Investigation of the Relationship between External Actors' Integration and Delivery Precision of the Petroleum Products in Pipelines and Products Marketing Company Limited in Nigeria

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Abstract: - The study investigated the relationship between external actors' integration and delivery precision of the Petroleum Products in Pipelines and Products Marketing Company Limited in Nigeria. Survey research design was adopted and structured questionnaire gathered the data of the study. The populace consisted of 862 staff of PPMCL. A sample of 274 respondents was studied, of which 231 copies of questionnaire representing 84.31% response rate were actually studied. Pearson's Product Moment Correlation Co-efficient (r) was specifically used to check the hypotheses in this study. The study revealed that external actors' integration allows facts and products flows to be continued and successfully executed by the company and that external actors' integration enables the company to execute profitable supply chain integration. Conclusively, external actors' integration has significant relationship with delivery precision of Pipelines and Products Marketing Company Limited. The study therefore recommended those Petroleum Products Marketing Companies should be engaged in proactive and dynamic external actors' integration arrangement which will encourage delivery precision in the oil sector and persons running the organization.

Key Words: — *External Actors, Integration, Delivery precision, Petroleum Products Marketing Company.*

I. INTRODUCTION

External actor's integration is linked with building close and long-term relationships anchored on mutual understanding between the supply chain customers and buyers. Such integration will allow information and goods flows to be continued and successfully executed (Prajago and Olhager, 2012; Schoeenherr and Swink, 2012). As suggested by Flynn etal. (2010), mutual understanding should be considered in future research on supply chain alliance. Inter organizational relationships plays an important place in supply chain alliance (Prajogo and Olhager, 2012; Zhao etal., 2011). Long-term relationships via sharing of responsibilities (Min etal., 2005) dedicated investments and joint relationship efforts (Nyagaetal., 2010) are required for a successful execution of supply chain alliance (Pajogo and Olhager, 2012).

Old friendship anchored on planning and sharing knowledge and resources assist firms to be continually generating a competitive advantage (Blome et al., 2014).

As supply chain alliance includes coordination and coorperation among trading partners, companies need to demonstrate willingness to continue in integrating with trusted supply chain allies (Zhao et al., 2011). A later study by Zhao et al (2011) found that old friendships with both buyers and sellers are important to external integration between trading partners. They contend that before external integration can successfully implement, companies must have agreed to align with external supply chain partners" (Zhao et al., 2011). The ability of supply chain allies to demonstrate willingness to share released facts is a resource that can lead to a continuous benefit (Fawcett et al., 2009). When mutual understanding exists in a supply chain relationship, is seen as a scarce resource which is according to RBV can generate a competitive advantage (Zhao et al., 2011).

Supply chain allies tend to possess different and conflicting interests and objectives (Wang and Chan, 2010). Therefore, long term relationship is impossible unless the supply chain

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owners feel that there is trust in the friendship (Zhang and Huo, 2013). Supply chain actors who attain mutual understanding will have a higher degree of satisfaction with their relationship and will dedicate resources to ensure its continuity (Nyaga et al., 2010). Mutual understanding and the willingness to retain the relationship becomes essential in order for companies to be integrated in their supply chains (Flynn et al., 2010). Hence, mutual understanding and long-term relationships are essential components of successful supply chain alliance (Chen et al., 2009).

Several studies revealed level of trust between external integration and organizational transportation optimization (e.g. Stank, et al, 2001). Stank et al. (2001) revealed buyer partnership positively influenced firm transportation optimization. Frohlick and Westbrook (2001) describing the "arcs of integration" introduced five classifications for the manufacturer's degree of downstream and upstream partnership in the supply chain.

They agreed that the greater the extend of partnership with the downstream customer and upstream suppliers, the better is the transportation optimization improvement Frohlick and West brook (2001) stated that "the most successful manufacturers appears to be those that have carefully linked their internal processes to external buyers and end users in unique supply chains Schoenher and Sink (2012), revisiting Frohlick and Westbook study also stressed the seriousness of integrating with buyers and end users for enhanced operational transportation optimization. Nevertheless, the study of Schoenherr and Swink (2012) submitted that future research on integrating requires the introduction of empirical evidence in other contexts.

