and marketing literature on technology adoption, as well as CRM research. These topics cover each of the major content areas of this study. As we noted earlier, the preliminary questionnaires were sent to and examined by a panel of experts. It was then modified based on the input of the experts. Content validity was established by carefully defining the topic of concern, describing items to be scaled, developing the scales to be used, and using a panel of experts to judge the quality of the instrument (Cooper and Schindler 1998).

Table 3. Scale description and measurement model results.

Construct item	Standardised loading	Convergent validity (<i>t</i> -statistic)	Construct (reliability)
OM customer focus on policies and practices			(0.85)
1. We are committed to our customers	0.77*	6.99	
2. We focus on creating customer value	0.83*	11.56	
3. We understand customer needs	0.88*	12.47	
4. We clearly define customer satisfaction objectives	0.81*	10.33	
5. We regularly measure customer satisfaction	0.78*	9.51	
6. Sales people share competitor information	0.72*	6.70	
7. Measure customer satisfaction	0.84*	11.71	
8. We regularly make interfunctional customer calls	0.81*	10.02	
9. All functions contribute to customer value	0.83*	11.29	
10. We meet with customers at least once a year to find out what products or services they will need in the future	0.77*	7.22	
11. We are slow to detect changes in our customers' preferences	0.80*	9.71	
12. We survey our customers at least once a year to assess the quality of our products and services	0.84*	10.74	
13. Customer complaints tend to be ignored	0.86*	12.19	
14. When we find out that customers are unhappy with the quality of our service, we take corrective action immediately	0.73*	6.66	
15. When we find that customers would like us to modify a product or service, the departments involved make concerted efforts to do so	0.70*	6.12	
Vendor relations capabilities that support OM			(0.83)
1. In general, our relationship with our vendor is satisfactory	0.70*	6.21	
2. Overall, our vendor is a good company with which to do business	0.80*	9.41	
3. We are satisfied with the performance of our vendor	0.79*	7.26	
4. All in all, our vendor has been fair with us	0.74*	6.32	
5. Overall, our partner's policies and programmes benefit the joint venture	0.81*	10.32	
6. We feel very little loyalty to our vendor	0.70*	6.53	
7. We really care about the fate of our vendor	0.73*	6.72	
8. Deciding to enter into a joint venture with this vendor was a definite mistake on our part.	0.83*	10.73	
9. Given our needs, we bought our CRM system from the best possible vendor	0.76*	6.14	
10. We are proud to tell others about our CRM vendor	0.79*	7.27	
11. We could have obtained similar results from a different CRM vendor	0.82*	10.57	
12. We consider that the choice of our vendor was the correct one	0.78*	6.92	
13. Our vendor usually keeps the promises it makes to our company	0.81*	10.12	
14. Our vendor gives sound advice on our business, and our company knows our vendor is sharing its best judgement	0.80*	9.68	
15. Our vendor is concerned about our company's welfare, particularly when making major decisions	0.77*	7.25	
16. Our vendor responds with understanding when we inform it of problems	0.74*	6.52	
17. We can depend on our vendor's support in matters of importance to us	0.80*	9.39	
OM reasons for CRM adoption			(0.82)
1. Improve internal efficiency	0.81*	9.37	
2. Coordinate sales and delivery	0.70*	6.07	

(continued)

Table 3. Continued.

Construct item	Standardised loading	Convergent validity (<i>t</i> -statistic)	Construct (reliability)
3. Support customer service	0.73*	6.26	
4. Improve service quality	0.83*	10.33	
5. Reduce operational costs	0.72*	6.41	
6. Access new distribution channels	0.84*	11.39	
7. Establish relationships with new suppliers	0.81*	10.76	
8. Improve speed of response to customers	0.83*	11.13	
9. Improve service reliability	0.76*	7.23	
10. After-sales support	0.73*	6.78	
11. Order tracing	0.76*	7.12	
12. Forecasting	0.75*	7.02	
Reasons for CRM vendor selection			(0.81)
1. Financial resources	0.69*	5.37	
2. Experienced managerial personnel	0.70*	5.62	
3. Experience working with major competitors	0.73*	6.01	
4. Control of CRM-related patents, licenses, or other proprietary knowledge	0.72*	5.99	
5. Local or national identity	0.80*	9.23	
6. Post-sales customer service network	0.82*	10.12	
7. Full line of CRM products and services	0.76*	7.17	
8. Features available in the vendor's CRM products	0.77*	7.16	
9. Product development capabilities	0.77*	7.09	
10. Technically skilled employees	0.76*	6.88	
11. Relations with other major vendors	0.73*	6.23	
12. Technological capabilities	0.76*	6.58	
13. Strong reputation in their primary markets	0.75*	6.39	
14. Prior experience working with this vendor	0.80*	9.21	
15. Experience working with similar companies in other geographical regions	0.81*	9.26	
16. International experience	0.76*	7.25	
CRM business performance			(0.81)
1. Market share gains	0.71*	5.72	
2. Sales growth	0.74*	6.12	
3. Revenue growth	0.76*	6.25	
4. Return on investment	0.80*	8.57	
5. Return on sales	0.83*	9.74	
6. Liquidity	0.81*	8.79	
7. Cash flow	0.70*	5.73	
8. Profitability	0.82*	9.81	
9. Business operations innovations	0.79*	7.35	
10. Product/service innovations	0.81*	9.35	
11. Reputation among major customer segments	0.75*	7.01	

