Imperative of Optimization in Innovative Custom-fit

Tadeusz Gospodarek

Wałbrzych School of Management and Entrepreneurship
ul. 1 Maja 131; 58-305 Walbrzych, Poland
tgospo@op.pl

Abstract

Some behaviours of business entities observed on the market as creation of local supply chains, and migrations to global supply chains for access to VRIN resources and the best fulfilments of clients demand according to rules of minimization of resources and energy consumption, had confirmed the Prahalad & Krishnan's statement "N=1 and R=G". The innovative organization tries to fulfil the most individualized requirements of a consumer (N = 1) using all available resources scattered elsewhere in a network R = G. It may be concluded that the measure of innovation optimality of an organization is the highest level of its product customization. The original formula "N=1 and R=G" needs some updates to be recognized as a formal, scientific sentence. Also it is necessary to make it more consistent with the observed situations in practice. This paper offers the mentioned generalization as well as a new concept of the N interpretation. There exist a minimum value N≥1 which may suggest the type of strategic behaviour of the organization. For bigger values of N it may be concluded the resource based type of strategy, whereas for N near to 1 strict market orientations are more adequate.

Introduction

The concept of strategy of innovative market behaviours of organizations directed at diversification of products according to original suggestion "N=1 & R=G" (Prahalad & Krishnan 2008) undoubtedly seems to be one of the most interesting concepts in the field of management science. It is correlated to arising of new local supply chains, a phenomena which can be observed on the market, (Neace & all. 2012; Gospodarek 2010) and their migration to global supply chain for the best fulfillment of customer requirements at the minimum engagement of energy and resources (Gospodarek T., 2012). According to Prahalad & Krishnan, the innovative, customer-oriented organization aims at satisfying the most individualized needs "N = 1" using all available resources scattered elsewhere in a global network "R = G". This suggests that the measure of optimality of innovation is the highest level of client customization (custom-fit) of the product (von Hippel 1998), expressed as the minimum of N. On the other hand, the scattering of necessary resources and some outsourcing processes and logistic optimizations are observed from the manufacturer perspective. Such an approach provides an excellent example of cooperation of the resource based view and the contingency theory in explaining the structure of innovative products, especially the auto-adaptive tuning of manufacturing processes to customer requirements with the use of feedback. Product innovation and adapting to customer expectations as variant (custom-fit) is the opposite to market adjustments (mass customization) commonly observed (Piller 2008; Zipkin 2001; Syam & all 2005).

The original formula „N=1 & R=G" is rather a kind of cognitive metaphor where lack of semantic formality eliminates its usefulness as a paradigmatic type sentence of management (Gospodarek 2010 and 2012). The equity sign related to two different categories R (resources) and G (global) is a semantic error, but in the case of metaphoric sentences is not the cognitive defect (Lakoff & Johnson 1980). But one cannot deny that the original formula of Prahalad & Krishnan includes the imperative to optimize both the logistics and interactions of the organization with the market. Therefore, it is an indication to management which is worth further reflection and clarification of its form so as to achieve logical consistency and to gain the possibility of inference, based on the revised formula.

The purpose of this paper is to show that the customization of products and innovative behaviour are mutually joined characteristics of the system generating value, expressed by the limited size of the level of product customization. This implies the existence of a custom-fit/mass-fit equilibrium which is determined by N. The second aspect is to indicate the explaining role of the resource based theory in the orientation of the manufacturer on products of the custom-fit type.

Generalization of the N=1 concept

As a preliminary discussion on the formulation of Prahalad and Krishnan, it is necessary to determine the degree of truth of the hypothesis. It cannot be inferred through deduction, because there is no coherent system of true sentences, of which it may arise. However, it can be assumed with a high degree of probability that the formula "N = 1 and R = G" is a generalized descriptive sentence derived from some observations (Gospodarek 2012). This means that it results from a number of observations that constitute a certificate of its authenticity. But one should also be aware of the fact that today there are a lot of falsifiers of such a hypothesis, especially those related to the profitability of client customization of products and the imperative of economic optimality. As one can see, asking for the resources too distant from the final assembly place causes conflict of profitability of the logistics, leading to a lack of economic justification of such outsourcing, what automatically generates a strong falsifiers of the original concept. On the other hand, there are organizations that offer completely customized value N = 1, and those where the product is subjected to partial customization relationally fixed N > 1 (but not yet mass-fit classes), and such where customization is a variable that adjusts to the utility u, functionality r and customer's preference p on autoadaptive way. Then, N is a function of the mentioned variables $N = \phi(u, r, p)$, as for customization of database software (Bernhardt & all 2007). It may also change over time of the product use, resulting from the use of feedbacks between the customer and the producer and the market and the organization.