External integration describes the length to which a company establishes collaborative relationships, shares information and coordinates external integration activities with both buyers and end users (Barratt and Barratt, 2012). The external integration activities can be grouped into three dimensions: allotment of action links, resource ties, and actors' bonds through interaction among individuals (Alptekinoglu and Corbett, 2010). The actors in the activities include three autonomous firms (a focal company's integration with both customers and suppliers) and represent thus the supply chain (Brody, 2016).

Every action must be consented to the SC partners' readiness in investing on collective real and on real properties (e.g. carrier

or enquiry and man power sharing) (Wong, Wong and Boon-Itt, 2013). Material or non-material involvement depends on what is agreed (Thun, 2010) and (Stock and Boyer, 2009). The actors' bonds dimension refers to more interdependent decisions, commitment, trust and adaptation between the supply chain allies (Veil, Dillingham and Sloan, 2016).

Wang and Chan (2010) rapped up that integration requires instruments for evaluation of not only external integration practices but also of internal integration. The aim is to detect shortcomings of the current extend of alliance and to propose possible initiatives to make better the situation.

However, as many writers pointed, numerous companies witness problems in directing the complication in visiting alliances with SC allies either outside or inside a company (Zhang and Huo, 2013). The previous supply chain and transport research provides only limited guidelines for the evaluation (Zsidisin and Ritchie, 2009). Some authors mean that the lack of standardized approaches for evaluation of inside and outside partnership is one of the reasons for deficiencies in partnership practice (Misra and Sharma, 2014).

Regarding *external integration*, several authors have emphasized a need to increase understanding about organizational context and essential circumstances for integration with supply chain professionals (Dainton and Zelley, 2015). Dolcourt (2017) concluded that only a few companies managed their integration (i.e. intensity of integration) with buyers and end users in relation with the standard that "not all relationships are created equal". Many firms have invested valuable resources in relationships with a low value co-creation potential which resulted in poor return on investment. The reasons stressed by the managers were lack of skills to identify "the right partner and to build the right relationships with them". Moreover, many integrative relationships with supply chain associates are primarily driven by a desire to manage volume and costs rather than to see potential in strategic growth.

There are several levels of intensity of external merger discussed in literature. Spekman et al. (1998) identified four levels including arm´s length relationships, cooperation, coordination, and collaboration. DeGroote and Marx (2013) suggested other terms such as low, medium, and high extend of external merger.

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According to structural contingency theory (Zhang and Huo, 2013) the level (i.e. intensity) of external merger depends on several contextual factors. These factors represent inside and outside organizational contexts (Grant and Tan, 2013) with regard to organizational, customer, supplier, competitor, socio-political and technological aspects (Brody, 2016). External integration in this thesis is characterised as the management of inter-organizational relationships of autonomous firms. The scope encompasses a focal company and its integration with both end users or buyers (Zhang and Huo, 2013). Misra and Sharma (2014) define a friendship between two organizations resulting in an interaction process where connections have been grown between two parties that produce mutual orientation and commitment.

Additionally, three major dimensions are distinguished which constitute such relationship: Activity links, Resource ties and Actors bonds. The type of the relationship can be thus described by the dimensions and their relative importance in a specific relationship. This view closely corresponds to the main characteristics of external merger discussed in supply chain and transportation literature emphasizing, among others, the interaction process and mutual orientation (Zuckerman, 2002). Despite the Thus, the present study investigated of the relationship between external actors' integration and delivery precision of the Petroleum Products in Pipelines and Products Marketing Company Limited in Nigeria.

II. MATERIALS AND METHODS

The study was carried out in the Pipelines and Products Marketing Company Limited, Nigeria. Pipelines and Products Marketing Company Limited (PPMC) was established as a helpful and crucial trade detachment of the Nigerian National Petroleum Corporation (NNPC). PPMC operates in complying to the authoritative capacity through attributes by the institution of the corporate body, Nigerian National Petroleum Corporation (NNPC).

The population under study was made up of all team members that transport fuel or crude oil comprising. Depot managers, Distribution managers, Department supervisors, Superintendents, Billing clerks and registered tanker drivers that conveyed fuel or crude oil at the refineries was 862 that defined the people of this study (Table 1).

