

# Diversity in the Early Phases of Product Development

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## Abstract

*Internationalization of R&D activities and the strategy of reverse innovation are new challenges of product development which will be discussed in this paper. These challenges in companies' environment require organizational skills to reduce uncertainties as well as to enable flexibility and adaptability. The consideration and use of diversity in the early phases of product development can be a way to meet these challenges. Therefore potential benefits of diversity and the relationship between diversity and innovation are shown in this paper. The potential opportunities of diversity but also its challenges like conflicts as well as communication and cooperation barriers point to the need for a management model which systematically considers and handles diversity in the early phases of product development.*

**Key words:** *Diversity, Early Phases, Internationalization, Product Development, Reverse Innovation,*

## 1. INTRODUCTION

Today, companies operate in a highly competitive, complex and dynamic environment. Change is not a future scenario, but an everyday reality, which calls for a higher flexibility and adaptability of companies [1], [2], [3]. The ability to develop new product innovations in line with market requirements will be an indispensable prerequisite for the creation of competitive advantages and the successful survival of companies [4], [5], [6]. Considering diversity of people involved in product development is an opportunity to deal with the increased demands, but also leads to new challenges for companies, because diversity is also considered as an element of complexity [7].

In recent years, the concept of diversity has increasingly become an important topic for product development. Responsible for this trend are socio-demographic changes, the search for differentiation in saturated markets, current and future shifts in purchasing power, the internationalization of markets and product development, the trend towards individualization and potential advantages which are linked with a diverse human resource.

Due to the internationalization of R&D activities and the huge market potential in emerging markets this paper not only focuses on the general topic diversity but considers the cultural dimension of diversity. Furthermore the early phases of product development will be considered as these links the strategic goals of companies with the actual product development

activities. The aim of this paper is to give a better understanding of potential benefits related to diversity in the early phases of product development.

## 2. CHANGING CONDITIONS FOR NPD

The rise of emerging countries (e.g. China, India) will lead to a substantial growth of the global economy [8]. Already today, increasing shares of sales by companies from industrialized countries come from these new markets and it is believed that this trend will continue [9]. While companies in the traditional industrial markets see themselves exposed to a tremendous competition for market shares in saturated markets, the battle for future growth will be won in the emerging markets.

Therefore, if the leading companies want to succeed, they need to adapt their products and business to the needs of their new customers [9]. As local competitors have a better understanding of the prevailing conditions and needs, these are expected to benefit disproportionately from economic growth and thus become serious competitors. Companies which succeed to offer appropriate products and services for these new customers will have access to a huge market [9].

Market competition is forcing companies to bring tailored products and services to the market. Differences between traditional and new markets, for instance, with respect to local customer needs and the physical and socio-cultural environment, contribute to a high market-related uncertainty. Companies from the industrialized nations are faced with new challenges in

product development. If this market uncertainty cannot be reduced, products will miss market orientation and the huge market potential will remain untapped.

In addition, current local needs and emergent trends would not be recognized and absorbed, leaving a large innovation potential for new, radical product innovation untapped. Especially German companies are seen to have deficits when it comes to realize market- or application induced innovation, particularly if pulses come from customers and lead markets abroad [10].

### 3. A NEW PARADIGM FOR PRODUCT DEVELOPMENT – REVERSE INNOVATION

Products are not designed and created for its own sake but to serve customer needs and to help to solve problems for customers. The benefits of a product for customers are therefore the focus of deliberations. This results in a dilemma, because the benefits of a product are due to diverse customer needs and requirements different [11]. This is of particular importance in the light of internationalization, because there are different local needs and conditions.

This paper mainly discusses exploring new, promising markets in emerging countries and tapping the innovation potentials of these markets. As already mentioned in countries like India or China locally prevailing requirements as well as physical and socio-cultural conditions differ partly dramatically from the initial assumption under which the products were developed in industrialized countries. To identify specific local requirements and conditions as well as emerging trends and to better integrate these into the product development more and more companies are shifting product development activities into emerging economies [10].

In this context, the topic reverse innovation [12], [13], [14] is gaining importance and is considered by companies as a serious strategic component. The strategy of reverse innovation is shown and compared with the traditional way for innovation in Fig. 1. In the traditional approach products were developed in industrialized countries and adapted to meet the needs and conditions in foreign markets. This includes the renunciation of product functions to reduce costs, and other country-specific, mostly minor, changes to the product. Due to the differences in conditions as well as the significantly lower purchasing power of potential new customers in emerging markets, such adaptations are not sufficient to fully exploit the market potential.