From the logical point of view, the expression "N = 1 and R = G" has no value because there is not a sentence. One can not judge neither the consistency of such hypothesis nor its accuracy, since the methodology requires first to build a sentence formally correct, both syntactically and semantically. Thus, for consistency, it is necessary to propose the modification the formula of "N = 1" to the form:

$$N = \min_{n}\{opt[EBITDA(n)]\} \qquad [1]$$

The above means that creating the value, an organization is to meet requirements of a minimum set of customers of a certain size n, satisfying the condition to provide a total assumed income before taxes, as measured by EBITDA for the product or service. In other words, there is a *limes inferior* to N, greater than one. This way, minimizing the number of contractors is subjected to a criterion of profitability and/or market equilibrium, which is difficult to deny by pointing out the falsifying case of the hypothesis. This preserves the imperative of optimization, which improves significantly the functionality of the expression [1]. But it also highlighs the existence of a balance between the client customization (custom-fit) and the market customization (mass-fit), which may be determined by the N parameter.

The measure of optimality is assumed *a priori* the value of EBITDA satisfactory for the considered product or service. It means, that the expression [1] may be taken into account only in cases from the Pareto optimum range which create significant but not necessary the maximum profit. As the limit the N = 1 value may be true as it was pointed out in the original concept of Prahalad & Krishnan. The limit proposed in expression [1] allows to eliminate most of the cases falsifying the hypothesis N = 1, because the number of customers grouped inside the custom-fit procedure N for a given product and a given manufacturer is different, and its value depends on the criteria of optimality assumed by the manager. It may be concluded that the presented modification is rational and more useful than that original, because it includes the most of known cases.

For the form expressed as equation [1] it may be possible to evaluate its logical value (true or false), but on account of empirical character of the propositional variable, this value may be establish

using the probabilistic logic and a set of confirmation certificates. The following sentence may be assumed as reasonable: *organizations of high level of innovative behaviour tend to customize each product to include in a variant of the smallest audience, bringing a cumulative EBITDA satisfactory.* It follows that if EBITDA is satisfactory for a single client (expensive watch Patek-Philippe), the customization will be rational as proposed by Prahalad and Krishnan. This way the principle of bounded rationality (Simon 1978, Jones 1999) is taken into account by the subjectivity of the assumed optimality criterion. Satisfactory level of EBITDA for the product and the organization is determined *a priori* by the manager and such assumptions are always burdened with relativistic *ceteris paribus*. EBITDA criterion sets automatically an assortment filtration, assuming that if $N > \varepsilon$ (where ε is a fixed number of customers) at a given EBITDA value, then the product is considered as subjected to the mass customization (mass-fit) and must be produced according to the assumptions of serial production . However, it may be individually customized (custom-fit) later.

Case 1: Car tuning

Customization is possible up to a limit of N = 1, but it is true for manufacturers of prototypes, for example, Donkervoort. However, if it was a rule for any size of production, the agency of tuning companies would not be observed in individual custom-fit performance of standard cars. Their existence indicates the lower limit of N for large producers of the serial products, below which it is not worth further customization at the factory level. Therefore, deeper customization requires participation of smaller organizations (3-hand), such as Brabus for Mercedes or Hamann for BMW. But is it possible to say that the lack of customization to the level of N = 1 for the BMW products is sufficient to classify them as not innovative? The company is able to build any prototype having extraordinary performance characteristics and duplicate it if requested. Technologically it is possible. Economic rationality requires, however, providing a more averaged products of mass-fit class, which may be customized by third parties. Are then independent tuners more innovative? This seems not to be a reasonable suggestion. Hence the low value of N is not an indicator of the level of product innovation, but rather a set of attributes that represents the customer's preferences and equilibrium mass-fit/custom-fit.

Case 2: Haute couture/soho clothes

Customization at the level of N = 1 is characteristic of the class of haute couture clothing. Is it since possible to put a statement that they are innovative? Not necessarily - it's their design and marketing that is innovative. (Astronauts' suits are truely innovative) It should be noted that due to low value of EBITDA for casual clothing, in this segment, characterized by high values of N, rather poor level of customization ca be observed and it is only restricted to a size, color or model. Innovation manifests itself in engineering and sewing technology. Companies from the haute couture segment assume the uniqueness of their products, as a kind of artistic work, and their market strategy is targeted at the niche of wealthy customers with specific preferences. For that reason they can realize strategies of N = 1. Products of denim related to street style have a mass-customization based on of several models and sizes, and few kinds of fabric type. Thus N has a rather large value, resulting from the scale of production in accordance with the principles of mass distribution and supply chain structure. Niche model in this case does not function, and deeper customization does not make sense, because of the strong price competition and the required EBITDA for profit criterion for each product.