Table.1. Population Allotment of the Stakeholders and Determination of their Sample Size

Status	Population	Sample Size
Managers	76	24
Operations	169	54
Supervisors	208	66
Superintendents	164	52
Tanker Drivers	245	78
Total	862	274

2.1 Sample and Sampling Techniques

The procedure of the sampling involved first purposively selecting the tanker drivers randomly. Purposive sampling technique was adopted by selecting a sample unit hinged on a criteria and generalization of result limited to those who have met the criteria. The following were the conditions: Depot Managers, Distribution Managers, Superintendents, Depot Supervisors, Billing Clerks and Tanker Drivers. The study focused on the above cadre of personnel specifically selected in this thesis who have operated during the period - 1999 to 2018 covering South East and South-South Nigeria. Using Taro Yamane (1967) formula to calculate the population sampled, this study adopted significance level of 95% while the precision level was 0.05. The sample bigness being calculated thus:

$$n = \frac{N}{1 + N (e)^2}$$

Where; n= sample size, N =Population of analysis and e = level of precision (0.05)

Systematic sampling techniques were employed to select the outcome of this study.

Hence; n = 862

$1+862(0.05)^2= 862$

3.155 = 273.217 = 274

Sample Size = 274

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Resting on the above calculation, the sample size of 274 with error limit of 5% was considered appropriate for this study.

Both primary and secondary data were used for the study. The primary source was through administering questionnaire and the secondary data were facts derived out of books, gazettes, publications, newspapers, cyberspace, etc. The questionnaire was structured in two parts: Part A consisted of the numerical figures from respondents, while Part B consisted of facts on supply chain alliance and transportation optimization. Each part consisted of questions with five different options (of Likert Scaling) and calibrations as follows: Strongly Agree= 5, Agree = 4, Disagree = 3, strongly Disagree= 2 and Undecided = 1. However, in measuring the variables in the study, the ordinal scale that is a quantitative scale was applied. Reason being; a self-rating instrument, which allows the respondents to be placed in the category he or she feels is most appropriate.

To ensure reliability and validity, certain question items were tested (pretested) before the final test. Further, the hypotheses formulated were discussed with some specialists when collecting data that confirmed their connection of the topic under discussion. The research instrument was validated through experts' opinions; thus, the questionnaire items were confirmed to test the hypotheses and offered solutions to the questions raised. The study used Cronbach Alpha in deciding the uniform inner flexibility among the measurement items.

From the alpha results, it is revealed that the instrument is reliable and generally connected for the subject matter examined in this study. The data collection instrument was tested for accuracy capability using Cronbach's Alpha and study confirmed acceptability within the acceptance range of 0.70 and above as the overall reliability test of instruments is 0.8054. Validity test was also done, using experts knowledgeable on the subject under investigation, pears review and supervisor's approval to ascertain that the instruments were relevant and measure what they were expected or designed to measure. The dimensions and measures of the constructs have alpha ideals in a Nunnery threshold of 0.7 and are therefore considered reliable. The analytic tools consist of descriptive and inferential statistics with SPSS version 22 providing aid. The inferential statistics involved two parametric inferential tests- Pearson's product moment correlation. Pearson's product moment correlation (r) analyzed how each independent variable explains or predicts supply chain transportation optimization (interactive association) at 0.05 (two-tailed test). Data were presented using tables and graphs.

III. RESULTS AND DISCUSSIONS

3.1 Demographic Characteristics of Respondents

The demographic issues raised here included gender, age, marital status, educational background and job experience of the respondents. Table 2 shows the gender details of the people and this section enables the study in knowing the number of men and women that participated in this study. The Table reveals that 214 males (93%) responded correctly to the questionnaire while 17 females (7%) responded correctly to the questionnaire. This indicates that the male respondents are in the majority. Table 3 shows the elderliness of the people. The data reveal that 69(29.87%) feedback gotten were between the age of 19 - 29 years; 62(26.84%) of the people were between the age of 30-39 years; 46(19.91%) of the people were between the age of 40-49 years; 34(14.72%) of the people were between the age of 50-59 years.

