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Effect of purchasing and marketing integration on new product development speed: The moderating role of environmental dynamism

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ABSTRACT

The increasing relevance of purchasing-marketing functional integration (PMFI) has drawn scholars' attention in recent years. However, more empirical research is still needed that adopts a contingent approach and studies the differentiated role each of these two functions plays in PMFI. Based on Information Processing Theory, the two flows of information that PMFI requires, from marketing to purchasing and vice versa, are used as a PMFI proxy. The study posits a positive impact of these two information flows on a typical NPD performance indicator, namely, its speed, and a positive moderation of environmental dynamism on that effect. Data from 141 Spanish firms are used to conduct a moderated multiple regression analysis to test these effects, showing that the marketing information impact of NPD speed is positive regardless of the level of environmental dynamism. However, the effect of purchasing information on NPD speed is positive when the rate of environmental dynamism is medium or high, but negative when it is low. These results will help managers to assess when each one of these flows should be promoted. Above all, they stress the need to control for possible asymmetries in the role the different functions play in functional integration.

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1. Introduction

Higher competition in today's markets has drawn attention to the need firms have to be market-oriented [1]. This need to integrate the marketing function with the rest of the organisation has also been extrapolated to the particular context of new product development (NPD). Sundry studies have analysed marketing integration with different functions during NPD, such as R&D [2], or manufacturing [3].

However, the benefits of integrating the marketing function with the purchasing function in particular have only recently received significant attention [4-9]. The reason for this delay may well be that purchasing has traditionally been considered a merely administrative function, subject to the dictates of other functional areas [9, 10]. Nevertheless, different factors have revealed that not only is a firm's dependence on exigent markets greater than ever, but so is its dependence on external resources for production and innovation. For example, firms now generally rely more on outsourcing non-core activities [4]. The competition for supplies is also greater than ever in a global economy [4]. All these trends have led scholars to present purchasing-marketing functional integration (PMFI) as the necessary internal complement to supply chain integration initiatives [7, 8].

Nevertheless, PMFI is still in need of theoretical and empirical development. Firstly, very few empirical articles support recent conceptual contributions. Secondly, the literature has reported that the roles customers and suppliers play in increasing NPD success are undeniable. NPD benefits from the integration initiatives of external customers and suppliers [11]. However, the necessary internal integration of the two functions representing them within companies (purchasing and marketing), and complementing these external integrations, has scarcely been addressed in the NPD context. Thirdly, there is a need to separately analyse PMFI's impact on different business objectives (e.g., quality, costs, and speed), as extant studies rely on economic performance measures or aggregated measures that combine different operational objectives [8, 12]. Fourthly, recent decades have witnessed a development in contingent thinking on strategic management that has also been reflected within the context of NPD [12, 13]. There is a scarcity of empirical studies that analyse PMFI under different circumstances (e.g., stable vs. dynamic markets, radical vs. incremental innovation). The contingent approach helps to explain when PMFI acquires more relevance. Fifthly, there is a call for studies that use different theoretical lenses to explain the functional integration phenomenon [14]. Finally, scholars also signal the need to conduct studies that focus on analysing functional integration per se, or integration components (e.g., information sharing or communication) instead of studies that focus on analysing practices that could enable this functional integration (e.g., functional diversity, physical proximity, computer-aided design instruments, common rewards, etc.) [14, 15]. This study will refer to these practices or drivers as "integrating mechanisms" [2].

The particular barriers these two functions encounter [9, 10] and the variability in the way purchasing integration has been conceptualised and operationalised in previous research make it difficult to simply extrapolate their results to this particular purchasing-marketing case. This paper therefore seeks to expand previous PMFI by helping to fill the abovementioned gaps. Consequently, it focuses on the NPD level instead of the company level; and it adopts theoretical background, specifically Information Processing Theory (IPT) to analyse PMFI by focusing directly on its main component, information shared and understood, rather than on PMFI's possible drivers. This research differs from similar prior studies by separately analysing the two information flows involved in PMFI: from marketing to purchasing and vice versa. It also differs from previous studies by conducting a contingent empirical analysis of these two flows and their effect on a typical performance indicator, namely, speed [2, 12, 13, 16], in different environments in terms of dynamism.

