The Extent of New Product Development Partnership between Universities and the Manufacturing Firms in Ghana

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ABSTRACT

The importance of new product development in building both technological and technical capacity of university and firm cannot be overemphasized. Collaborations between HE and industry in NPD is conceived as mutual interaction for skills acquisition and economic improvement. The study was designed to determine the extent of new product development partnership between HEIs and the manufacturing firms. A survey was conducted, and a sample of 400 was drawn from both HE and industry; the data were then analyzed using structural equation modeling (SEM) software of EQS version 6.2. The results revealed that there is weak interaction between HE and industry, also there is no formal partnership between the two on new product development. In order to strengthen the mutual relationship, a conceptual model had been developed after a careful examination and assessment of the key factors of NPD and after preliminary CFA analysis conducted to establish the determinants of the main construct. A nine-factor model was then developed for university and industry. The study therefore recommends that higher education and industry adopt this new model for effective partnership on NPD.

Keywords-- Higher Education Institutions, Firms, New Product Development, Partnership, Technical Capacity

I. INTRODUCTION

The importance of new product development in sharpening the technical capacity and improving the technological capabilities of firms reaches far and wide in the manufacturing industry. Extant literature has informed the various models that have emerged to provide different pathways for organizational processes as well as how to develop a new product (Tidd et al., 2001). Initially NPD was a sole function of the industry; universities were not involved in joint NPD. Because the linear model of technology innovation was peculiar to university just as it was to industry. Of late, universities enter into partnership with manufacturing firms on NPD which accounts for a number of mutual benefits for the two partners; benefits in terms of improving technological know-how, improving technical skills and product marketability. University partnering with manufacturing firms on NPD is an important resultant of technology innovation, in that innovations have to be converted into locally manufactured finished goods. Partnership between university and firms on new product development is a rigorous attempt and therefore needs a special model. Obviously, newly manufactured products account for both technological and economic impacts such as employment, economic growth, technological progress, and high standards of living (Nadia, 2011). Several structured models and methods have been explored and developed by researchers, with the aim of improving NPD. Their efforts include models examining the process, and particular techniques or methods with which to optimise various production stages. The adoption of these types of models by firms has been found to improve the chances of success (Ette and Elsenbach, 2007; Barczacet et al., 2009). However, new product development in this current study is viewed as a way of maximizing technical and technological capacity of both university and industry through joint activities. It is required that universities showcase their potentials to the industry, likewise the firms to the universities. Universities should discourage the idea of linear model of product development; they should see the necessity to engage industrial firms. Clearly, many scholars have tried to develop models that capture the relevant stages of the NPD process (Ulrich & Eppinger, 2011; Wind, 2001; Cooper, 2001). A number of detailed NPD models have been developed over the years; the best known of which is the Booz, Allen and Hamilton (1982) model known as the BAH model, which underlies most other NPD systems that have been put forward. New product development process differs from university to university and from firm to firm. Indeed it should be adapted to each firm in order to meet specific company resources and needs (Booz, Allen & Hamilton, 1982).
Table 1: Theoretical Frameworks of Previous Works

| Source | Description |
|--------|-------------|
| Booz *et al* (1968) | Exploration, screening, business analysis, development, testing, and commercialization. |
| Wilson *et al* (1996) | Product ideas, customer future needs projection, product technology selection and development, process technology selection and development, final product definition and project targets, product marketing and distribution preparation, product design and evaluation, manufacturing system design, product manufacturing delivery and use. |
| Kazimierska and Grębosz (2017) | Feasibility study, design phase, preparation of the prototype, manufacturing. |
| Booz, Allen and Hamilton (1982) | New Product Strategy, Idea generation, Screening, Business Analysis: Development, Testing, Commercialization |
| Ioannis Komninos 2002 | Creation of ideas, Evaluation of ideas – Selection of final idea, Product development, Manufacture of prototype, Product promotion |

Source: Organized from Literature

The fact that a university engages in technology transfer confers on it the duty of ‘new product development’. Evidently new product development is a traditional function of industry. The idea of taking over the role of each other from time to time cannot be ruled out, and does not lead to the structure’s losing its traditional identity. This study rather focuses on innovative and technical competence to be exercised in order to get a product actualized by university and the manufacturing firm. However this current model is quite unique from those models mentioned above, in that the new model calls for joint activities between university and industry in light of building mutual capacity.