Finally, Table 3 shows that 20(8.66%) other response were between the age of 60 old age and above. Table 4 shows the marital status of the people. The data reveal that 126(54.50%) of the people were married; 62(26.80%) others were single; 17(7.40%) of the women were widows; 14(6.10%) of the rest were divorced. Finally, Table 4 shows that 12(5.20%) were separated. Table 5 shows that 35 (15.20%) of respondents got their jobs with SSCE/OND or its equivalent; 86(37.20%) of the people are holders of HND/BA/B.Sc.; 79(34.20%) possess Masters/ MBA/M.Sc.; 31(13.40%) are PhD holders. Table 6 shows the years of job experience of the people. The data reveal that 41(17.70%) of the people have been on the job for `1-5 years; 39(16.90%) others have been on the job for 6-10 years; 52(22.50%) have worked for 11-15 years; 55(23.80%) have been on the job for 16-20. Finally, Table 6 shows that 44(19%) of the rest have been on the job for 21 years and above.

Table.2.   Gender Details of the People

Sex	Number of Respondents	Proportionate Percentage
Male	214	93.00
Female	17	7.00

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Total	231	100.0

Table.3. Age of Respondents

Options	Number of Respondents	Proportionate Percentage
19 - 29 years	69	29.87
30-39	62	26.84
40-49	46	19.91
50-59	34	14.72
60 and above	20	8.66
Total	**231**	**100.00**

Table.4. Marital Status of Respondents

Marital Status	Number of Respondents	Proportionate Percentage
Married	126	54.5
Single	62	26.8
Widow	17	7.4
Divorce	14	6.1
Separated	12	5.2
Total	231	100.0

Table.5. Educational Status of Respondents

Options	Number of Respondents	Proportionate Percentage
SSCE/OND	35	15.2
HND/BA/B. Sc.	86	37.2
MBA/M.Sc.	79	34.2
Ph.D.	31	13.4
Total	**231**	**100.0**

Table.6. Job Experience of the People

Options	Number of Respondents	Proportionate Percentage
1 - 5 years	41	17.7
6 – 10 years	39	16.9
11 - 15 years	52	22.5
16 – 20 years	55	23.8
21 years and above	44	19.0
Total	231	100.0

3.2 External actors' integration as a Dimension of Supply chain

Table.7. gives the detailed analysis on how external actors' integration as a dimension of supply chain was tested to determine its effect on transportation optimization and to show its descriptive statistical outcome resting on the questions deposed. Table 7 shows that five statement items represent a dimension in the 5-point scale. The data revealed the mean and standard deviation scores of 3.658 ± 1.392, the results confirmed that their company is linked with building close and durable connections with vendors and end users. Also, a mean and standard deviation scores of 3.455 ± 1.337, the results confirmed that external actors' integration allows facts and goods flows to be continued and successfully executed. The data also affirmed that the people again admit that external actors' integration enables their company execute profitable supply chain alliance as the mean and standard deviation scores 4.143 ± 0.933. With these scores of 3.199 ± 1.304 it backed the fact that external actors' integration enables their company to make profit after successful supplies. Finally, the data in Table 4.7 revealed another mean and standard deviation scores of 3.312 ± 1.334, confirming that external actors' integration allows productive and convenient supply chain at profit.

Table.7. External actors' integration as a Dimension of Supply chain

S/No.	Question Items on External actors' integration	N	$\overline{X}$	SD
1	Our company is affiliated with building close and durable connections with vendors and end users.	231	3.658	1.392
2	External actors' integration allows	231	3.455	1.337

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	facts and goods flows to be continued and successfully executed.			
3	External actors' integration enables our company execute a profitable supply chain alliance.	231	4.143	0.933
4	External actors' integration enables our company to make profit after successful supplies.	231	3.199	1.304
5	External actors' integration allows for convenient and productive supply chain at profit.	231	3.312	1.334