The rest of the article is structured as follows: Section 2 includes the study's theoretical underpinnings. Section 3 introduces an explanatory model of the impact that the purchasing information shared and understood with/by marketing has on NPD speed, as well as of the capacity environmental dynamism has to moderate that relationship. Section 4 presents the methodology used to test the hypotheses. Section 5 presents the results of the analysis. Section 6 discusses the results' implications and summarises the study's conclusions.

2. Theoretical background

2.1 Information processing theory

IPT was adapted by Galbraith [17] from developmental psychology. IPT [17, 18] considers that companies are open social systems that subdivide into specialised subunits as they grow [18]. These subunits become interdependent when they undertake mainstream tasks requiring their particular expertise. This specialisation and interdependency inform the myopic perspectives and limited rationality of functional decision-makers, causing uncertainty. Companies should therefore deal with the uncertainty derived from both the environment they are exposed to and the mainstream tasks involving interaction across specialised subunits. To reduce this uncertainty, organisations become information processing systems. "Information processing refers to the gathering, interpreting, and synthesis of information in the context of organisational decision making" [17, p. 614]. The greater inter-unit task interdependence and the more unstable the environment, the greater the need to process information [18].

IPT represents an ideal theoretical framework for our work for several reasons: Firstly, the specific unit of analysis, NPD, adapts perfectly to IPT assumptions. NPD is an interdependent task requiring different specialised functional areas or subunits (e.g., marketing, R&D, manufacturing, purchasing, etc.) to interact with each other during different stages, such as the selection of ideas, appraisal and approval of the product's final prototype, production, and distribution. Each one of these interactions affects its outcomes. Their interdependence during this process generates uncertainty. They are also subject to external uncertainty, as to succeed they need to adapt to unstable markets and suppliers. NPD therefore requires information processing.

This leads us to the second reason for relying on IPT. Information Processing occurs within and between subunits of functional areas, being described therefore as an integrating concept [17, 18]. This argument explains our use of information exchange as a proxy for functional integration. This notion is reinforced by the fact that information exchange or interaction has traditionally been seen as one of the essential components of functional integration [19-22].

Thirdly, IPT development and implications will help to explain the relationship between the variables under study: purchasing-marketing information exchange, NPD speed, and dynamism. The relationship between information processing and delivery times has been explained by IPT [18, 23], as has the relationship between information processing and dynamic environments [18]. The proposed model (Section 3) further develops these arguments.

Previous studies on functional integration have also relied on IPT [20-22], reinforcing the validity of this approach. Each one of these contributions focuses on different performance indicators and levels of analysis, providing different insights into the functional integration phenomenon and complementing each other. This paper expands this approach by providing a novel application of IPT. Specifically, it considers that information processing requires several flows of information that should each be analysed separately.

2.2 The moderating role of dynamism

The contradictory results often obtained when analysing the effect that one variable has over another has led scholars to formulate contingent hypotheses. This contingent approach has also been applied to the analysis of NPD success factors, such as NPD speed. Along these lines, Carbonell and Rodriguez [12], for example, have investigated how the effect of different factors on NPD speed depends on the product's technological complexity. Swink [12] has studied how the capacity different mechanisms have to streamline NPD varies depending on whether there is an accelerating intention in their use.