The aim of this study was to investigate the extent of new product development partnership between universities and the manufacturing firms while the specific objectives were:

- to investigate the extent of formal interaction between the two partners on new product development
- to develop a model of new product development for university and the manufacturing firms

II. THEORETICAL UNDERPINNING

Literature informed that most new product development concepts rather paid attention to individual companies or universities as sole production units based on the resources and capacity they possess. University and industry have not been considered as a unit in terms of partnership for new product development. Invariably, those previous studies examined competitiveness of companies or universities based on marketing of products, and customer satisfaction. Focusing on the fact that the market is dynamic; expectations of more customer share from customers requires new technique and strategy for management (*Gurbuz*, 2018). Developing the “right” new product is quite fundamental to firm’s success and is often cited as key competitive dimension (*Roussel* et al. 1991: *Cooper* et al. 1998). Indeed, modern innovation trends emphasize the non-linear model of new product development; it emphasizes collaboration between universities and industrial firms. Literature further informed that developing countries have low capacity in terms of technical and management skills, including technical infrastructure (*Were*, 2016). Therefore, industrial firms and universities in Ghana need to be upgraded in terms of structure and skills in order to collaborate effectively.

This current study developed a common model for university-industry collaboration on new product development. The framework is quite comprehensive and is geared towards building the competitive urge of collaborative partners, mutual capacity maximization and skills development. Capacity development is achieved through sharing of technical know-how, product design, technical skills as well as sharing of technical infrastructure. Figure 1 displays a graphical representation of the new concept on new product development collaboration for university and industry.
III. MATERIALS AND METHODS

3.1 Research Design

The study took cognizance of a two-stage research approach to examine the relationship between university and industry and to develop a model on new product development. The first stage involved the review of literature to identify the factors that constitute NPD. Literature has provided information for the researcher to carefully select and adapt the variables of NPD to this current study. The second part involved the use of survey to evaluate the measurement model of NPD. The survey research questionnaire was found to be more appropriate for this study. The data were collected in the form of field research by distributing self-administered questionnaires including online Google form via e-mail. A sample of 400 was selected from both higher education and industry on equal proportions. The sample was deemed a representation of the population that had substantial knowledge and understanding of higher education and industry Collaborations on NPD. The data collected were entered into SPSS and transported to structural equation modeling (SEM) for analysis. The EQS software version 6.2 was used for the analysis. SEM is noted for being the most inclusive statistical procedure in social and scientific research. SEM embraces all general linear modelling (GLM) of statistical operations such as analysis of variance (ANOVA), multivariate analysis of variance (MANOVA) and multiple regressions (Kline, 2005:14). It is noted that a smaller sample size in SEM analysis contributes to greater model fit bias (Tong, 2007). Therefore, in order avoid this bias the study considered a sample of 400 including both higher education and industry.

