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Modelling of the evolutionary methods to satisfy the consumer's needs in new product development

The article deals with regularities of evolutionary needs and means to satisfy them. As a result evolutionary models of methods and means to satisfy the consumer's needs in a form of corresponding development lines are represented by sets of successive discrete states regularly passed by these methods and means in the process of evolution were developed.

Keywords: evolutionary model, line of development, consumer's need, new product development, satisfaction of need.

General problem statement. Ability to develop and to launch new products is one of the key terms of firm surviving and business success nowadays. Permanent updating of value proposals is necessary even to maintain the competitive position; in order to gain competitive advantage the firm has to produce new products, which are able to satisfy ever growing and every consumer's various demands and needs. Studies empirically show a strong correlation between the success of new product development (NPD) and the extent of correspondence between the product features and consumer's needs [1]. However need identification methods, which are able to provide this correspondence in all efficient stages of product lifecycle, are still absent.

Analysis of the recent researches and publications. New product correspondence with customer's needs is one of the critical terms in their market success. Existing methods to estimate this correspondence are based on customer's needs marketing researches data, demands and degree to satisfy them, described by well-known marketers such as R. Cooper [1], A. Griffin [2], J. Hauser [3], J. Majawa [4] and many others. The methods include VOC (Voice of Customer) interviews, in-depth interviews, market surveys, user studies, customer meetings, customer visits to company or mail / phone responses, market surveys, websites and SME studies, consumer idealization, participatory design, empathic design, focus groups, beta tests, lead-user community etc and are reviewed briefly by H. Awa [5]. All these methods make it possible to estimate only "obvious" needs and demands in the moment or during the period of interaction with the consumer while latent and future needs remain beyond the investigation. Consumers are not static in their needs and behaviour,

their demands to level and means to satisfy needs are changed under the influence of volatile environment and as a result of consumer's self-development. J. Lloyd [6] stresses that rapidly changing business environment is characterized as VUCA (volatile, uncertain, complex and ambiguous) will provide the opportunity of business success only if customer-centring becomes a strategic imperative. According to B. Johansen [7] challenges of VUCA world needs to understand not just what and why customers buy now but "what needs / dreams / fears & motivations they have for the future". However, data which is collected and proceeded by traditional marketing research technologies don't provide in-depth and reliable understanding even of consumer's needs structure present state owing to difficulties to synchronize and integrate varied consumer's inputs [4] and fuzziness of consumer's segments; a problem to indentify future needs for successful new product development is still left in abeyance.

Unsolved parts of general problem. The necessities for consumers to evolve in direction that is determined by the law of necessities growth as well as by dynamics to change significance different level needs in the need hierarchy. Regularities and laws of needs development and methods to satisfy them are generalized by V. Petrov [8]. D. Mann [9; 10] proposed discretization of system development patterns transforming them to the development lines (trends) as sets of successive discrete states regularly passed by the system in the process of evolution. This is a well-known method to determine either current or future evolutionary state of any system. Compliance of innovative product with the current or future stages in development selected lines is served as a criterion of its potential success [10; 11]. Thus the lines of consumers' needs development, methods and means to satisfy them could become an efficient instrument to determine their evolutionary state and predicting the consumer value of new product.

The aim of an article. This work aim is to develop evolutionary models of methods and means to satisfy the consumer's needs in a form of corresponding development lines. Such models are supposed to match demands of the NPD process providing an objective appraisal and predicting the consumer's value of innovation taking into account the change of consumer's needs and attitude toward the methods to satisfy them under global market changes and consumer's trends that these changes reflect.

Main results of research. Satisfaction of any need is evolved in direction of "idealization" [8] which means to satisfy in a moment and place of the need emergence free of charge. The idealization trend is realized through: 1) dynamization, integration and specialization of needs; 2) increase of every need and number of simultaneously satisfied needs satisfaction level; 3) reduction of consumer's expenditure on need satisfaction with decreasing of concomitant to this satisfaction harmful effects. It is obvious that development lines of methods and need satisfaction means must match the needs development lines and fit the practice of successful NPD. Considering that we distinguish such several lines among which the following ones seem to be the most obvious and robust: a specialization (segmentation) line of methods and need satisfaction means according to consumers' segments features; a dynamization line of needs satisfaction; a coordination line of satisfaction need with place/time/conditions of need emergence; a reduction line of intermediate stages number while need satisfaction (approaching to the satisfaction of ultimate need); a combination (integration) line of need satisfaction (in space, in time etc.); a individualization line of need satisfaction; a consumer's contribution increase line in individualized consumer's value creation and a simplification line of need satisfaction. Main stages are identified for every line; number of stages was unified to 10 in order to simplify the further quantitative appraisal of

new product indicators with consumer's value [11]. Indicator of the consumer's need satisfaction evolutionary state may be considered a vector: $I = \{I_i\}$, where I_i are partial indicators of the evolutionary state according to certain lines of development. Quantitative value of the partial indicators coincides with the number of the stage on the corresponding line of need satisfaction development or methods and means of this satisfaction obtainment development line.