The products must be reduced to a minimum and largely developed from scratch with regard to local requirements. For this reason, products are increasingly developed and tested on site. This not only reduces development costs by reducing personnel costs, but also helps to make use of the local innovative potential of human resources, that furthermore helps to consider physical and socio-cultural framework conditions in product development activities. This leads to an increase of cross-cultural collaboration between people involved in product development.

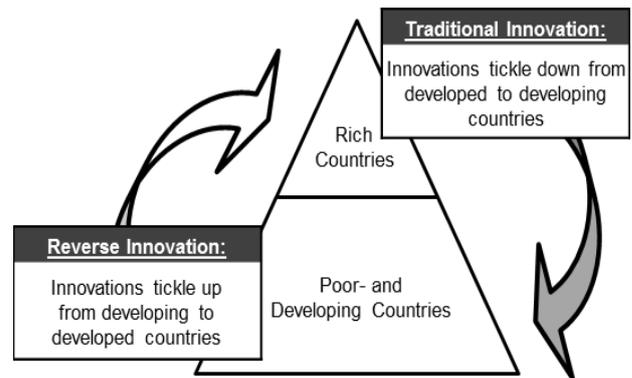


Figure 1. Strategy of reverse innovation [13]

The results of these local, cultural diverse product development activities are new and favourable products that meet the specific local requirements. Later these products can also be transferred to other developing countries or even to existing markets in developed countries as shown in Fig. 1. Due to their special characteristics, these new products can change competition in existing markets or even open up new market segments in industrialized countries [12], [15].

For this reason reverse innovation faces companies from industrialized countries with new challenges and demonstrates the need to consider emerging markets in product development. If companies from industrial nations do not operate in these emerging countries, local competitors will gain and strengthen market shares in these huge markets and will benefit from economic growth of these emerging economies.

In addition, companies from industrialized nations would miss the opportunity to develop skills and expertise needed to remain competitive even in the traditional markets in the future. Because products from emerging countries will in future also enter into western markets and therefore will open up serious competition with existing products. These new products will finally change the market on basis of their low price and special features [12], [15].

### 4. THE EARLY PHASES OF PRODUCT DEVELOPMENT – BASIS OF SUCCESS

Before an idea becomes a product on the market and thus a product innovation, this idea needs to pass many different stages of development and evaluation. Product development can be seen as a problem solving process, which has an innovative, new product as output at the end. Fig. 2 shows a product innovation process according to [16]. Product development is divided into five phases, with the first two phases to be named as the early phases of product development. These phases will be subject of the following considerations.

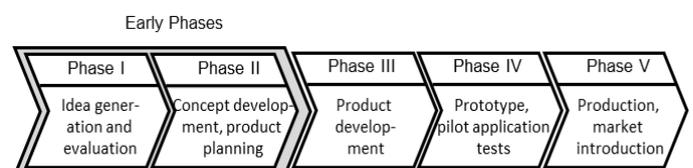


Figure 2. Model for product development including the early phases [16]

The early phases of product development include all activities, from the first impulse for a new product to the go-no-go decision on the implementation of the product concept and thus to accommodate the actual development of the product [17], [18]. The early phases represent the link between strategic planning and a specific development project. These phases are seen to have a decisive influence on the success of the subsequent product development phases as they are important for strategy implementation [19]. The early phases are thus an upstream part of the actual product development process. Here ideas are generated, selected and refined, product concepts are developed and evaluated and, based on that development projects will be defined.

In the early phases of product development fundamental decisions for the prospective product are made. For instance which ideas are taken up and deepened and which development projects are addressed in the company. A substantial part of the future benefit of the product as well as the development and production costs are therefore determined prior beginning of the actual product development [20]. Therefore these phases are important for implementing the strategy of local product innovation respectively reverse innovation in (cultural) diverse teams.

Fig. 3 shows the extensive influence of the early phases on costs, product benefits, development time and further success-related variables for product development. While in the early stages these properties are set, realization takes place later in product development process [21].