IV. RESULTS AND DISCUSSION

From the descriptive statistics in table 3, academic qualification for university was25.0% for PhD and 74.5% for Master’s Degree holders, indicating that those with master’s degree are in the majority within the technical universities in Ghana. Bachelor’s degree holders were 6.0%. With the industry, Bachelor’s degree holders were in the majority; they attracted 57.5%, followed by higher national diploma, representing 34.5%, however master’s degree holders in the industry represented 8.0%, suggesting that industry is interested in skill labour and professionalism; emphasis is not placed on academic qualification. Clearly, most higher education qualifications in developing countries are research inclined with little
emphasis on practicality. Two technical universities in two different communities were considered. These were Ashanti (Kumasi Technical University, 47.5%, (N=95), Greater Accra Metropolis (Accra technical university), 52.5% (N=105). These are the regions where there are clusters of industries. These two universities were considered on the basis of their experience with industries as well as good policy on staff development including collaborations they have so far established with firms in the area. With industrial firms, Ashanti and Greater Accra each had 110 and 90 respondents respectively, representing 55.5% and 45.0% respectively. As indicated earlier, these two regions are industrial areas where most of the firms in Ghana are found. In considering how long the respondents have been working in the higher education institution, those who have worked from 6-10 years were 52.0% and were in the majority followed by 1-5 years (32.5%).

Table 3: Demographic Respondents’ Information

| Qualification (University) | Frequency | Percentage |
|---------------------------|-----------|------------|
| Higher National Diploma   | 0         | 0.0%       |
| Bachelors                 | 12        | 6.0%       |
| Masters                   | 1497      | 74.5%      |
| Doctoral (PhD)            | 50        | 25.0%      |

| Qualification (Industry)  | Frequency | Percentage |
|---------------------------|-----------|------------|
| Higher National Diploma   | 69        | 34.5%      |
| Bachelors                 | 115       | 57.5%      |
| Masters                   | 168       | 84.0%      |
| Doctoral (PhD)            | 0         | 0.0%       |

| Metropolis Academia       |            |            |
|---------------------------|-----------|------------|
| Ashanti                   | 9547      | 52.5%      |
| Greater Accra             | 105       | 52.5%      |

| Industry Number of years at work | Academia | Industry |
|----------------------------------|----------|----------|
| 1-5                              | 6532     | 63.0%    |
| 6-10                             | 10452    | 2914.5%  |
| 11-15                            | 2412     | 5125.5%  |
| 16-20                            | 5        | 9045.0%  |
| 21-25                            | 21       | 10.5%    |
| 26 or more                       | 0        | 3.15%    |

However, 11 – 15 years were 12.0%. Both 16-20 and 21-25 were 2.5% and 1.0%; this low trend of work experience is due to the fact that technical universities had just been upgraded and therefore needed a rigorous and accelerated staff development plan. With the industrial firms, those with 16 to 20 years’ experience (45.0%) were in the majority, followed by those with 11 to 15 (25.5%), and those with 6 -10 years (14.5%). Those 21-25 were 10% while 1-6 and 26 and over were the least. The fact remains that most of the firms have been in existence longer. Therefore explains the longer work experience as compared to those from the technical universities which
have just been upgraded. In addition, the work experience is more distributed as compared to that of the university. Table 4 displays the results of interaction between university and the manufacturing sector on new product development. The results revealed that collaboration between the two partners on new product development is very weak, since 86.25% of the participants confirmed the fact there is no collaboration on new product development between the two partners. Likewise, joint design of new product interaction is as low as 3.75%. Presently, there is informal interaction between students and firms on new product development with regard to their final project works. However there is no formal partnership between universities and firms on new product development (77.5%). For technical universities to fulfill their mandate, they need to partner with the manufacturing industry on concept development, design and product development as well as prototype testing. Exactly 80.25% admitted the fact that there is no joint prototype testing between the university and firm. In addition, the results revealed that higher education and industry do not collaborate on indigenous product 80.5% manufacture. This is as result of absence of formal collaboration. Clearly each party promotes indigenous product development without the involvement of a partner, thus the linear model of technology innovation. In terms of adequate technology of university to partner with industry, majority of the respondents agreed to this fact (88.5%). Likewise the study revealed that firms have adequate material resources to partner with university (68.75%). Also university is endowed with adequate technical infrastructure to be able to go into new product production partnership with the industry (70.25%). Likewise industrial firms have adequate technical infrastructure to partner with universities (72.5%). The results revealed that each party conducts in-house assessment of machinery and equipment at regular intervals to ensure effectiveness and efficiency hence can go into collaboration. Evidently, university and firm have downplayed the importance of patent and license for product. The study revealed that 94.25% have not licensed their new products.