Case 3 Nylon stockings

An interesting case is that of nylon stockings production, which were highly innovative products in the 50's , with customization of a mass-fit type for any important manufacturer, understood as: 6 sizes of three subclasses (short, medium and long), several thicknesses of yarn (10, 15, 20, 30 Dn), few patterns (plain, diamond, micro-mesh) and several types of stockings (RHT, NHT, RT, FF) in several colors. Suddenly, the market received products too individualized from the economic point of view, impossible to maintain in mass distribution. In order to obtain complete customer satisfaction stores

were obliged to have a representation of goods for at least 6 * 2 * 2 * 2 * 2 = 96 items (six dimensions, two types, two thicknesses, the two patterns, two colors) from a single manufacturer. Such diversity at the retailer level of distribution is unprofitable and forces the manufacturer to reduce the level of mass customization-fit. That is why in the 60's there was a migration towards stretch products (optimization of market customization), where the size chart is limited basically to three categories and standardized thickness of yarn for each color. This is an example of innovative actions (change of the yarn material and weaving technology) to optimize the utility and economy, clearly indicating the existence of the lower edge of customization due to EBITDA. Additionally, this example shows that product customization is not only dependent on the manufacturer but also on the economics of the system manufacturer-logistics-seller. Each of them brings lower bound on N, and the system takes the maximum of the values obtained in the supply chain. Thus N is determined also by 3-rd parties of the network structure and thus $N \gg 1$.

Case 4 Personal computers

Customization of computer configuration is an idea derived from producers' concept and market expectations, but in this case along with the economic aspect there is an additional factor limiting the level of customization. These are protocols and standards, which require functional uniformity. Customization is then performed by the user at the level of hardware and software configuration. As a result, one can observe a catastrophic change in product's functionality and its redefinition. A computer programmed and parameterized with user programs and data (configured), ready to perform desired tasks, becomes an intelligent system and, as such, has significantly reduced value of matching N' to the N of the original product (a computer with preinstalled system). It is certainly an innovative product, but it also has a fuzzy boundary of customization limited from the bottom $N > N' \geq 1$. In an extreme case of adaptation with a use of dedicated? programs the value of N' may reach 1 for the system ready for operation. It is clear however that in this case, the customization process is adaptive, depending on the user. There is a fluid line between the mass-customization and custom-fit, which shall be defined by the system provider, not the manufacturer of your computer or software. This is an example of fine tuning by the user (or system provider being the 3 party in the distribution processes) and changes of the balance custom-fit/mass-fit due to redefinition of the objective ontology (from a computer to the information system).

The existence of a lower limit of the level of customization can be justified by the following aspects:

1. The economic aspect, derived from the profitability of customization, measured by EBITDA of the manufacturer for a given product.
2. The aspect of logistics, setting higher values of N than it follows from the customization level of the manufacturer, which involves the optimization of the distribution supply chain. There are N'=sup {inf (N)} due to the largest value of N in the supply chain (case 4).
3. The aspect of the scale strategy, business strategy and the type of activity (low values of N for personalized services, activities in market niches and strategies avoiding competition, high N for mass production despite of innovative technology).
4. The aspect of artificial intelligence included in the product, enabling auto-adaptation of the product by the user and changing the level of customization or redefining its original being (conversion of the standard computer into an information system).
5. The aspect of the influence of the environment through consumer-producer interactions, leading to the adaptive processes of manufacturing the desired goods (creating the needs by media and third parties, re-engineering strategy).
6. The aspect of hidden usefulness, introducing the possibility of tuning the standard product on an individual basis by third parties, redefining its utility or functionality.

Aspect of the resource based strategic orientation

This aspect is related to achievement of necessary resources and is expressed as a metaphoric equation "R = G" (Resources equal to Global). But regardless of a very good cognitive explanation, this quasi-formal linguistic expression in not a correct logical sentence. It also shows a negative correlation to the resource based theory RBT (Barney 2011; Gospodarek 2012) although the RBT was the base of Prahalad & Krishnan's concept. The use of globally scattered resources remains opposite to their uniqueness understanding as VRIN class set of resources, because any system can copy or replace them by equivalent ones using the potential network. Therefore, the creation of the VRIN set of resources which are scattered around the network, allowing to hold innovative power and originality, seems to be impossible.