Studies like these indicate that both operating conditions and environmental conditions moderate the effect that different variables have on NPD speed. Dynamism has been one of the main variables used in the literature to characterise this environment. This attribute refers to the presence of instability, turbulence, volatility, or degree of change [24, 25]. This dynamism has also been related to functional integration and the need for interfunctional communication. In more dynamic or changing environments, more anomalies are recorded, and it is more difficult to predict what is going to happen next, and so greater uncertainty is therefore generated [24]. This uncertainty limits the possibility of normalising processes [18]. In such circumstances, an organisation needs to resort to other coordination and integration mechanisms, such as lateral relations [18]. It may therefore be concluded that this dynamism is a relevant factor to be considered when analysing the relationship between shared information and the outcomes of NPD processes.

3. Model and hypotheses

IPT establishes a relationship between information processing and delivery time, stating that when an organisation's information processing capacity is insufficient to cope with the uncertainty it faces, a possible solution is to extend completion dates [17]. Consequently, increasing information processing will reduce delivery times. IPT explains the nature of the impact information processing has on cycle time, whereby information processing reduces the bounded ra-

tionality specialised subunits are subject to, leading to a common understanding [22, 23]. This enables more robust and optimal decisions [17], avoiding workarounds and redundancies, which in turn avoid time-wasting and reduce the cycle time [22, 23].

This paper applies this reasoning to the purchasing and marketing case during NPD. These two functions' exposure to environmental uncertainty is high, as they depend on the unknown reactions of external agents such as customers, competitors, or suppliers. If purchasing assimilates marketing information, such as customer preferences, purchasers can start the provisioning process from the early stages of NPD, even when product specifications have not been fully determined. This practice will also allow the earlier booking of manufacturing capacity in suppliers' production plants and obtaining better delivery dates. Understanding market preferences will avoid wasting time in searching for and evaluating supplier options that are not aligned with them.

Despite the time taken up by inter-functional communication, the absence of this information will impede proper coordination between the two functions' requirements and capabilities, causing delays due to the need to conduct reviews as the NPD process advances. This reasoning leads us to formulate the following hypothesis:

H1: The extent to which information related to the marketing function is shared and understood with/by the purchasing function is positively related to the speed of the NPD process.

Likewise, having more knowledge on suppliers' requirements and capabilities from the very first stages of the process will enable marketing to promote product options along the different stages of the NPD process, which being more closely aligned with customers' expectations will be more consistent with those resources and outside capabilities. Such requirements may be taken into account at the prototype testing stage. Swink and Song [26] have reported that including questions related to manufacturing issues in market surveys ensures a closer alignment between manufacturing and marketing. The same happens with suppliers' manufacturing processes. This better alignment from the very first stages will subsequently avoid provisioning problems or having to change a product's specifications, with the ensuing delay this entails. During the production stage, if marketing staff better understand the impact decisions on volume and variety have on the supplier's production process (e.g., adding another colour to a component's production line), they will be more likely to propose more closely aligned product specifications [26]. In a word, a greater understanding of the resources and capabilities available in the suppliers' market enables the marketing function to investigate and promote NPDs based on them in a speedy and direct manner, avoiding having to review negotiations, with the ensuing waste of time.

H2: The extent to which information related to the purchasing function is shared and understood with/by the marketing function is positively related to the speed of the NPD process.

Secondly, the model postulates that the abovementioned effects are moderated by environmental dynamism. In those environments that record more changes in technologies, suppliers, customers or competitors, there will be a greater need to vary a product's specifications in order to adapt to the new situation, more decisions will have to be made during NPD, and there will be more uncertainty over what is going to happen next and over the implications for other functions. According to IPT, the greater the uncertainty, the greater the need for processing information for making more robust decisions that pre-empt unexpected problems [17, 18]. Applying this reasoning to the logic of our two first hypotheses, it may be deduced that purchasing's greater assimilation of marketing information, as well as the opposite, will be more useful for avoiding workarounds and redundancies in more dynamic and changing environments. The literature on purchasing-marketing integration has also reported a greater need for communication between purchasing and marketing in order to save time in more agile environments [7].