| Variable | Yes | No | Do not know | Total |
|----------|-----|----|-------------|-------|
| Partnership for concept development | 50  | 345| 5           | 400   |
| Partnership for design of new product | 15  | 370| 15          | 400   |
| Joint product development | 86  | 310| 4           | 400   |
| Joint prototype testing | 67  | 321| 12          | 400   |
| Joint promotion of indigenous products | 73  | 322| 5           | 400   |
| Adequate technology to partner with industry | 374 | 17 | 9           | 400   |
| Adequate material resources to partner with university | 275 | 115| 10          | 400   |
| Adequate technical infrastructure to partner with university | 68.75 | 28.75| 2.5 | 400 |
| Adequate technical infrastructure to partner with university | 281 | 111| 8           | 400   |
| Assessment of machinery for effective collaboration | 380 | 16 | 4           | 400   |
| Joint patent and license for products | 95.0 | 4.0| 1.0         | 400   |
| Joint with industry | 2.75 | 94.25| 3.0         | 400   |
4.1 Measurement Model for New Product Development (NPD)

This section is a presentation of new product development as a construct by means of unidimensional approach. The number of cases that were analysed were 400. The proposed hypothesis which implies that the NPD construct is explained by the indicator variables from NPD1 to NPD9 was therefore evaluated as shown in Table 5. The NPD constructs was made up of 10 observed variables. However preliminary CFA analysis revealed that only one indicator variable had an unacceptably high unstandardised and standardized residual covariance matrix. The hypothesis that the NPD construct is explained by the indicator variables NPD1- NPD9 as shown in Table 5 was therefore evaluated.

| Latent construct | Indicator variables | Label |
|------------------|---------------------|-------|
| New Product Development (NPD) | University partners with industry for new concept development | NPD1 |
| | University designs new products with industry | NPD2 |
| | Product development is undertaken by university and firm | NPD3 |
| | Prototype testing is conducted between university and industry | NPD4 |
| | University promotes indigenous products for partnership with industry | NPD5 |
| | University has adequate technology to partner with industry | NPD6 |
| | Industry has adequate material resources to partner with university | NPD7 |
| | Industry has adequate technical infrastructure to Partner with university | NPD8 |
| | Technical assessment of the machinery is conducted for efficiency to ensure effective collaboration | NPD9 |

4.2 Diagnostic Fit Analysis: Analysis of Residual Covariance Estimate

This is to determine whether there is an acceptable fit between the new product development model and the sample data. The results obtained for the NPD measurement model were suggestive of an acceptable fit to the sample data since all residual values were below the cut-off, 2.58 (Byrne, 2006:94). It is clear from the results that all the absolute residual values and the average off-diagonal absolute residual values were close to zero. The unstandardised average off-diagonal residual was 0.0302 (Table 6) while the standardized average off-diagonal residual was found to be 0.0191 (Table 7). The results obtained for the NDP component measurement model suggested a fairly acceptable fit to the sample data because the absolute residual was all less than 2.58.

| Unstandardized Residual Covariance Matrix for NPD | NPD1 | NPD2 | NPD3 | NPD4 | NPD5 | NPD6 | NPD7 | NPD8 | NPD9 |
|--------------------------------------------------|------|------|------|------|------|------|------|------|------|
| NPD1                                             | 0.000|      |      |      |      |      |      |      |      |
| NPD2                                             | 0.038| 0.000|      |      |      |      |      |      |      |
| NPD3                                             | 0.049| -0.017| 0.000|      |      |      |      |      |      |
| NPD4                                             | -0.037| -0.008| -0.009| 0.000|      |      |      |      |      |
| NPD5                                             | -0.092| -0.062| 0.043| 0.044| 0.000|      |      |      |      |
| NPD6                                             | 0.093| -0.004| -0.050| 0.021| -0.012| 0.000|      |      |      |
| NPD7                                             | -0.018| 0.022| 0.010| -0.046| 0.011| 0.036| 0.000|      |      |
| NPD8                                             | -0.023| -0.012| -0.029| 0.022| 0.026| 0.014| -0.003| 0.000|      |
| NPD9                                             | -0.012| 0.059| 0.017| 0.008| 0.015| -0.098| -0.014| 0.013| 0.000|