The specialization (segmentation) line of need satisfaction methods matches the trends on diversification and specialization of needs [8]. It is in fact the segmentation line of need satisfaction methods according to the requirements concerning smaller segments in these segments features space of all bigger dimensionality (Table 1).

Table 1 – Specialization (segmentation) line of methods and needs satisfaction means, (developed by author on basis of [8-10] and numerous empirical data)

Stage	Specialization of needs satisfaction methods	Example
1	Segmentation after the needs of certain group of consumers	Pet food. Software for economists
2-3	Segmentation after the needs of the consumers' distinguished group obvious segments	Cat food, dog food etc. Software for accountants, marketers, managers
	Segmentation after the segment needs satisfaction means features which have superior influence on making a decision about purchase	Content of vitamins or additives in food. Food consistency (dry pet food), food main ingredient (meat, fish, poultry). Accounting on PC for dummies
4	Segmentation after the needs of all smaller segments differing in combination of features significant impact on purchase decision-making or need satisfaction degree	Food for kittens – food for especially active kittens – food for kittens aged from 2 to 4 months etc. Professional software for blind
5	Segmentation after the expected special result of consumption significant to certain narrow segment	Dietary cat food under different diseases
6	Segmentation after the expected result of consumption by certain segment under certain circumstances	Food for animals in trips. Software WapAlta mail agent for mobile phones
7	Segmentation after the additional features beyond the main function, after the unexpected or system result of consumption	Vitamins for cats-Aries. Honda Vamos Travel Dog car for dog owners
8	Segmentation after the new niches of market beyond previously existing and / or satisfied necessities	Software for e-books. Software for pop-up advertising blocking
9-10	Segmentation after the individual changing needs (individualization, customization, personification of need satisfaction means)	Adjustable / personified software. Customized T-shirts and accessories

Need dynamization [8] trend reflects the dependence of needs on a place, time, terms of their emergence and significance for a consumer group. To satisfy more and more demanding consumers' means to satisfy needs are to evolve in direction of meeting immediate consumers' expectations in any place and under any terms (Table 2).

A trend of need integration passes the stages similar to all lines of mono-bi-poly kind [9; 10]. It is reflected by the integration line of needs in their satisfaction process followed by the line of methods and means development providing their joint satisfaction (Table 3). E.g., coffee "Mincer" is positioned simultaneously as coffee and means for becoming thin.

Table 2 – Dynamization line of needs satisfaction in space / time,
(developed by author on basis of [8-10] and numerous empirical data)

Stage	Dynamization of needs satisfaction means	Example
1	Need can be satisfied only in one fixed place/during one definite space of time	Withdrawing cash from a bank account exclusively in one banking institution on work hours
2-4	Need can be satisfied in several fixed place/during several intervals of time	Network of ATMS, exchange offices
5-6	Need can be satisfied in several fixed place/during several intervals of time on consumer's demand	Payment by credit card. "Offline" ordering of software update/upgrade
7-8	Place/time of need satisfaction can be shifted on client's demand or on salesman's order as well as according to the need change predicted dynamics	Goods delivery to customer. Mortgage credits with one year's outage in credit repayment on borrower's request. "Online" software upgrading
9-10	A place/time of need satisfaction coincides with the place/time of its appearance; process of need satisfying is commonly supported by electronic communication means	Mobile banking. Surgical operations in the mode of videoconferences. Automatic online software upgrading

The trend is realized also through joint granting the packages of similar or absolutely different services, i.e. integration of value proposals in the sale (hypermarkets), shared access to the means of different needs satisfaction etc.

