NordDesign 2020
August 11-14, 2020
Kgs. Lyngby, Denmark

Evaluation of Ideas in the Crowdsourcing process for product innovation

Joade Cortez Gomes[1], Técia de Lima Silva[1], Laíssa Nogueira Rêgo[1], Paula de Oliveira Ferreira[1], Mario Orestes Aguirre González[1]

[1] Federal University of Rio Grande do Norte
joade@reitoria.ufrn.br
tecia-lima@hotmail.com
laissa.nr@gmail.com
paulaferreira@ufrn.edu.br
mario@ct.ufrn.br

Abstract

Ideation is an increasingly demanded skill in the market. In view of this reality, crowdsourcing is a process that has gained use and notoriety in the last decade as a good way to encourage collaborative innovation. Its practice is based on the opening of themes and problems to large groups, so that, in this way, ideas and efforts can be shared openly through an online platform. However, the high volume of contributions in the process requires assertiveness in the selection of the ideas to be implemented. The purpose of this article is to propose criteria, methods and factors to evaluate ideas generated from a crowdsourcing approach. To this end, a systematic literature review was carried out by reading 90 (ninety) articles on the themes of crowdsourcing and evaluation of ideas. In addition, a case study was carried out at the Office of Ideas, an institution created within the Federal University of Rio Grande do Norte. This Institution aims to carry out projects to improve and innovate products and services for the university community, and acts essentially in the processes of capturing, evaluating and implementing projects in the organization. In this way, the internal processes of an innovation ideas office were observed and this made it possible to validate the elements that should compose an evaluation system, proposed through a focus group with representatives from various sectors of the organization. From these steps, the following elements for evaluating ideas were selected: Popular and technical filter, which evaluates ideas from a Popularity Index (IP); Detailing of ideas, which aims to minimize the factors that influence the evaluation process and get to know the ideas more deeply, solving doubts about their specifications and; Final evaluation by multicriteria and consensual analysis, which evaluates the ones using the multicriteria of originality, acceptability, applicability and effectiveness and, the influencing factors, which should be studied and considered by organizations.

Keywords: Ideas Office; idea management; collective creativity; crowdsourcing; open innovation.

1 Introduction

Innovating is a latent need of organizations and given this demand, a collaborative approach that has been gaining a lot of attention in the world is crowdsourcing (Chiu, C., Liang, T., & Turban, E., 2014). Basically, the crowdsourcing process can take on various formats and compositions (open innovation, co-creation, collective intelligence, user innovation and open source), but its structure can be summarized as proposing a theme or problem of interest to the crowd. This, interacts and participates in the resolution process by means of ideas, submitting to the end of an evaluation process in which the best is selected and can become viable product (processes, products, solutions) (Chiu, C. et al., 2014; Blohm, I., Riedl, C., Leimeister, J. M., & Krcmar, H., 2011).

Public organizations also need to be adapted to respond with efficiency and quality to users and, for this, they need to be committed to modern management practices. Promoting creativity in the public environment and generating innovative proposals also becomes a strategic priority.

Attentive to these issues, the Federal University of Rio Grande do Norte (UFRN) foresees in its strategic guidelines innovation as a guiding factor for its actions. Thus, in the sense of participative management, the University has been working since 2014 on the Office of Ideas and Innovation (EI), which operates essentially in the processes of capturing, evaluating and implementing projects in the organization.

The Office of Ideas and Innovation perceived that making crowdsourcing one of its processes of action could solve problems in an integrative way with the university community (employees and students), stimulating cultural change and directing it towards the use of creativity. In addition, with this approach, there is the empowerment of those involved and the increase of the community's intrinsic motivation.

Considering that research in the evaluation of ideas remains a challenge (Gutiérrez, E., 2014; Eling, K., Langerak, F., & Griffin, A., 2015; Blohm, I., Riedl, C., Füller, J., & Leimeister, J. M., 2016) there is an intrinsic need for studies structured on methods and criteria for evaluating ideas. Given this statement, this research aims to address which criteria, methods and factors should comprise a system for evaluating ideas generated from a crowdsourcing approach, from the perspective of an ideas office at a public university. This process unleashes a scenario of a great amount of generated ideas, thus becoming one of its challenges, the assertiveness in the selection of ideas.

The article is organized is 5 sections. Section 2 describe the research method. Section 3 presents the literature review and concepts on generation and evaluation of ideas. Section 4 describes the case study. Section 5 presents the elements for using the Crowdsourcing approach in the Ideas Office and in the last section is described the final consideration, limitations and recommendation for future studies.