In contrast, within a context in which there are fewer changes in the environment, there will in turn be fewer changes in the specifications of NPDs, and fewer decisions to be made. Having more information on purchases within this context will take more time than can be saved via more aligned decisions. Based on this reasoning, the two following hypotheses are formulated.

H3: Environmental dynamism positively moderates the relationship between the extent to which information on the marketing function is shared and understood with/by the purchasing function and the speed of the NPD process.

H4: Environmental dynamism positively moderates the relationship between the extent to which information on the purchasing function is shared and understood with/by the marketing function and the speed of the NPD process.

4. Methodology

4.1 Data

To test our model we selected a population 535 firms from the "top ten technological areas in terms of patent application" as per the 2013 ranking of the OEPM (Spanish Office of Patents and Trademarks). These firms are expected to be intensively involved in NPD, which should ensure good levels of knowledge regarding the concepts being studied. Specifically, we selected the following sectors: Fabricated Metal Products, except Machinery and Transportation Equipment (SIC 34), Transportation Equipment (SIC 37), and Electronic and other Electrical Equipment and Components, except Computer Equipment (SIC 36). From these three sectors, we retained those firms with more than 50 employees. The higher the number of employees in a firm, the higher the possibility that that firm is organised into specialised functions. Firms organised into specialised subunits are more likely to need internal integration for successful NPD. Selecting bigger firms from the initial population will ensure further good levels of knowledge on our model's variables.

A questionnaire was sent to these companies, with 197 being returned: 56 of them were unusable because of the high rate of missing data. Out of the remaining 141 surveys, five had a missing value. To complete the missing value in these five incomplete surveys, respondents were contacted by email or phone. This initiative allowed completing another two questionnaires, with the one missing value in the remaining three surveys being replaced by the mean score. This therefore provided a total of 141 surveys for our analysis, at a response rate of 26 %. The sampling error was ± 7.08 %, with a 95 % level of confidence. An ANOVA analysis was conducted to test for differences between the sample and the population, and between the first and the last 25 respondents regarding two demographic variables (number of employees, total assets). Not significant differences were found which indicates that non-response bias is not a problem in our sample.

Purchasing managers were selected as key informants. Key informants should be knowledgeable about the matters being studied and willing to discuss them (Kumar *et al.*, 1993). For this study's particular purposes, purchasing managers were considered competent to assess both information flows, as they have a long tradition of receiving requirements from other functions and providing them with information [8, 10]. While the marketing function also has an extended culture and tradition for relaying commercial information to other subunits, the literature has reported that the tradition of receiving purchasing information may be weaker [9,10]. Hence, they may not realise they are missing useful supplier-related information. Purchasers' incentives are frequently related to the fulfilment of suppliers' pre-scheduled delivery dates, which means they are well informed on this variable. They were considered to be in a position to report the environment's degree of dynamism during a particular NPD that has already been completed. The response rate and low levels of missing data confirm their validity as informants.

Using a single data source involves the risk of common method bias. Although there are some statistical procedures for dismissing this bias, Podsakoff *et al*. [27] state that they are not suitable when formative constructs are an integral part of the study. This study uses formative constructs as explained in Section 4.2. In such cases, they recommend relying on different procedural remedies when designing the questionnaire. We have therefore applied their recommendations for counterbalancing the order of the dependent and independent variable questions in the survey and separating the variables' measurement using different response formats. Once the answers had been obtained, a Harman Test [28] was conducted to control for this bias. This test revealed that the variables in our analysis do not load in a single factor, but in many different

ones; five of them record an eigenvalue higher than 1, and each one of them accounts for a low percentage of the variance. We may therefore conclude that common method bias is not a significant problem in our sample.

4.2 Metrics

Respondents were asked to answer the survey questions referring to a specific NPD that met the following criteria: (1) the selected NPD's specific process had to have already finished and information on its level of success had to be available (e.g., sales, market share, etc.), and (2) the selected NPD's supply activities had to be managed by the respondent's team. In order to avoid receiving surveys referring solely to successful NPDs, respondents were asked to select the last NPD that met these two criteria. To ensure all the answers refer to the selected NPD, respondents were asked to describe the product at the beginning of the survey.