Table 3 – Combination (integration) line of needs satisfaction,
(developed by author on basis of [8-10] and numerous empirical data)

Stage	Integration of needs satisfaction and evolution of their joint satisfaction means: stage content and examples	
1	Satisfying one need by one means (single-order device)	
2-4	Simultaneous satisfaction of two consistent needs or incremental satisfaction of one need by a bisystem of means (package of two commodities or services for satisfying one / few ultimate needs)	Satisfaction of similar needs by homo/heterogeneous means (two deposit accounts, credit against deposit) bisystem
		Satisfaction of similar needs by a means bisystem with shifted or inverse characteristics (savings and deposit accounts)
		Satisfaction of shifted needs by a homo/heterogeneous means bisystems, joint application of which provides to satisfy several needs (different bank cards for one account, combined running and savings accounts in All Inclusive Ultra proposition of UkrSibbank etc.)
5	Joint satisfaction of needs polysystem by the means polysystem (several needs are satisfied by one kit of means (by the package of goods or services) that work simultaneously or consistently)	
6-8	Satisfaction of two homo / heterogeneous needs by one means (bisystem of needs is satisfied by one or almost one means), e.g. camera can be used not only for shooting, but for viewing with zoom as well	Satisfaction of two similar or consistent needs (filming and mailing of film by smartphone)
		Satisfaction of two needs with shifted characteristics (video filming on photo camera)
		Satisfaction of two concurrent needs (smartphone as PC and as player)
		Satisfaction of two opposite (alternative) needs (bonus for talk and for silence from mobile operators)
9	Combination of satisfaction of several needs (satisfying the polysystem of homogeneous, heterogeneous, competitive or opposite needs by one means), e.g. smartphone as PC, camera, video camera, mail agent, navigator, tool for booking tickets for transport as well as a ticket itself (image on the screen)	
10	Absorption of one need by another or generation of new need due to combination of several needs satisfaction, satisfaction of new needs by existing means new application, e.g. Delta Innovation Class	

Now a lot of innovations exploit resources to transfer to the final stages of the means evolution line to joint satisfaction of needs. E.g., 3 from 10 top innovations of 2014 [12] can be positioned on stages from 8 to 10. A Mobile app “PareUp” (launched in May 2014) is designed to reduce the annual USD 165 billion food waste simultaneously with providing consumers with cheaper food. The service enables restaurants, coffee shops and grocery stores to offer consumers the food which they’re going to throw away (and need to pay for utilization) at a discounted price. Participating merchants can send an alert to users who can then pick up the food that would otherwise have been wasted. This app creates win-win situation by satisfying heterogeneous needs of different segments [12]. Integration of needs during satisfaction process may concern the integration of several persons’ similar needs in order to maximize an average level of satisfaction under less expenditure. New products and services aim to increase overall happiness by taking into account collective preferences. A General Electric’s crowdsourced thermostat “CrowdComfort” [12], launched in 2013, adjusts a building’s temperature according to aggregated information from occupants. Via a companion app users rate their comfort level using a five-point scale and “CrowdComfort” analyzes the data to suggest the optimum temperature for each floor. An extraordinary means for simultaneous self-improvement, acquiring and sharing unique experience, visiting interesting places and events is proposed by air carrier Delta which in March 2014 has launched its “InnovationClass” [12] – an ongoing mentoring program that enables budding entrepreneurs to connect with established industry professionals. The airline invited a number of leaders in the fields of art, business and technology to travel to selected events around the globe and offer people the opportunity to sit next to them. Mentees could apply for the free seat using their LinkedIn profile. Every human has a need to feel “good”. Satisfying this need requires to live according to the most deeply-held human values and aspirations. However, satisfying immediate needs in tasty food or pleasure consumers often run counter to these values and aspirations. Every day consumers are served with more information on dysfunctional business processes and ethics or receive scientific insights on the health drawbacks of many favourite snack or beverage. So satisfaction of the need makes a consumer to feel guilty for the harm that this satisfaction makes. In response value proposals absolving the guilt (providing so called Guilt Free Consumption, GFC) appear to be more and more frequent and more and more efficient [12]. E.g., the Peddler’s Creamery ice-cream shop in Los Angeles (opened in April 2013) powers its churner by asking customers to peddle an in-store bicycle. Bottles containing perfumes “Treson Spring Water” are made of 100% toxin-free plant-based materials. Each bottle comes with a reply mailing label so that it can be placed into any USPS mail box once it has been emptied. Once received, all bottles are sustainably recycled. And for every bottle of “Treson water sold” the brand plants one tree, with a mobile app allowing consumers to track where their tree has been planted. In May 2014 McDonald's and Coca-Cola have launched an app “BFFF Timeout” that rewards users for not using their phones. Once individuals in a group have all opened the app, the timeout begins and points are earned for every moment the phones are left alone. Users' scores are ranked on a public leaderboard, and prizes include trips to Japan and Singapore.