Note: * $p < 0.001$; GFI = goodness-of-fit index; AGFI = adjusted goodness-of-fit index; CFI = comparative fit index; IFI = incremental fit index; RMSEA = root mean square error of approximation.

Model: $\chi^2 = 129.94$; $\chi^2/df = 2.17$; $p < 0.01$; GFI = 0.94; AGFI = 0.91; CFI = 0.94; IFI = 0.93; RMSEA = 0.063; critical $N = 82$

Criterion-related validity is the degree to which the survey instrument correlates with one or more criteria. The expected cross validity index (ECVI) is one measure for criterion-related validity (Kline 1998). The ECVI values of all constructs (largest being 0.81) in this research were well below the value of 1 that has been described as 'adequate'. The unidimensionality test provided evidence of a single latent construct (Flynn *et al.* 1990). This study employed Confirmatory Factor Analysis (CFA) in LISREL to test the unidimensionality of the constructs, because CFA is deemed to be a better technique for assessing unidimensionality than EFA (Bagozzi 1980, O'Leary-Kelly and Vokurka 1998). Standardised loadings for scale items ranged from 0.69 to 0.88. These CFA loading results were in the moderate-to-high range. Moreover, *t*-values for scale items ranged from 5.37 to 12.47 for US data exceeding the 2.0 rule of thumb. As a result, all loadings for scale items were significant ($p < 0.01$).

Convergent validity concerns the degree to which multiple methods of measuring a variable provide the same results. Stand-alone indices (LISREL) are used to test convergent validity based on the maximum likelihood function. Stand-alone indices include goodness-of-fit index (GFI), Adjusted Goodness-of-fit index (AGFI), incremental fit index (IFI), competitive fit index (CFI), root-mean-square-error of approximation (RMSEA), χ^2 , χ^2/df , and Critical N. Hu and Bentler (1998) recommend a maximum cutoff value close to 0.06 for RMSEA. A minimum cutoff value close to 0.9 is suggested for GFI, AGFI, IFI, and CFI (Bollen 1989). The χ^2 value should be significant at the 0.05 level (Kline 1998). The recommended value of χ^2/df is less than 3.0 (Bagozzi 1980). Critical N allows research to assess the fit of a model relative to identical hypothetical models estimated with different sample sizes (Hoelter 1983). Critical N is computed based on χ^2 and its degrees of freedom. A critical N that is lower than the actual sample size in CFA shows that CFA has sufficient power to detect problems causing poor fit (Jöreskog and Sörbom 1993).

Table 3 also shows the summary of the CFA measures of the conceptual model. The RMSEA (0.063), χ^2 (significant at level of 0.01), and χ^2/df (2.17) values met the requirements for good fit. All GFI, AGFI, CFI, and IFI values exceeded the minimum cutoff value of 0.90. Critical N s (i.e. 82) were lower than the sample sizes of 215, indicating that the conceptual model is a good fit. All constructs and scale items used in this study thus met the requirements for adequate validity.

The model provided a satisfactory fit (for fit statistics, see Table 3 also), indicating unidimensionality of measures (Anderson and Gerbing 1988). Loadings of items on their respective factors were all positive, high in magnitude, and statistically significant, showing that the scale had satisfactory convergent validity (Anderson and Gerbing 1988). The results suggested that for every pair of factors in the measurement model, a two-factor model fit the data significantly better than a one-factor model, demonstrating satisfactory discriminant validity (Churchill 1979, Spector 1992). Taken together, the measures had good convergent and discriminant validities.

4. Results

In this study, two types of structural equation modelling (SEM) were used in data analyses. While LISREL (i.e. a covariance-based SEM) was used for construct validity tests (see the previous section), partial least squares (PLS) was employed to test the theoretical structural model based on some of its advantages over LISREL (Chin 1998).

We used PLS 3.0 to examine the structural model and our hypotheses. The predictive validity of the model was assessed by looking at the R^2 , because PLS does not provide an overall goodness-of-fit index. To estimate the effects of interacting variables, we employed a two-step estimation approach suggested in Ping (1995). The first step of the approach involved calculating the loading and error variance for the single indicator of the latent product using measurement model parameter estimates. The second step fixed the loading and error variance at their calculated values in the structural model.