However, it may be discussed whether the uniqueness of the scattered resources can not be ensured by possessing knowledge of how to organize them and of some core competencies in this field (Prahalad & Hamel 1990). But this is rather a semantic problem of the cognitive metaphor, which must be removed in case of building an explaining theory. Therefore, in the phrase "R = G" the equal sign (which is a syntax error, and consequently a semantic error) has to be replaced by a sign "→" which represents "tends to", and the cognitive abbreviation "Global" by 'GSC' (Global Supply Chain). Thus, a logical sentence which should read as follows: *availability of resources of an innovative organization tends to the resources of a given global supply chain* was constructed. This formulation provides a hypothesis that has significant support from the area of the observation certificates of logistics and supply chain management (Neace, at all 2012). It is, however, too general to be of practical use for an organization of any size. Hence, it is a rational way of reasoning to limit the space-time scope from the global to the local supply chain LSC, in which the organization participates and is its creator (Neace & all. 2012). Of course, in the extreme case of large network organizations it will be a global chain (GSC). In this part of the model, the imperative of optimality is related to economic aspects of access to external services and resources. A clear criterion is the minimum logistics costs. Thus, narrowing the notion of "G (Global)" from the original concept of Prahalad and Krishnan to GSC or LSC seems to be a reasonable move without a loss of generality. As a result of the suggested modifications it follows a sentence of a paradigmatic type that can be written formally as:

$$\{\mathbf{R}\} \subset \{\text{GSC}\} \qquad [2]$$

The set of resources R necessary to realize business processes of an innovative organization is included in the set of resources of the global supply chain the organization is associated with. This way the sentence gets a logical value, close to the true judgment, because it is a formal generalization of a theorem character. It can therefore be attached to a set of basic statements of management science. In addition, it is subjected to falsification in the Popperian sense (*tollendo tollens*). In fact it is enough to find such a collection of resources of an organization that does not belong to the associated global supply chain. However, it seems that such a case is not going to be found in business practice because it is a deductive conclusion, using the fact that the relevant organization always belongs to any global supply chain, and thus the set of its resources is contained in a set of resources of that chain. What remains to be done is to combine the two sentences, presented by the formulas [1] and [2] to get the correct compound sentence, for which a logical value may be specified and which has become a falsifiable hypothesis. Thus, as a final result the following expression is valid:

$$N = \min_{n}\{opt[EBITDA(n)]\} \wedge \{\mathbf{R}\} \subset \{\text{GSC}\} \qquad [3]$$

Highly innovative organizations tend to customize each product in order to include in a custom-fit variant the smallest possible number of recipients N, giving the satisfactory value of EBITDA, while their set of resources ***R,*** *necessary to perform the processes of creating value, is included in the set of resources {GSC} of the global supply chain it is associated with .*

In the above characteristics, given by the expression [3] it seems to rational to limit the range of {GSC} set from global to local mode {LSC}, which is more reliable for small enterprises. This limitation includes the imperative of optimality in the logistic part of value creation. What's more, each organization do optimize their activities and set the exact structure of the resources of the related {LSC} and therefore the structure of the associated local supply chain beings with its creator. The optimum set of resources may be recognized as VRIN class (Wernerfelt 1984; Barney 1991) with key competences that enable answering the fundamental issues: "know how", "know what" and "know where". This is a very convincing example of explanation of the resource based theory (Gospodarek 2012). The expression [3] can be finally rewritten to the form:,

$$N = \min_{n}\{opt[EBITDA(n)]\} \wedge \{\mathbf{R}\} \subseteq \{\text{LSC}\} \subset \{\text{GSC}\} \qquad [4]$$

Highly innovative organizations tend to customize each product in order to include in a custom-fit variant the smallest possible number of recipients N, giving the satisfactory value of EBITDA, while their set of resources ***R*** *necessary to perform the processes of creating value is included in the set of resources {LSC} of the local supply chain or is equivalent to this set.*

This way, the concept of Prahalad and Krishnan has been modified to pass a determinable value in the language of formal logic. This is a very important milestone. For the resource based theory it is a supporting statement with characteristic of a good paradigm. It becomes possible to determine the measure of a product innovativeness in the form of a synthetic indicator. A particularly important aspect is the relation {LSC} $\subset$ {GSC}, which allows to take into account the size of an organization creating value in the study of its flexibility. While Apple as a global giant will use the global supply chain resources, a highly specialized manufacturer of process control computers does not need globalization and remains at local supply chain level, which is always included in any global supply chain which may be used on request at any time.