Dynamization of need satisfaction is accompanied by the coordination of method, place and time to be satisfied with conditions, time and place of need emergence. It is reflected in corresponding lines of coordination degree increase; similarity of the lines makes it possible to present them in one table (Table 4). Thereafter it is reasonably to propose, in addition to lines of time, spatial and structural dynamization (Table 4), such lines of methods development and satisfaction needs means as need satisfaction individualization lines (Table 5), line of step-by-step reduction concerning direct human participation in “non-creative” stages of need satisfaction up to full exclusion; reduction line of need satisfaction intermediary stages;

increase of consumer's participation in creative processes of the individualized value creation (Table 6).

Table 4 – Coordination line of need satisfaction with place/time/conditions of need emergence, (developed by author on basis of [8-10] and numerous empirical data)

Stage	Coordination of need satisfaction		Example
1	Non-coordination	Need can be satisfied only in fixed places / time/ conditions unrelated to place / time / conditions of need emergence or realization	Stationary location and fixed time of bank work or ticket office. Stationary professional defibrillators in hospitals
2-4	Partial coordination	Need can be satisfied in a set of fixed places/ time intervals/conditions characterized by enhanced probability of the need emergence in case of the largest or most profitable consumer segments	Producing of signets in the places of enterprises registration. Automated external defibrillators in business centres. Insurance policy execution in travel agencies. Currency exchange points in elite shops, airports, railway stations
5-6	Enhanced partial coordination	Need can be satisfied in a set of fixed places/ time intervals/ conditions characterized by enhanced probability of consumer staying	Portable public access defibrillators in trade centres, supermarkets, exhibition halls, stadia, metro stations etc. ATMs in supermarkets
		Satisfaction of a need is matched to places/time intervals / conditions of the main consumer segment concentration	Non-professional defibrillators in patrol cars. Drugstores in hospitals
		Satisfaction of a need is matched to places/time intervals/conditions of narrower and narrower consumer segments concentration	TV-shopping of household goods during advertising pauses in love story series. Goods/services delivery on call (on demand)
7-8	Full coordination	Satisfaction of a need in any place/time/ conditions of need emergence on consumer demand due to the standing source of satisfaction and / or communication electronic means	Mobile communication. Mobile banking, mobile enquiry services, Google map navigation etc. Automatic wearable cardioverter. Twenty-four hour pizza delivery. Order of unknown sounding melody by phone
		Matching the possibility and methods of need satisfaction with consumer's individual requirements	Individualization and customization of goods and services on different levels (from the choice of delivery method, design, set of functions up to PC configuration)
9-10	Self-coordination	Satisfaction of a need in any place / time / conditions of need emergence without additional initiation by consumer	Implanted cardioverter. Jackets with built-in liquid crystalline thermometers
	Dynamic coordination	Means and method of satisfaction change according to need change (adjust to the need characteristics) or technological potential of realization of functions for need satisfaction	Personified software. Multifunctional adaptive goods. Automatic upgrading of software. Mobile apps for booking, insurance etc.

*Table 5 – Individualization line of need satisfaction,
(developed by author on basis of numerous empirical data)*

Stage	Individualization of needs satisfaction	
1	Minimum sufficient satisfying of common needs	
2	More sufficient satisfying of needs common to most consumers	
3	Satisfying of different consumer segments needs on a level determined by every segment	
4-5	Supreme satisfying of narrow segment needs	due to improvement of methods and means of satisfaction
		due to improvement of satisfaction terms
6	Development of existing needs and creation of new needs for a narrow consumer's segment with further needs satisfaction	
7-9	Satisfying of individual needs	On consumer demand
		According to consumer need forecast based on his individual features investigation
		With participation of the customer in the process of value creation
		With participation of the customer in development and further improvement of value
10	Automatic satisfying of volatile individual needs (adaptive goods)	

Table 6 – Consumer's contribution increase line in individualized consumer value creation, (developed by author on basis of numerous empirical data)