By applying the PLS analysis, we were able to see the PLS results and correlations among all the variables (Table 4). PLS analysis also allowed us to assess the effects of OM customer focus on policies and practices, and vendor relations capabilities that support OM on OM reasons for CRM adoption, the effects of OM reasons for CRM adoption, reasons for CRM vendor selection, and the effects of reasons for CRM vendor selection on CRM business performance. Lastly, Table 5 shows the effects of moderating terms of reasons for CRM vendor selection and OM reasons for CRM adoption on CRM business performance. The R^2 values for the regressions range from 0.39 to 0.43; thus, the proposed predictors have satisfactory explanatory power.

Hypotheses H1 and H2 suggest a firm's OM customer focus on policies and practices and vendor relations capabilities that support OM have positive effects on the firm's OM reasons for CRM adoption. Table 4 shows that a firm's OM customer focus on policies and practices has significant influence on OM reasons for CRM adoption ($\beta = 0.50$, $p < 0.01$), and vendor relations capabilities that support OM have a positive, significant impact on OM reasons for CRM adoption ($\beta = 0.33$, $p < 0.01$), thus supporting H1 and H2.

We suggest in H3 that a firm's OM reasons for CRM adoption have a positive impact on reasons for CRM vendor selection process. The results in Table 4 show that the firm's OM reasons for CRM adoption does have a significant positive impact on reasons for CRM vendor selection ($\beta = 0.29$, $p < 0.01$), supporting H3.

The authors hypothesise that a firm's reasons for CRM selection have a positive effect on CRM business performance in H4. Table 4 shows that reasons for CRM selection do have a positive effect on CRM business performance ($\beta = 0.41$, $p < 0.01$), supporting H4.

Table 4. Results of hypotheses 1 to 4.

	H1, H2, H3, and H4		
	OM reasons for CRM adoption	Reasons for CRM vendor selection	CRM business performance
Independent variables			
OM customer focus on policies and practices	0.50*		
Vendor relations capabilities that support OM	0.33*		
OM reasons for CRM adoption		0.29*	
Reasons for CRM vendor selection			0.41*
Control variables			
Firm's type	0.09	0.07	0.05
Overall model			
F-value	19.17*	23.36*	20.21*
R ²	0.42	0.39	0.43

Note: * $p < 0.01$.

Table 5. Moderating effect of OM reasons for CRM adoption on reasons for CRM vendor selection (Hypothesis 5).

	H5 CRM business performance
Moderating term	
Reasons for CRM vendor selection × OM reasons for CRM adoption	0.19*
Independent variables	
Reasons for CRM vendor selection	0.48*
OM reasons for CRM adoption	0.15**
Overall model	
F-value	29.39*
R ²	0.47

Note: * $p < 0.01$; ** $p < 0.05$.

H5 suggests that there is a moderating effect between OM reasons for CRM adoption and reasons for CRM vendor selection on a firm's CRM business performance. According to Table 5, the two way interaction with OM reasons for CRM adoption and reasons for CRM vendor selection is positively related to CRM business performance ($\beta=0.19$, $p < 0.01$) in support of H5. These results suggest that when there is improvement in the CRM adoption process, reasons for CRM vendor selection become more important.

The results indicate that each of our hypotheses is supported. Based on these results, we find a firm's reasons for CRM vendor selection is positively associated with both the firm's OM customer focus on policies and practices and vendor relations capabilities that support OM as well as a firm's OM reasons for CRM adoption. We also notice that a firm's reasons for CRM vendor selection have a direct, positive effect on a firm's CRM business performance. Moreover, under circumstances of improved OM reasons for the CRM adoption process, the influence of reasons for CRM vendor selection on CRM business performance is more pronounced.

5. Discussion

The results of this study have implications for prior ERP research and practices, OM and marketing integration research, and future research opportunities. The positive findings regarding OM's customer focus on policies and practices and the OM reasons for adoption of CRM (H1) suggest opportunities for greater integration of common interests and collaboration between differing functional areas. Our findings support the positive outcome results found in prior integration and collaborative research between OM and marketing (Hsu and Chen 2004, Swink and Song 2007). The result of a marketing orientation of operations managers represents a new finding in OM literature, particularly with regard to ERP system planning and vendor selection. Our results also aid in supporting the contingency theory, the socio-technical theory-based study by Hsu and Chen (2004), and information processing theory study by Gattiker (2007), who found that integrating OM with marketing via ERP results in improved business performance. As Maltz and Kohli (2000) and O'Leary-Kelly and Flores (2002) have suggested, it may be that OM and marketing are becoming more integrated with other functional areas. This integration can lead to a similarity of tasks, practices, and policies necessitating an appreciation of any software applications that can help operations managers complete their own functional duties.