Thus, these phases are characterized by a relatively low resource requirements and comparatively low expenses. Simultaneously, the influence on the entire development process and on the future product is highest. Changes to the product at this time are still associated with fairly low cost [22], [23]. The early phases are seen to have a leverage effect on the subsequent product-development process and to the success of the future products [23].

In the following process exertion of influence decreases, while the expenditure of resources and modification costs as well as time required for changes increase. The possibility to change product features and costs decreases seriously. Therefore clarity of customer needs, requirements and the market prices need to be integrated at a very early stage of product development.

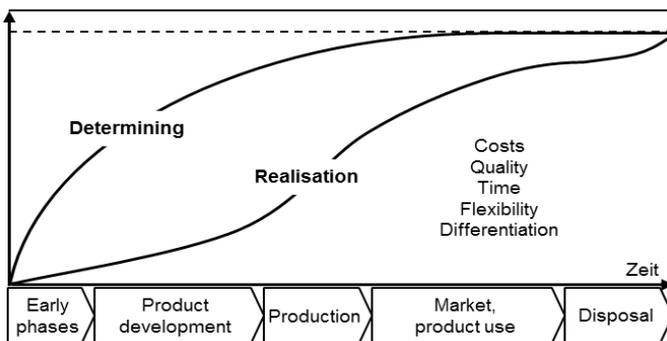


Figure 3. Influence of the fuzzy front end – set of product properties and realization [21], [24]

For the present work, this means that close cooperation in diverse teams (e.g. functional, cultural, etc.) already in the early stages is a prerequisite for successful product innovation. Local needs, requirements and conditions, and possible sales prices must be integrated as early as possible in order to enable a successful product development. The costs of the future product are of particular importance to markets in emerging countries.

Thus, the early stages are an important lever to the implementation of the strategy of reverse innovation in order to opening up new markets and to tap innovation potentials within emerging markets. Despite the mentioned importance of the early phases for product development success, literature often addresses the lack of considering these phases and providing these with sufficient resources in practice [25], [11], [23]. This deficit will be addressed by this paper emphasizing on the (culturally) diverse collaboration in the early stages of product development.

The next section will analyze potential benefits of a diverse workforce for the early phases of product development.

## 5. DIVERSITY AND THE EARLY PHASES OF PRODUCT DEVELOPMENT

In recent years, diversity and diversity management are becoming more and more an important topic in science and practice [26]. Especially in connection with innovation and product development diversity is discussed more often. (e.g. [27], [28], [29], [30], [31]) The term diversity can be understood as heterogeneity, inequality, or difference. In the corporate context diversity describes the range of diverse employees, customers, partners and suppliers.

In literature (e.g. [32], [33], [34], [35], [36]) different dimensions and levels of diversity have been developed in order to make diversity accessible. Today there are numerous dimensions of diversity; a common definition of the characteristics of diversity does not exist. Often, the primary or core dimensions of diversity are used. These include features which are deemed to exist and therefore to be relatively stable. These include the dimensions age, gender, nationality or ethnic-cultural background, sexual orientation and physical and mental ability (disability).

### 5.1 General Benefits of Diversity

So far only the phenomenon of diversity, thus the difference and commonality of demographic and organizational attributes of individuals were considered. The potential benefits and challenges of diversity for activities in the early stages of product development have not been addressed yet.

The expected benefits of diversity result from the assumed cognitive diversity, which can be derived from the demographic and organizational diversity. It is expected that individuals with different ages, nationalities, gender and functions have different skills, experiences, perspectives and approaches, and this results in a benefit for their joint action. In short, it is expected that an organizational demographic diversity

leads to a cognitive diversity, which in turn leads to higher performance of the group or the entire company [37]. Several studies discussed the benefits of a diverse workforce like a higher creativity, positive effects on problem solving and decision-making or a higher flexibility. (e.g. [38], [39], [40], [41], [42], [43], [44])

However, it is believed that diversity also has a negative influence on the interaction processes in groups and organizations and thus on performance. According to this, diversity can lead to a higher level of conflict, fewer communication and less social integration between involved people. This creates barriers to communication and cooperation, which influence group outcomes negatively [37], [45].

In literature there are two main social effects discussed that can contribute to these negative effects of diversity: Similarity attraction theory [46] and social categorization [47], [48], [49]. These negative social effects have in common that differences in relevant socio-demographic characteristics lead to the fact that certain persons and groups in organizations interact socially less with each other if they have a choice in their work. If there is no choice given, this may cause conflicts, a lower level of social integration and communication, inefficiency and a higher level of dissatisfaction.