Stage	Consumer's contribution in individualized consumer value creation		
1-4	Adjustment	Required products somewhere at times	Producer takes into account consumer's need, known to him while creating the value proposal
		Required products (goods or services) in a proper place / at the proper time	
		Required products (goods or services) in a necessary place and at the proper time	
		Specialized products based on consumer's problems investigation	
		Individualized and personified products	
5-7	Partnership	Joint design, assembling, adjusting, configuration including on-line configuration	Consumer participates in creation of value
		Synchronization / optimization of variants	
		Integration of variants or businesses, collective choice, crowdsourcing	
8-10	Coaching	Achieving maximum efficiency of need satisfaction due to gained competences	Producer teaches and develops consumer's competences to gain additional benefits from product and to understand their needs much better as well as consumer coaches the producer on all stages of product life cycle
		Rearrangement of need satisfaction process due to producer's and consumer's joint efforts	
		Consumers' involvement in the process of prototyping and new product ideas generation up to outsourcing this process to consumers (crowdsourcing)	
		Revealing of application new ways on known products up to creation of markets of new needs. Creation of new needs by new products	

The above mentioned lines mainly are exhibited simultaneously. They result in strengthening of new product value by consumer. E.g., in March 2014 the "Esurance Insurance Services Company" proposed a new app function to its customers that speeds up the post-accident process. Customers can open a video chat with an Esurance appraiser, and have the damage assessed via their cellphone camera in real-time, avoiding the need for an in-

person vehicle inspection (time and spatial dynamization, exclusion of human participation, reduction of intermediary stages of need satisfaction). The app exists in versions for I-Phone and Android (line of specialization), can be downloaded directly from the site and is supported by help, teaching, access to claim processing and possibility of feedback (line of integration).

It is worth to mention that a trend on joint satisfaction of needs and orientation on the higher order needs concerns not only the methods and means of need satisfaction (goods or services) but also means to promote them to the market. Thus advertisement of engine oil "Lotus" pools various advertisement resources: advertising through the acquaintance of consumer with the mechanism to get the useful effect, its impact on the engine (protection) and on the driver (comfort of mind). Similarly as far as promotion resources of the certain brand are getting exhausted the "Branded Brands" trend [12] arises. The trend consists in joint work of several well-known brands that produce complementary services or goods in the range of one space and product proposition or consumption time. E.g., American Airlines serve its passengers on board with coffee only from Starbucks Coffee and cakes only from Mrs. Fields Cookies.

Development of needs satisfaction means in direction of their dynamization, specialization and coordination is reflected in the line of consumer's control increase upon the means creation process: one-way control by producer according to preliminary accepted options (suggestion of one problem solution by producer) → adjustment of means in response to consumers reaction → granting consumer a possibility to choose one from a set of proposals → adjustment of product according to consumer demands on earlier and earlier stages of means creation → granting consumer a possibility to generate the concepts of new means (products). Coordination lines of needs and increase of customer's control is developed in the sphere of production into customization and personalization lines.

Conclusions and recommendations for further research. Evolutional state of consumer's needs satisfaction may be appraised and predicted according to the position of the need and means to satisfy it on the distinguished development lines. The evolutionary models presented by development lines of needs and means to satisfy them are based on general laws and regularities of needs development. Therefore these models combined with empirical data concerning top achievements in the need satisfaction provide an objective generalized appraisal of current and future evolutional state of any need and means to satisfy it, tolerant to permanent small shifts of individual needs in volatile environment. Indicator of the consumer's need satisfaction evolutional state is a vector. Its constituents are partial indicators. Their quantitative value coincides with the number of the stage on the corresponding development line of need satisfaction or methods of this satisfaction achievement. In case of evolutionary correct new product the value of these indicators can not diminish as it conflicts with regularities of needs development. It means that these methods after approbation and sophistication can be successfully used to estimate reasonability of innovation at any stage of NPD process.

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Моделювання еволюції методів задоволення потреб споживачів у процесі розроблення нових продуктів

У статті досліджені закономірності еволюції потреб і засобів їх задоволення. За результатами дослідження розроблені еволюційні моделі способів і засобів задоволення потреб споживачів у вигляді відповідних ліній розвитку, які є набором послідовних станів, які ці методи та засоби закономірно успішно проходять у процесі свого розвитку.

Ключові слова: еволюційна модель, лінія розвитку, потреби споживачів, розроблення нового продукту, задоволення потреби.

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Моделирование эволюции методов удовлетворения потребностей потребителей в процессе разработки новых продуктов

В статье исследованы закономерности эволюции потребностей и средств их удовлетворения. По результатам исследования разработаны эволюционные модели способов и средств удовлетворения потребностей потребителя в виде соответствующих линий развития представляющих собой наборы последовательных состояний, закономерно успешно проходимых состояний этими методами и средствами в процессе своего развития.

Ключевые слова: эволюционная модель, линия развития, потребность потребителя, разработка нового продукта, удовлетворение потребности.

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