Based on IPT, functional integration was measured through the degree of information shared and understood by these two functions. The four items for its measurement (see Table 1) were adapted from Schoenherr and Swink [21], and inspired by the work of Gupta *et al*. [29].

An Exploratory Factor Analysis (SPSS, 23) and a Confirmatory Factor Analysis (AMOS, 23) were conducted to confirm that purchasing-marketing information assimilation split into these two dimensions. These EFA and CFA analyses are shown in Table 1. CFA results reveal adequate levels of the fit indicators -$\chi 2/df$, GFI, AGFI, TLI, CFI, and RMSA - according to generally accepted reference values [30, 31]. The indicators of reliability, Cronbach's Alpha and Composite Reliability, also recorded recommended values [31]. Convergent validity was confirmed by the levels of the standardised coefficients, as well as by their significance. Discriminant validity is also satisfactory, as each construct's average variance extracted (AVE) is higher than the square of its estimated correlation with the other constructs.

The scales used for measuring both the speed of the NPD process and environmental dynamism fulfilled the assumptions of the formative constructs [32, 33]. We built their metrics by computing the mean of the scores assigned to the different items used for measuring each one of them, as featured in Tables 2 and 3. This scale makes interpretation and replication easier.

NPD speed was measured through a multivariate construct. The heads of purchasing were asked to use a Likert-type scale to rate the speed, related to the schedule (from 1 – well below to 7 – well above), of five specific stages of the NPD process. Relative measures of NPD speed allow comparing the results for very different types of products, and are frequently used by researchers [12, 13, 34, 35]. Scheduled NPD time is often used as a yardstick in these relative measures [34], and it was selected for this study because purchasing managers are often rewarded for meeting NPD deadlines and are familiar with this information. When these deadlines are set by companies, they already take into account competition lead times. Finally, to ensure respondents used the same stages when scoring NPD speed, as Chen *et al*. [35] recommend, the respondents were asked to rate the speed of five specific stages of the NPD process.

Environmental dynamism was measured through a multivariate construct, asking the purchasing managers to rate the extent to which a series of statements matched their own experience using a Likert-type scale from 1 (not at all) to 7 (completely/intensely). These statements were adapted from the studies by González Benito *et al*. [25] and Miller and Friesen [24].

As explained earlier, we have intentionally avoided the inclusion of integrating mechanisms in our analysis. However, to control for alternative explanations, other possible antecedents of NPD speed have been included in the study: (1) Participant's exclusive dedication to NPD. Following Carbonell and Rodríguez [13], the heads of purchasing were asked to use a Likert-type scale from 1 (not at all) to 7 (fully) to rate the extent to which the participants in the NPD process were dedicated full-time to the project. (2) Participants' experience in similar NPD processes. Again, following Carbonell and Rodríguez [13], the purchasing managers were asked to use a Likert-type scale from 1 (not at all) to 7 (fully) to rate the selected participants' experience in NPD. (3) Clarity of objectives. Based on Swink [12], the heads of purchasing were asked to use a Likert-type scale from 1 (not at all) to 7 (fully) to rate the extent to which clear and explicit objectives had been set for the selected NPD process. (4) Firm size. This data was retrieved from the SABI database.