Average Absolute Residual = 0.0242
Average Off-Diagonal Absolute Residual = 0.0302
% falling between -0.1 + 0.1 = 100%
Table 7: Residual covariance matrix for NPD (Standardized)

| Standardized Residual Covariance Matrix for NPD |
|-----------------------------------------------|
| NPD1  | NPD2  | NPD3  | NPD4  | NPD5  | NPD6  | NPD7  | NPD8  | NPD9  |
|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| NPD1  | 0.000 |       |       |       |       |       |       |       |
| NPD2  | 0.024 | 0.000 |       |       |       |       |       |       |
| NPD3  | 0.029 | -0.011| 0.000 |       |       |       |       |       |
| NPD4  | -0.024| -0.006| -0.006| 0.000 |       |       |       |       |
| NPD5  | -0.057| -0.042| 0.028 | 0.030 | 0.000 |       |       |       |
| NPD6  | 0.053 | -0.003| -0.030| 0.013 | -0.007| 0.000 |       |       |
| NPD7  | -0.011| 0.015 | 0.007 | -0.032| 0.007 | 0.022 | 0.000 |       |
| NPD8  | -0.014| -0.008| -0.019| 0.015 | 0.018 | 0.009 | -0.002| 0.000 |
| NPD9  | -0.007| 0.038 | 0.011 | 0.005 | 0.010 | -0.059| -0.009| 0.008 |

Average Absolute Residual = 0.0153
Average Off-Diagonal Absolute Residual = 0.0191
% falling between -0.1 +0.1 = 100%

4.3 Goodness-of-Fit Statistics – Robust Maximum Likelihood (RML)

With the chi-square (Table 8), the sample data on new product development component measurement mode yielded $S-B\chi^2 = 61.567$ with 27 degrees of freedom (df) and a probability of $p=0.0000$. This is an indication that the chi-square value was insignificant and hence an indication of an acceptable fit. The chi-square value indicated that the departure of the sample data from the postulated measurement model was not significant. Also, the value of the normed chi-square, which is a ratio of the chi-square and the degree of freedom, is 2.280 suggesting an acceptable fit. Normed values up to 3.0 are normally recommended (Kline, 2005:137). The ratio, 2.280 was found to be less than 3.0. Additionally, the value of RMSEA was found to be 0.057 while the CFI was found to be 0.979. The CFI value in this case is higher than the cut-off limit of 0.95, thereby guaranteeing the model to be described as having a good fit. Also, the absolute fit index RMSEA value of 0.057 was less than the cut-off value of 0.09, indicating that the result showed a good fit model with an RMSEA value of 0.057. This fit indices measurement model suggested that the postulated model adequately described the sample data (Table 8).

Table 8: Robust fit indices for NPD

| Model Fit Indices | Threshold/Values | Estimated | Comment |
|-------------------|------------------|-----------|---------|
| $S-B\chi^2$       |                  | 61.567    |         |
| Df                |                  | 27        |         |
| Chi-square ($\chi^2$/df) | < 5 (acceptable fit); | 2.280 | Good fit |
|                   | < 3 (good fit)   |           |         |
| Comparative Fit Index (CFI) | > 0.90 (acceptable fit); | 0.979 | Good fit |
|                   | > 0.95 (good fit) |           |         |
| Incremental Fit Index (IFI) | > 0.90 (acceptable fit); | 0.980 | Good fit |
|                   | > 0.95 (good fit) |           |         |
| Normed Fit Index (NFI) | > 0.90 (acceptable fit); | 0.964 | Good fit |
|                   | > 0.95 (good fit) |           |         |
| Root Mean-Square Error of Approximation (RMSEA) | ≤ 0.08 (acceptable fit); | 0.057 | Acceptable |
4.4 Factor Loadings and Z-statistics of NPD Model