Empirical studies give evidence that diversity can have both positive and negative effects [37], [45], [50]. There are positive effects of diversity on group performance as well as negative effects on group processes and outcomes identified. This means that at the same time beside desired effects of diversity unplanned negative secondary effects exist, neutralizing the positive effects of diversity. Despite the ambivalent discussions of the benefits of diversity, it is expected that in areas and for tasks where not efficiency, but the effectiveness, flexibility, instability, creativity and problem solving skills are important, diversity is a benefit. Thus in this paper which deals with diversity in the early stages of product development it is assumed that there is a positive effect of diversity.

## 5.2 Diversity and Innovation – Making use of Diversity in Product Development

Diversity is seen to be a catalyst for a variety of ideas in the context of development activities [51]. The arguments mentioned above are frequently taken up in the general discussions, but without going into further detail. However, there are other publications [28], [31], [52] that go beyond the simple listing of these arguments and consider a positive correlation between diversity and innovation more detailed. The main ideas of these publications are depicted in Fig. 6 and are discussed and extended in the following.

### Absorptive Capacity

In a turbulent and dynamic environment in which changes are the rule rather than the exception, knowledge can be understood as a dominant competitive factor [53]. In the past, the innovation activities of companies were understood as an internal process. Today external factors and interaction with the environment are seen to be much more important. The

concept of absorptive capacity [54] deals with the importance of external information to generate innovations. This emphasizes the need for the ability to recognize, assimilate and to apply external information.

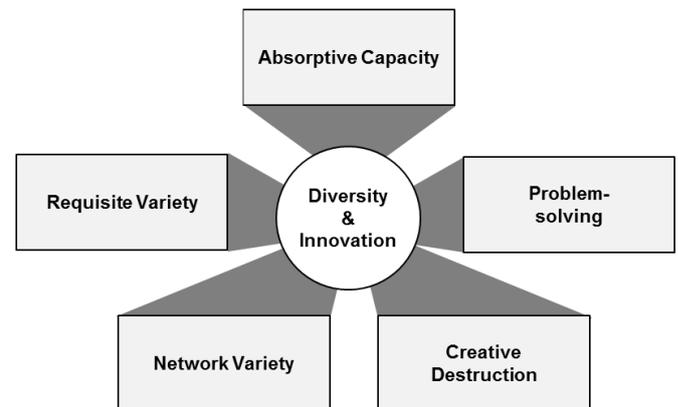


Figure 6. Expected relationship between diversity and innovation

Within corporate environment, a large number of information is available that appear to be relevant to activities in the early phases of product development. These must be perceived, which means that the relevance and implications of the information for product development must be recognized. This requires and bases on existing knowledge of persons involved in product development and decision making [19]. Thus, to assimilate and apply new knowledge, persons in product development need to have similar previous knowledge related to the information [54]. Therefore previous knowledge fosters the ability to absorb, store and to apply new knowledge.

A variety of different perspectives is seen to be conducive to innovation, because it raises the prospect that incoming information is linked with already existing knowledge within the company [28]. According to Cohen and Levinthal "in a setting in which there is uncertainty about the knowledge domains from which potentially useful information may emerge, a diverse background provides a more robust basis for learning because it increases the prospect that incoming information will relate to what is already known" [54]. A high absorption capacity leads to creative ideas as it fosters the skills of an individual to recognize connections between previously incoherent domains of knowledge [54].

Transferring this conclusion to the group level, it seems to be obvious that cognitive diverse work groups have a greater pool of resources available and therefore have a higher absorptive capacity [31]. Diversity within companies or work groups, thus allow a wide range of cognitive possibilities and directions which reduce the organizational path dependence [28]. Within a company there must be a sufficiently wide range of perspectives and skills as it is not foreseeable, from which area and in which manner the new relevant knowledge is arising.

The absorptive capacity not only benefits from the complementary skills and perspectives, but also enables and contributes to the organizational capability responding to environmental changes [28]. This

organizational ability can be described as "Requisite Variety", which is considered in the following.