Some attention should be paid to the objective N from the equation [4]. It is the indicator of the flexibility of any organization (including innovation). The smaller the average rate of N for the range of products offered, the more market-oriented is the organization to which the rate applies. The lower rate of N for any product, the higher level of customization is achieved. However, the rate of N doesn't allow to inferred anything about the product innovativeness. An example would be Apple, which is certainly one of the most innovative, but its great innovative products such as Ipod, Ipad and Ifone were not subjected to significant customization of hardware level, and were examples of very successful mass customization. In principle, the same applies to all intelligent devices for self-customization. But all AI class devices require individualized service, which means that there will be some organizations for which $N \to 1$, for example, dedicated software developers. Can something be concluded about their innovation on this basis? In general, yes and no. Therefore, the question of innovation taxonomy using an index N has not been resolved, as suggested by Prahalad and Krishnan, since both for the $N \to \infty$, and for N = 1 high level of innovation has been observed, and the examples given above are serious falsifiers.

Does index N allow to comment about the resource strategic orientation of an organization? This seems to be a very interesting possibility of evaluation. Organizations whose products will show a high value of N can be treated as resource oriented, and only mass-customization is then available. This means that they are not focused on capturing opportunities in the surroundings but on the strategic orientation in creating customer demand based on available resources within the GSC of VRIN nature and the possessed core competences. Their products can be highly innovative, but because of the problem of scale, they can not be precisely tailored to any client requests without breaking the assumed level of EBITDA.

When $N \to 1$ one should expect a pure market orientation, associated with high levels of customization of products (custom-fit type) and capturing local opportunities emerging in the environment. An example of this can be fashion designers, offering individual creations of haute couture, according to market trends. Their production is mainly based on knowledge but one cannot

recognize that their resources are VRIN class, as any other rival fashion house has similar substitutable resources and expertise. Hence a logical conclusion might be the supremacy of market orientation and a product offer of a custom-fit class, along with maintaining a high ability to create specific consumer attitudes and creation of competitive imitation processes by manufacturers of mass consuming industry who can be able to offer only mass-fit and therefore less innovative products.

In the case of Samsung, Nokia and Apple, available resources and key competencies do not allow too high a level of individual customization of their products, as manufacturing capacities exceeded a certain scale and the criterion of minimum EBITDA for the product prevents the entry of the small number of items in this group of products. Holdings are able to generate value only in large scale in order to maintain a reasonable EBITDA for a price acceptable for the market, which indicates a strategy directed on resources and the flexibility to change their production capacity. The offered products, however, are of a smart type, which makes them possible for further customization by the user and the attached software, changing the original ontological concept of the product to an intelligent system with a high capacity configuration and self-adaptation to a custom-fit mode. It is worth noting that in this group of manufacturers significant business activities grounding high usefulness of VRIN resources have taken place. An example is Google's takeover of Motorola in order to obtain patents and strike back legal attacks of Apple and other competitors, trying to limit the usefulness of the resources owned by Google and the expansion of product.

Conclusions

Formulation [4] is a formally modified version of metaphoric formula of Prahalad and Krishnan „N=1 i R=G" with a limit describing the resource set necessary for the value creation (whose creator is the analyzed organization) as the resources belonging to a local supply chain. The LSC may expand to GSC if the scale of the resources engagement will exceed a given average level of N.

The formed set of resources fulfills requirements of the imperative of optimality migrating to its VRIN form. This enables to extend innovative properties of the products under condition of key competences use. It is an example of the RBT theory usefulness for analysis of market directed strategic orientation of systems generating value.

The expression [4] may be considered as a measure of product elasticity, based on average N value for a given set of products of the subjective organization. The lower value of average N, the greater is the level of customization and the product uniqueness by the value of EBITDA per unit assumed *a priori*. This indicator is adequate for general comparisons, because it is dimensionless whereas the economic score may be expressed in PPS or Int$ units. The mentioned property makes N almost independent on a place of calculations.

The presented concept combines together the RBT approach, as well as market contingency by taking into account client's demand in developing customized products. It may be an example of a paradigmatic formulation, to which both of these theories belong (resource based and contingency theory). It is possible to link the N coefficient from the equation [4] with the level of market contingency, where low values of N establish a high level of market contingency for the organization and the need for a custom-fit structure of the created value, while high N determine the reverse dependence and allows to apply the mass customization and the resource based strategic orientation.

Product innovation is a feature of auto-adaptive adjustments to the utility, which at the time of its allocation on the market cannot be fully determined. Thus, **N** in formula (4) may be not only a function of EBITDA, but also some parameter considered as *ceteris paribus*. It should be noted that the economic impact on the customization strategy of the firm has the highest degree of significance and therefore should be regarded as zero-level approximation of the optimality.

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