3.3 Technology integration

Table.8. shows the descriptive results on the statement of agreement concerning technology integration as a dimension of supply chain. The outcomes from the five statement-items on the 5-point-scale show a distribution indicating that technology alliance is a veritable platform for supply chain. Table 8 shows that the first question item having mean and standard deviation scores of 3.844±1.231, showing that the respondents generally agreed that the work force adopts technological integration in synchronizing integration among supply chain partners. The 2nd statement item showed the mean and standard deviation scores of 3.567±1.085, indicating that the people noted that the firm adopts technological integration as very vital for successful logistics integration and information integration. For the 3rd statement item, there was an inclined the agreement continuum in the mean and standard deviation scores of 3.537±0.767. This descriptively shows that the firm adopts technology integration to quicken the movement of facts within the different departments of the company and among the firms occupying separate areas in the supply chain. In the case of the 4th statement item, the mean and standard deviation scores of 3.610±1.385 imply that the people gave a favourable answer that the firm adopts technological integration to elicit successful logistics integration and information integration for efficient

supplies. The 5th statement revealed a close and accepted change scores of 3.892±0.705 indicating strong agreement by the respondents that the company's technological integration helps for successful information integration that leads to reliable and dependable supply efficiency.

Table.8. Descriptive Results on Technology integration

S. No	QUESTION ITEMS	N	MEAN	S. D
1	Our company adopts technological integration in synchronizing integration within supply chain members.	231	3.844	1.231
	Our company adopts technological integration as an essential feature for successful logistics integration and information integration.	231	3.567	1.085
3	Our company adopts technology integration to hasten communication channel among the different departments within the firm and between firms occupying different positions across the supply	231	3.537	0.767
4	Our company adopts technological integration and elicits successful logistics integration and information integration for efficient supplies	231	3.610	1.385
5	Our company's technological integration helps for successful information integration for reliable and dependable supply efficiency	231	3.892	0.705

3.4 External Actors' Integration and Delivery Precision of the Pipelines and Products Marketing Company Limited

Whose questions and a hypothesis have earlier been raised that also showed worth of relationship that exists between external actors' integration and delivery precision of the Pipelines and Products Marketing Company Limited. The outcome of the external actors' integration and delivery precision of hypothesis (H_{O1}) shows that rho is 0.789 @

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p=0.000 (p<0.05), denoting that powerful definite friendship abides in the examined variables and also significant. This entails that the valueless hypothesis 1 (H_{o1}) is rejected and the substitute hypothesis 1 (H_{i1}) accepted, therefore; "there is meaningful relationship amidst external actors' integration and delivery precision of the Pipelines and Products Marketing Company Limited".

Table.9. Results of external actors' integration and delivery precision of the Pipelines and Products Marketing Company Limited

		External Actors' Integration	Delivery Precision
External Actors' Integration	Pearson Correlation	1	.789**
	Sig. (2-tailed)		.000
	N	231	231
Delivery Precision	Pearson Correlation	.789**	1
	Sig. (2-tailed)	.000	
	N	231	231

The study established that external actors' integration was positively and considerably connected to delivery precision of oil and gas (0.789). This finding is in line with the main body of literature in supply chain theory that suggests that moderate external actors' integration is conducive to organizational transportation optimization at both subunit and organizational levels (Zsidisin and Ritchie, 2009; Zheng and Yu, 2015; Battini, Bogataj and Choudhary, 2017). Therefore, this study buttresses what it means to external actors' integration decision making in enhancing delivery precision of petroleum products' supply chains. This could explain why highly logistics oriented oil and gas establishments streamline or fasten communication, information and collaboration achieves supply chain objectives. For instance, if an engineering manager has to refer the smallest operational matters to someone higher up the hierarchy for a final decision, this could affect (slow down process) the lead-time transportation optimization and proactive managers frown at this type of scenario. Furthermore, the study consolidates the finding by indicating that external actors' integration was significantly and strongly related to delivery precision in the oil and gas as this is in line with other studies that have reported similar outcomes ((Danese and Romano, 2011; Cheng, Li, Ou and Kung, 2014; Dolcourt, 2017). Thun (2010); Campi (2013); Kalinainen (2013);Kang (2016); Lawson, Pil and Holweg (2017); Zang and Maina (2019) all established that higher external actors' integration encourages flexibility, deepens proactive problem solving, open communication, collaboration, and quick competitive response in oil and gas companies. However, if such domain experts were allowed to use informal rules with non-routine policies the outcome would have been less severe on company transportation optimization (time saved on decision making). Finally, this study's finding revealed that higher external actors' integration is woven with delivery precision of petroleum products, explains the happenings in an oil and gas companies with higher external actors' integration, communication process and coordination is slower, less accurate, and with more distributions, since it has to travel through many different hierarchical layers (Wong, Wong and Boon-Itt, 2013). The consequences of such arrangement could be more severe in the uncertain environment like as the oil and gas industries, where a lot of potential issues need to be mutually solved between organizations and its vendors and/or customers (timely decisions).