### **Requisite Variety**

The conclusion of the "Law of Requisite Variety" [55] is that a system such as a development group, is better at dealing with discontinuities in the environment when there is enough variety, for instance in the form of diversity of knowledge, skills, approaches within the group [56]. Andriani also refers to Ashby's principle of requisite variety and considers that "internal variety of a system should match the variety of the external environment. The response capability of a system should be at least as varied as the set of stimuli that the system receives from the environment. In this way, the system can successfully respond to environmental threats and opportunities" [57]. Diversity thus provides better flexibility and adaptability. Therefore, it is also viewed as a necessity for the promotion of an innovative environment and as a prerequisite to avoid technological lock-ins [58].

Nonaka and Takeuchi use the Law of Requisite Variety within innovation theory to describe how diversity can affect the problem solving and decision-making in companies [56]. The availability of a diverse resource provides an effective combination and internal exchange of knowledge and is therefore conducive to innovation and the creation of new knowledge domains [28]. Working groups with a high requisite variety have access to an internal pool of knowledge and a variety of skills [31], [52].

Companies can be interpreted as a reservoir of knowledge [53]. Thus, companies accumulate knowledge over time, bound in individual and collective skills, competencies and routines. This knowledge is usually because of its intangible and tacit nature difficult to transfer. The collective knowledge, with respect to future business development and the early phases of product development has a dual function. First it is a source of future progress and second it is a kind of inertia for the enterprise [53]. While there is a diverse base of knowledge, skills and competencies, companies can better respond to environmental changes, as there is a larger number of different possibilities for action available. Thus diversity allows a wide range and variety of knowledge and alternative actions, which reduce the path dependency of businesses and make them more flexible.

### **Network Variety**

Companies more and more open their innovation activities across their own corporate boundaries. In this context, but also for internal activities, networks are becoming increasingly important. In literature diversity within business networks (network variety) is described as an important aspect to discover new opportunities. The importance of network variety to find new external opportunities and for the formation of new knowledge is considered important [28], [59],[60].

Numerous studies (e.g. [59], [60], [61]) describe a comprehensive tendency toward homophily in networks. Homophily describes the propensity of individuals who rather tend to deal with and to set up

their network with similar people [62]. This preferably leads to homophilic bonds in the networks. The presence of homophily in networks, for example, with respect to the diversity dimensions age, gender, nationality or organizational function was demonstrated in a large number of studies [62].

It is assumed that a greater organizational diversity leads to an equally wide range of network. Therefore members of a diverse organization are more likely to have access to a wider network and thereby a larger internal and external knowledge pool. The linking to a variety of areas leads to a reduction of redundant information [60]. This makes it more likely that new and useful information is known and will be considered in the early phases of product development.

Due to access to a large internal and external pool of knowledge, the innovation potential of the group or organization is enlarged. Therefore a high network variety, which is associated with a diverse composition, has a positive impact on generating innovations. Aken and Weggeman in this context emphasize the significance of informal innovation networks in the early stages of product development. "The most promising domain for informal innovation networks is the fuzzy front end of the innovation process, where a large variety of technical and marketing input is to be used to create options for future mainstream innovation" [63].

### **Creative Destruction**

The creative destruction terminology was coined by Joseph Schumpeter and means that the development of new markets and the organizational development require changes which constantly question and destroy the old structures and continuously create new structures [64]. Successful companies are pursuing strategies of creative destruction, which means that they continually renew their capability bases and thus creating imbalances in the competition arenas. These companies heed the rules of competition and are also willing to change them before other companies will do [53].

According to Auh and Menguc diversity promotes creative destruction, which is seen as a necessary step before creative construction can take place [65]. Creative destruction questions fixed assumptions and existing best practices. In this context, Levitt describes the process of creative destruction as "being willing to destroy the old is the heart of innovation and the means to enormous profits" [66].

According to Thomas and Ely, diversity can help companies "[to] grow and improve by challenging basic assumptions about an organization's functions, strategies, operations, practices, and procedures" [67]. To take advantage of creative destruction groups and companies need diversity and the ability of continuously questioning existing processes. This requires being familiar in dealing with instability and uncertainty. Kruse sees the problem of a continuing trend towards maintaining stability. Thus a constantly and deliberately generated instability in a system can prevent rude awakening. Instability is seen anything else but a crisis. It is rather the most important requirement for avoiding

crises. Deliberately creating instability helps to preserve innovation capabilities in business and to avoid critical developments [2]. The tolerance for instability is seen as a key feature and the most important prerequisite for innovation. Without a constant critical reflection of current practices, there would be no need to search for new ideas and for innovation [2].