Table 9 presents correlation values, standard errors and test statistics. It reveals that all correlation values were less than or equal to 1.00, while Z-statistics were greater than 1.96. The estimates were therefore considered reasonable and for that matter statistically significant. The results revealed that the parameter with the highest standardized coefficient was the indicator variable NPD8 (Industry has adequate technical infrastructure to partner with university). The parameter coefficient was found to be 0.883. This variable was found to be more closely associated with the new product development construct than the other variables.

| Indicators | Unstandardised Coefficient | Standardised Coefficient | Z-Statistics | R-Square | Sig (5%) |
|------------|-----------------------------|--------------------------|--------------|----------|----------|
| NPD1       | 1.000                       | 0.843                    | -            | 0.711    | Significant |
| NPD2       | 0.907                       | 0.832                    | 21.074       | 0.692    | Significant |
| NPD3       | 0.988                       | 0.872                    | 22.882       | 0.761    | Significant |
| NPD4       | 0.889                       | 0.832                    | 21.092       | 0.692    | Significant |
| NPD5       | 0.922                       | 0.835                    | 21.232       | 0.698    | Significant |
| NPD6       | 1.000                       | 0.842                    | 21.512       | 0.709    | Significant |
| NPD7       | 0.937                       | 0.841                    | 21.480       | 0.707    | Significant |
| NPD8       | 0.969                       | 0.883                    | 23.400       | 0.780    | Significant |
| NPD9       | 0.947                       | 0.828                    | 20.913       | 0.685    | Significant |

It is clearly observed that all parameter estimates had high correlations values close to 1.00. The high correlation values are indicative of a high degree of linear association between the indicator variables and the unobserved variable. The $R^2$ values were also close to the standard value of 1.00, suggesting that the factors explained more of the variance in the indicator variables. The results therefore suggest that the indicator variables significantly predict the unobserved construct since all the measured variables are significantly associated with the new product development construct.

4.5 Internal Reliability and Validity of Scores

Internal reliability and validity are techniques used in this study to evaluate the quality of the research study. Reliability describes how consistent the method measures the indicators as against the construct while validity measures the accuracy of the relation. Generally, reliability coefficient should fall between zero and 1.00, and values close to 1.00 are the expected values (Kline, 2005:59). The scores for the internal consistency and reliability for the new product development construct was determined from the rho and the cronbach’s alpha coefficients (Table 10). The rho coefficient of internal consistency was found to be 0.958, which is above the minimum required value of 0.70. As a result, the value revealed a high level of internal consistency. Likewise, the Cronbach’s alpha was above the minimum acceptable value of 0.70. It was found to be0.957, and therefore revealed a higher level of consistency as well as reliability. Clearly, this suggests that the indicator variables represent the same construct(new product development).

| Indicators | Factor Loadings | Cronbach's Alpha | Reliability Coefficient Rho | Internal Consistency Reliability |
|------------|-----------------|------------------|-----------------------------|---------------------------------|
| NPD1       | 0.843           |                  |                             |                                 |
| NPD2       | 0.832           |                  |                             |                                 |
| NPD3       | 0.872           | 0.957            | 0.958                       | 0.958                           |
| NPD4       | 0.832           |                  |                             |                                 |
| NPD5       | 0.835           | 0.957            | 0.958                       | 0.958                           |
| NPD6       | 0.842           |                  |                             |                                 |
| NPD7       | 0.841           |                  |                             |                                 |
| NPD8       | 0.883           |                  |                             |                                 |
| NPD9       | 0.828           |                  |                             |                                 |
V. CONCLUSION

In conclusion, the results revealed that collaborations between higher education and industry on new product development is very weak (86.25%). There is no formal partnership between the HEIs and firms on new product development (77.5%). The fact that students’ final projects regarding new product development are jointly carried out with industry does not guarantee formal relationship, it is usually on individualism and on informal basis. Presently, there is informal interaction between students and firms on new product development with regard to their final project works. For technical universities to fulfill their mandate, they need to partner with the manufacturing industry on concept development, design and product development as well as prototype testing.