Table 1 Information shared and understood: Exploratory and confirmatory factor analyses

		Exploratory factor analysis		Confirmatory factor analysis	
		F1	F2	F1	F2
Marketing information shared and understood	Purchasing managers/professionals received enough commercial information (e.g., product strengths and weaknesses, trends, market threats and opportunities) to efficiently play their role during the NPD process.	0.903	0.147	0.796	
	Purchasing managers/professionals reached a high degree of understanding on the commercial implications of the decisions made during the NPD process.	0.886	0.194	0.832	
Purchasing information shared and understood	Marketing/Commercial managers/professionals received enough purchasing information (e.g., available suppliers, materials and components, costs, quality, deliveries) to efficiently play their role during the NPD process.	0.099	0.905		0.675
	Marketing/Commercial managers/professionals reached a high degree of understanding on the purchasing implications of the decisions made during the NPD process.	0.250	0.854		0.901
		Varimax rotation explained variance 81.98 %		X^2/g.l. = 0.645 GFI = 0.998 AGFI = 0.977 TLI = 1.017 CFI = 1 RMSA = 0	
		Cronbach's alpha:		0.797	0.756
		Composite reliability:		0.797	0.772
		AVE		0.663	0.634
		Squared correlation estimates:			0.228
		F2: Purchasing information shared		0.228	

Table 2 Speed of NPD

Speed of NPD	Speed, related to schedule, in brainstorming and screening stage
	Speed, related to schedule, in design stage
	Speed, related to schedule, in final prototype testing stage
	Speed, related to schedule, in production stage
	Speed, related to schedule, in transportation stage (from suppliers to point of sale)

Table 3 Dynamism

Dynamism	Consumer/customer preferences have changed very often.
	The technology and/or design trends in our industry have changed very often.
	Our key competitors' commercial strategies and actions have changed very often (campaigns, promotions, new openings, products, etc.).
	Our main suppliers' actions have changed very often (qualities, prices, timings, and conditions of service, etc.).

4.3 Analysis

In order to verify the hypotheses considered in the conceptual model, multiple regression analysis has been conducted for the direct effects, and moderated multiple regression (MMR) analysis for the moderating effects [31]. These two techniques are among the most popular ones for testing direct effects and interaction effects in social sciences. Estimating interaction effects using MMR involves creating different models, or regressions. The first model includes only the control variable, the second adds the independent variable, the third one the moderator, and finally, the fourth one adds the interaction between the independent variable and the moderator.

5. Results and discussion

The correlations and descriptive statistics for the variables in our study are included in Table 4. Table 5 shows the results of four different models used to test the effect on NPD speed of the marketing information shared and understood with/by purchasing, as well as the moderation of environmental dynamism on that effect.

Table 4 Mean, standard deviation, and Pearson correlation coefficients

	Mean	S.D.	1	2	3	4	5	6	7	8
1. Exclusive dedication to the NPD	3.60	1.99	1							
2. Experience in NPD	5.59	1.36	0.272**	1						
3. Clear objectives of the NPD	4.99	1.56	0.246**	0.261**	1					
4. Firm Size	2519	24503	0.115	0.095	0.115	1				
5. Marketing information shared and understood	4.50	1.42	0.045	0.258**	0.291**	0.120	1			
6. Purchasing information shared and understood	4.82	1.21	-0.157+	0.043	0.201*	0.080	0.374**	1		
6. Dynamism	4.65	1.08	0.136	0.050	-0.008	0.164+	-0.004	0.047	1	
7. Speed of NPD	4.66	0.89	0.041	0.295**	0.257**	0.089	0.289**	0.135	0.076	1

Note: +p < 0.1 *p < 0.05; **p < 0.01; ***p < 0.001. Pearson Correlation Coefficients (bilateral).

Table 5 Effect of 'Marketing information shared and understood' on the 'Speed of NPD', moderated by environmental 'Dynamism'

	Model 1	Model 2	Model 3	Model 4
Exclusive dedication to the NPD	-0.074	-0.057	-0.069	-0.070
Experience in NPD	0.257**	0.219*	0.218*	0.220*
Clear objectives of the NPD	0.195*	0.147+	0.153+	0.155+
Firm Size	0.051	0.036	0.025	0.016
Marketing information shared and understood.		0.185*	0.186*	0.008
Dynamism			0.074	-0.066
Marketing information shared and understood x Dynamism				0.229
R2	0.126	0.156	0.161	0.162
Δ R2	0.126**	0.030*	0.005	0.001
F	4.905**	4.980***	4.281**	3.677**
+p < 0.1; *p < 0.05; **p < 0.01; ***p < 0.001				