Our research relating to the vendor relations capabilities that support OM and the positive relationship with OM reasons for CRM adoption (H2) suggests opportunities for ERP vendors in selling their software modules. The results of our study have shown operations managers look favourably on adopting ERP software modules outside

their primary area of interest if the vendors establish a relationship that fosters closeness, honesty, and fairness. While this relationship is well documented in a general sense (Richard *et al.* 2007, Richards and Jones 2008), our study uniquely focused on OM relational vendor capabilities. From this we can suggest that an OM perspective leads to related OM reasons for software adoption. This result extends the non-OM research findings of Wilson *et al.* (2002) in marketing literature, Stone (2009) in information systems literature, and Ko *et al.* (2008) in organisation behaviour.

Our finding that OM reasons for CRM adoption is positively related to CRM vendor selection (H3) supports existing research findings (Jain *et al.* 2003, Peltier *et al.* 2009). As Peltier *et al.* (2009) discuss, it is logical to assume adoption reason antecedents are related to the selection of a CRM software vendor. Finding the right vendor to match those reasons is the next logical step.

The finding that CRM vendor selection is positively related to CRM business performance (H4) is well documented in the literature (Hartman *et al.* 2009, Love *et al.* 2009). This finding supports the existing research that suggests CRM systems improve business performance (Reinartz *et al.* 2004).

The moderating effect in our study of OM reasons for CRM adoption on reasons for CRM vendor selection in generating CRM business performance (H5) confirms the result by Minami and Dawson (2008), who found vendor implementation of CRM could have a moderating effect on return on equity. Our results confirm other research (Reinartz and Kumar 2000, Forza and Salvador 2008) supporting the moderating impact on business performance as well. While the results show the significant importance of vendor selection, the moderating effect result suggests OM reasons for CRM adoption may significantly impact resulting CRM business performance. It may be that the classic approach of first establishing reasons for adoption, then making the vendor selection is no longer appropriate (or at least not as beneficial to the firm) (Pivnicny and Carmody 1989). What may be needed is an integrated approach where OM reasons for adoption are explored within the business firm (i.e. collaborating with marketing), then interactively explored externally with CRM vendor input. This is an interesting path of organisational integration and collaboration that deserves future research.

6. Limitations and future research

One limitation of this study is that it is based on a cross-sectional design. Data were collected from diverse businesses across various industries categorised in (Pedhazur and Schmelkin 1991). The rationale for the cross-sectional design was: (1) the purpose of the research was to examine several constructs across industries, rather than in a specific industry; (2) it was necessary to obtain a sample size sufficient for analysis. Because the unit of analysis was a business unit, the potential sample size was small, especially considering how the questionnaires were distributed. However, the cross-sectional design is limited and does not eliminate all of the external factors in obtaining industry-specific information (Sabherwal and Chan 2001). We suggest exploring both individual categories and a broader collection of industries should be considered as a viable avenue of future study.

Another limitation is that all measuring instruments used in this research were based on managers' perceptions. While this is a valid process for measuring various constructs (Bollen 1989), it is recognised that all questionnaire surveys are limited by the truthfulness of the respondents. The validation and reliability analyses undertaken in this study provided some level of assurance of the ability of the instrument to capture useful measures.

Another potential limitation is related to the respondents' use of their experiences as a guide for assessing satisfaction with CRM modules. Hoch (2002) has argued that experience (in this study on CRM) might taint the respondents' opinions on which measures are based. That product experience can provide ambiguous information from which to make decisions. Such ambiguity might lead to differing causal relationships than those reported in our model. We feel the sample size of respondents with varying levels of experience may act as a means of averaging this potential bias in the final analysis, though future research on this issue could be justified.

One additional limitation may be the nature of the CRM adoption process. We restricted our sample to respondents adopting CRM modules, which we believed was important in order to capture adoption information our study sought to acquire. We did not factor in the possibility that entire ERP systems may be chosen to obtain a particular CRM module, or that other factors may impact CRM vendor choices. Given the significant size of our sample and the strength of the resulting statistical significance, we believe this potential limitation does not substantially alter our results. Alternatively, this limitation does suggest a possible avenue for future research to determine if this moderating factor actually impacts any of our conclusions.

An important contribution of this study stems from the marketing related tasks undertaken by OM managers and used as items in the constructs. The items used in the study may be limited in the context of their usage by the subjects. OM managers might, for example, engage in marketing tasks other than those listed, or may consider some of the item tasks inappropriate for OM managers (i.e. tasks that marketing personnel should perform, not OM personnel). In defence of the selected items, we pre-tested with experts a listing of the OM items. We also utilised statistical tests that confirmed their representativeness of our constructs. We do recognise, as Chen *et al.* (2004) suggests, that some listings of items can be limited. To the extent that we may have excluded relevant or needed additional items, we suggest this may limit the research findings of our paper.

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