Irving Janis introduced the term groupthink which means the complete assimilation of all individual opinions within a group to a single common group opinion [68]. In groups with a strongly pronounced tendency for group-think there is a high conformity with regard to assessment and evaluation of situations and derived actions. Members of a group have the desire to conform to the group consensus. They do not dare to express doubts and criticisms regarding approved resolutions. There is a great risk, because mistakes and wrong decisions will be overlooked or not addressed. Thus, innovative groups need to overcome the tendency of group thinking. Cognitively diverse groups consist of people with really different points of view. They should be less vulnerable with respect to the phenomenon of group thinking [31]. Through diversity there will active discussions that allow creative destruction, questioning the status quo and the testing of previously made assumptions [69].

### Problem Solving and Decision Making

Justens describes the ability to solve problems as a further potential of diversity in the context of innovation [28]. The ability to solve problems and to generate competitive advantages is understood as cross-linking of individual skills into a bundle of skills at the organizational level [70], [71]. It is assumed that a variety of perspectives improves problem-solving routines and processes [71], [72]. Accordingly, there is a need for diverse perspectives and approaches in problem solving and decision-making.

According to Justens [28] the literature suggests that the ability to integrate a greater number of diverse people in decision-making and problem solving will have a positive influence on organizational innovation [73], [74]. To restrict problem solving to a limited group of persons, for example, by strict bureaucratic procedures or a fix decision making process, leads to the fact that organizational decision makers are held from finding new sources of innovation [73], [75].

## 6. CONCLUSION

With the transfer of product development activities in emerging countries, as well as the strategy of reverse innovation important challenges in connection with product development were identified. These challenges in business environments require organizational skills to reduce uncertainties and to increase flexibility and adaptability of companies. It was shown that diversity in the early phases of product development can be one way to meet these challenges. Next to functional diversity, cultural diversity is coming more in the foreground because of increasing number of cross-cultural cooperation in product development.

The potential opportunities of diversity but also its challenges like conflicts as well as communication and cooperation barriers point to the need for considering and managing of diversity systematically in the early phases of product development.

In this context diversity management is not understood as an instrument for maintaining or monitoring diversity within a company. Rather it is to enable each person to bring in the full potential in his or her work. Diversity management goes far beyond anti-discrimination efforts to meet the appropriate laws or to establish tolerance for difference. It is understood as a concept to tap the potential of diversity and thereby reduce the negative effects of a diverse workforce.

In summary, it can be stated that diversity management has become a competitive factor for companies. Properly managed diversity can provide advantages and business benefits. Whereas a non-or poorly-managed diversity is associated with higher costs, conflicts, lack of motivation and fluctuations. Companies have to deal with the issue diversity, because "a diverse workforce is not something your company ought to have; it's something your company does have, or soon will have. Learning to manage that diversity will make you more competitive" [76]. Therefore there is a need for a management concept structuring available instruments for managing diversity in the early phases of product development to contribute to use diversity.

Additionally, further research should consider cultural diversity in more detail, for instance by analysing the early phases of product development with existing concepts of nation culture.

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## Diverzitet u ranim fazama razvoja proizvoda

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### Rezime:

*Internacionalizacija aktivnosti istraživanja i razvoja i strategija reverzne inovacije novi su izazovi razvoja proizvoda o kojima će se diskutovati u ovom radu. Ovi izazovi u okruženju kompanija zahtevaju organizacione veštine kako bi se redukovale neizvesnosti, kao i omogućile fleksibilnosti i adaptivnost. Razmatranje i upotreba diverziteta u ranim fazama razvoja proizvoda može da bude način da se odgovori ovim izazovima. Iz ovih razloga, potencijalne koristi diverziteta i odnos između diverziteta i inovacija je prikazan u ovom radu. Potencijalne mogućnosti diverziteta, ali i njegovi izazovi, kao što su konflikti i barijere u komunikaciji i kooperaciji, ističu potrebu za modelom upravljanja koji sistematično razmatra i rukovodi diverzitetom u ranim fazama razvoja proizvoda.*

**Ključne reči:** Diverzitet, Rane faze, Internacionalizacija, Razvoj proizvoda, Reverzna inovacija