Table 6 Effect of 'Purchasing information shared and understood' on the 'Speed of NPD', moderated by environmental 'Dynamism'

	Model 1	Model 2	Model 3	Model 4
Exclusive dedication to the NPD	-0.074	-0.057	-0.068	-0.084
Experience in NPD	0.257*	0.254*	0.253**	0.245**
Clear objectives of the NPD	0.195*	0.177*	0.183*	0.170*
Firm size	0.051	0.046	0.036	0.009
Purchasing information shared and understood.		0.076	0.071	-0.794*
Dynamism			0.067	-0.819*
Purchasing information shared and understood x Dynamism				1.286*
R2	0.126	0.131	0.136	0.170
Δ R2	0.126**	0.005	0.004	0.035*
F	4.905**	4.083**	3.504**	3.895**
+p < 0.1; *p < 0.05; **p < 0.01; ***p < 0.001				

Model 2 reveals that the effect that purchasing's assimilation of more marketing information has on NPD speed is positive and significant. This result confirms our first hypothesis (H1). However, Model 4 reveals that the effect of the interaction between environmental dynamism and purchasing's assimilation of NPD marketing information is not significant, at least insofar as our sample is concerned. Our third hypothesis (H3) is not therefore confirmed.

Tables 6 shows the equivalent models for the opposite flow of information, the one related to supplier aspects that go from purchasing to marketing. In this case, Model 2 shows that the effect of this second flow of information on NPD speed is not significant. This means our second hypothesis (H2) is not confirmed in our sample. Nevertheless, Model 4 shows how the interaction between the purchasing information assimilated by marketing and environmental dynamism do indeed have a significant impact on the speed of the process. We may therefore accept our fourth hypothesis (H4): environmental dynamism moderates the impact that the purchasing information assimilated by marketing has on NPD speed.

Fig. 1 shows an interaction plot revealing the nature of the relationship between the purchasing information assimilated by marketing and NPD speed in three different contexts (when environmental dynamism is low, medium and high). It is clear that the relationship between more purchasing information shared and understood with/by marketing and the speed of the NPD process is positive when the dynamism is medium or high, confirming our model's logic. Only when the dynamism is low does sharing more purchasing information have a negative impact on speed.

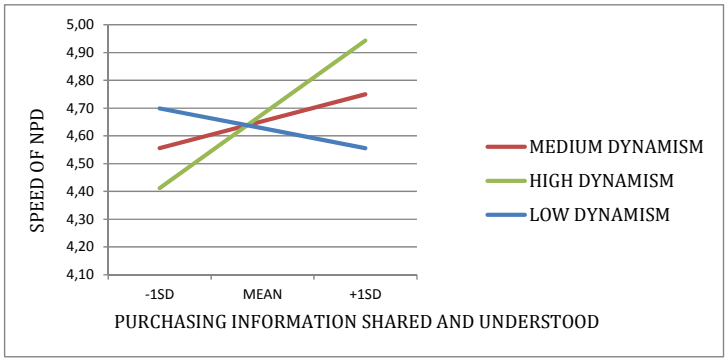

Fig. 1 Effect of the interaction between 'Purchasing information shared and understood' and environmental 'Dynamism' on 'Speed of NPD'

6. Conclusion and implications

The literature has recently stressed the need to integrate the purchasing function specifically with the marketing function [4-9]. The need to develop integrated systems that take into account supplier and customer integration during NPD has also been stressed [11]. However, further theoretical and empirical research in this field is needed. This study has contributed to its state-of-the-art by empirically studying how environmental dynamism moderates the impact that each one of the information flows PMFI requires has on NPD speed. The results show that these two flows behave differently. Marketing information assimilated by purchasing accelerates NPD regardless of the level of environmental dynamism. In contrast, purchasing information assimilated by marketing accelerates NPD only when environmental dynamism is medium or high, but when it is low it actually reduces NPD speed.