For the development of the new model, the study clearly examined and assessed the key factors of NPD, and a preliminary CFA analysis conducted to establish the determinants of the main construct. The results revealed that the parameter with the highest standardized coefficient was the indicator variable NPD8, thus, “Industry has adequate technical infrastructure to partner with university”, the parameter coefficient was found to be 0.883. Implying industry have enough technical capacity in order to collaborate effectively with university. This is followed by the indicator variable; product development should be undertaken collaboratively by university and firm (0.872). The other variables revealed high correlation values, suggesting that there is high degree of linear association between the indicator variables and the unobserved variable. Evidently, higher education and industry collaborating on NPD is indeed a manifestation of a two-way flow of effective interaction necessary for the growth of both partners. Obviously, NDP is geared towards enhancing the technological and technical capacity of higher education and industry. As a result, the study recommends that higher education and industry should collaborate on NPD activities, adopting the 9-factor model evaluated in this study for the mutual benefit of two.

REFERENCES

[1] Booz, Allen & Hamilton. (1982). New product management for the 1980’s. New York: Booz, Allen & Hamilton, Inc.

[2] Byrne, B. M. (2006). Structural equation modeling with EQS: Basic concepts, applications, and programming. (2nd ed.). Mahwah, NJ: Erlbaum.

[3] Cooper, R. (1998). Product leadership: Creativity and launching superior new products. Massachusetts: Perseus Books, Reading.

[4] Nadia, B. (2011). A framework for successful new product development. Journal of Industrial Engineering and Management, 4(4), 746-770.

[5] Were, A. (2016). Manufacturing in Kenya: Features, challenge sand opportunities. A Scoping Exercise Kenya.

[6] Kline, R. B. (2005). Principles and practice of structural equation modeling. (1st ed.). New York: Guilford Press.

[7] Tong, D. Y. (2007). An empirical study of e-recruitment technology adoption in Malaysia: Assessment of modified technology acceptance model. Multimedia University, Malaysia.

[8] Ulrich, K.T. & Eppinger, S.D. (2011). Product design and development. McGraw-Hill.

[9] Wilson, C., Kennedy, C., & Tramell, C. Superior. (1996). Product development: managing the process for innovative products. The University of Tennessee, Knoxville, Blackwell Business.

[10] Ioannis Komninos. (2002). URENIO - Urban and regional innovation research unit. Available at: http://www.urenio.org.

[11] Gurbuz, E. (2018). Theory of new product development and its application. DOI: 10.5772/intechopen.74527.

[12] Roussel, P., Saad, K.N., & Erickson, T.J. (1991). Third generation R&D, managing the link to corporate strategy, Harvard Business School Press & Arthur D. Little Inc.

[13] Kazimierska, M. & Grębosz-Krawczyk, M. (2017). New Product Development (NPD) process – An example of industrial sector. Management Systems in Production Engineering, 25(4).

[14] Barczak, G., Griffin, A., & Kahn, K. (2009). Trends and drivers of success in NPD practices: Results of the 2003 PDMA best practices study. Journal of Product Innovation Management, 26(1), 3-23.

[15] Ettlie, J. E. & Elsenbach, J. M. (2007). Modified stage-gate regimes in new product development. Journal of Product Innovation Management, 24, 20-33.

[16] Tidd, J., Bessant, J., & Pavitt, K., (2001). Managing innovation; Integrating technological, market and organizational change. (2nd ed.). Sussex, England: John Wiley & Sons Ltd., West.