3.5 External actors' integration and profit maximization of the Pipelines and Products Marketing Company Limited

Relationship that exists between external actors' integration and profit maximization of the Pipelines and Products Marketing Company Limited is displayed in Table 10. The rho outcome of 0.807 @ p=0.000 (p<0.05) reveals a meaningful definite relationship amidst external actors' integration and profit maximization and it is also significant; therefore the valueless hypothesis 2 (H_{o2}) is rejected and alternate hypothesis 2 (H_{i2}) accepted signifying that; "there is meaningful friendship amidst external actors' integration and profit maximization of the Pipelines and Products Marketing Company Limited".

Table 10. Results of external actors' integration and profit maximization of the Pipelines and Products Marketing Company Limited

		External Actors' Integration	Profit maximization
External Actors' Integration	Pearson Correlation	1	0.807**
	Sig.(2-tailed)		0.000

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	N	231	231
Profit maximization	Pearson Correlation	0.807**	1
	Sig. (2-tailed)	0.000	
	N	231	231

This study empirically tested the connection in external actors' integration and profit maximization of oil and gas. They established that external actors' integration significantly and positively affects profit maximization of oil and gas (0.807). These findings are similar and in line with other researches that have investigated and reported that external actors' integration enables and improves profit maximization of petroleum products (Veil, Dillingham and Sloan, 2016; Prajogo and Olhager, 2012; Schoenherr and Swink, 2012). As indicated above this study reported a definite connection with external actors' integration and profit maximization of oil and gas. This was in line with other several supply chain studies (Danese and Romano, 2011; Cheng, Li, Ou and Kung, 2014; Dolcourt, 2017). Therefore, this study reinforces how meaningful external actors' integration is in enhancing profit maximization of supply chains operations. This implies that cross-functional teams could be used for process improvement and new product development. For example, in manufacturing companies coordination and team work with the engineering and R&D department external actors' integration could be enabled by technological advancement, and consequently improve profit maximization of petroleum products (Disterfano, Merlino and Puliafito. 2012).

Furthermore, the outcome also signify external actors' alliance is highly significant concerning profit maximization of petroleum products; this could explain the attention of external actors' alliance contribution to the companies supply chain. Kalinainen (2013) argues that such industry customers are usually not the final consumers, and could act as suppliers to other customers along their coordinatio. They are typically the giant companies that enter into partnership to carry out projects, and thus viewed as strategic collaborators and are very

significant to the focal company. Finally, this study's finding in external actors' integration has relationship with supply chain and transport maximization; it further reinforces previous research findings of Jia and Lamming, 2013; Lee and Lee, 2016; Misra and Sharma, 2014). However, there were studies that did not find a direct association between external actors' integration and profit maximization of petroleum products (Perols and Kortmann, 2013; Williams, Roh, Tokar and Swink. 2013). By comparing the outcome of this work to other similar topical research, it is important that such mixed findings could be explained by first examining individual influence of supply chain dimensions made up of external actor's integration, information integration and technology integration has on profit maximization. It is therefore suggested that associating external actors' integration and profit maximization is a more comprehensive one, when all three extensions of supply chain are measured collectively. In cognizance with structural contingency theory, it is argued that the three extensions of supply chain should be aligned together to represent the best profit maximization of a company.

IV. CONCLUSION

This study can be concluded that external actors' integration has a definite and meaningful relationship with delivery precision and profit maximization of Pipelines and Products Marketing Company Limited. It is therefore recommended that Petroleum Products Marketing Companies should be engaging in proactive and dynamic external actors' integration arrangement, which will encourage delivery precision in the oil and gas sector. In addition, Petroleum Products Marketing Companies should be operated on cost productive and conducive way through putting in place effective external actors' integration arrangement that would continuously contribute to profit maximization to income growth of the petroleum sector.

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