This research has straightforward managerial applications. It invites managers to assess whether NPD speed is relevant for their companies to compete, and what their environmental degree of dynamism is. It shows which flow of information should be promoted in each context, and it indirectly invites an evaluation to be made of the integrating mechanisms that should be used to promote each flow. González-Zapatero *et al.* [36] have reported that certain traditional integrating mechanisms do not foster both flows of information. Such was the case of the mere physical proximity of the two functions. Perhaps because of the lesser tradition in sharing purchasing information, this co-location simply promoted the flow of information from marketing to purchasing, but not the other way around. Companies deciding to adopt a concurrent engineering approach to NPD could also find our research findings useful. Concurrent engineering involves considering different function requirements and preferences from the beginning of the NPD process [37], especially those of the manufacturing function [16]. Taking into account, for instance, the requirements of the production function without ensuring a good marketing-

purchasing integration may delay the NPD process, especially in more dynamic environments. The production function may spend time finding good alignments with marketing or R&D requirements and resources, but then when they try to obtain the supplies needed to start manufacturing, they may discover that these supplies are not available. Purchasing-marketing integration is therefore an important link in a concurrent engineering approach. This study's findings are also useful for SMEs, especially in transactional economies (e.g., Serbia). In these economies, NPDs are mainly pull market-driven [38]. This research paper may help them to see the potential of including a supplier's voice in NPD by fostering PMFI, especially as environments become more dynamic.

This study also has important implications for academics. Firstly, this work adds to that of other scholars who highlight the importance of addressing functional integration itself directly through the study of its different components, instead of studying it indirectly through different integrating mechanisms. This direct analysis shows each component's true potential. However, studying FI directly poses a challenge because, as scholars recurrently decry, there is a lack of consensus about the concept itself [13, 18]. In this paper, we have relied on IPT to study information processing as a proxy for PMFI. Our proposal draws attention to the fact that information processing implies several flows and should be taken into account both in defining and operationalising the concept. Further developments of the concept of functional integration [13] will enrich this analysis. Secondly, there is a pressing need to conduct more contingent studies. Some of the most recent conceptual studies on the purchasing-marketing link report the expediency of managing this link in a different way depending on the context in which a company operates [6,5]. Wagner and Eggert [5], for example, contend that the purchasing-marketing link should be managed differently depending on a company's level of dependence on its customers and suppliers. The margin of time for managing this dependence may also have a bearing on how to do so, as this work suggests. Thirdly, the NPD process requires integrating other functions (R&D, marketing, production, logistics, etc.). The activities that all these functions undertake during the NPD process may be organized into different sequences [37, 39, 40]. Some scholars have stressed that different sequences, also labelled product development process (PDP) architectures [40], may have a greater impact on NPD performance than others. This paper's findings should be taken into account by academics studying the efficacy of different NPD or (PDP) architectures.

This research has certain limitations; for instance, the scales used to measure the variables are perceptual. Although these scales rely on extant literature, and although the Harman test [28] shows that common method bias does not seem to be a significant problem for this analysis, combining different data sources will constitute a useful extension. Including other control variables, such as the degree of dependence on customers or suppliers or the degree of innovation, could also help to explain the purchasing-marketing link. Considering the theoretical implications described above and overcoming these limitations provide a path and orientation for further research. Other developments of this analysis would be to identify possible practices that foster or help to manage the desired information flows. Although some scholars have studied possible PMFI drivers [36], the potential new available technologies have to manage this link remain unexplored. These technologies include big data business analysis, artificial intelligence, the internet of things, and virtually reality. In the era of Big Data the traditional techniques used to process information may be insufficient in some contexts [41-43].

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