2 Research method

The research procedure developed for this article is described in Figure 1.

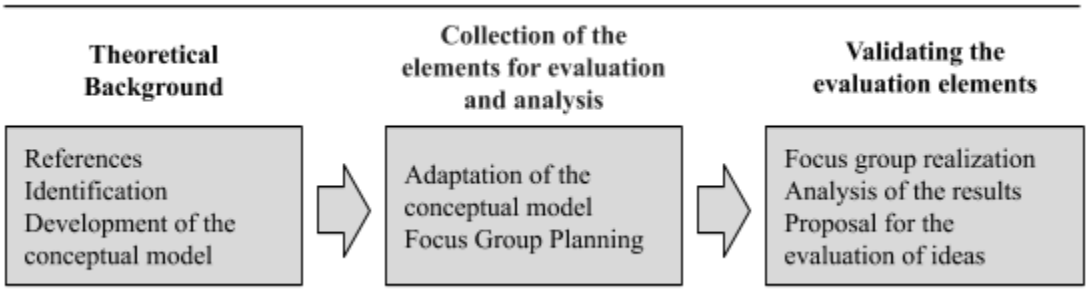

Figure 1. Summary of the research procedure. Source: own elaboration

The theoretical background was carried out based on a systematic literature review, which focused on the crowdsourcing and idea evaluation themes and counted on the analysis of 90 articles, in addition to some books, dissertations and theses, compiling the information on a spreadsheet. The questions that guided the research were: What is the concept of crowdsourcing? What are its typologies? How is its operation structured? What criteria are used in an idea evaluation process? What methods are used? What factors influence this process?

From the identification of the state of the art, elements for the evaluation of ideas were related. Adapting to the characteristics of UFRN's innovation and improvement process, the elements were put to validation in a focus group session. The participants of this session were a multidisciplinary team: The UFRN rector; the people management manager; the coordinator of program of creativity and innovation; the office ideas manager; the engineering supervisor; the information technology supervisor and; the web programming and design coordinator.

The focus group was conducted by three facilitators who had planned and training before application. The session was recorded and lasted three hours. The participants had used paper, pen and post-it for registered their contributions. With the analysis of the results of the focus group session, a proposal for the elements that make up a system for evaluating ideas generated from a crowdsourcing approach was structured.

3 Ideas generation and its evaluation in crowdsourcing approach

This section describes the main concepts and definitions about the idea generation in crowdsourcing approach and the forms of evaluation of the ideas obtained.

3.1 Crowdsourcing

Despite the lack of consensus in the definition of crowdsourcing in the literature (Forbes, H. L., & Schaefer, D., 2018), Crowdsourcing can be understood as problem solving which takes

advantage of networks to gather information and distribute the tasks of large scale or soliciting ideas for existing problems as a challenge (Brabham, D. C., 2008). In this way, crowdsourcing use massive resources to achieve an objective, for example create a low-cost, product, system or service (Wilson, K., Bhakoo, V., & Samson, D., 2018).

In an increasingly technological global environment, crowdsourcing surges from a general trend where information technology allows ideas and efforts to be shared openly through the Internet. There are some studies in the literature that seek to classify crowdsourcing mainly in terms of motivating criteria: the strategic role of the model (Howe, J., 2008), the view of the information system (Geiger, D., Rosemann, M., Fielt, E., & Schader, M., 2012) and the management process and levels of control measures adopted in the initiatives (Saxton, G. D., Oh, O., & Kishore, R., 2013), as can be seen in Table 1.

Table 1. Classification by criterion of crowdsourcing. Source: own elaboration

Authors	Criterion	Classification
(Howe, J., 2008)	Strategic role of the model	Crowd Wisdom or Collective intelligence Crowd Voting Crowd Creation Crowdfunding
(Saxton, G. D. et al., 2013)	Information system	Intermediary Model Citizen Media Production Model Collaborative Software Development Model Digital Goods Sales Model Peer-to-Peer Social Financing Model Consumer Report Model Knowledge Base Building Model Collaborative Science Project Model
(Geiger, D. et al., 2012)	Management process and control levels	Crowd Processing Crowd rating Crowd solving Crowd creation

Thus, any organization that aims to adopt crowdsourcing in an effective way, should carefully consider the characteristics of the process that will be used to achieve its particular objective. For this article, the Jeff Howe typological model was adopted as a reference, applying the Crowd Wisdom and Crowd Voting types (Howe, J., 2008). The first applies collective wisdom and intelligence to solve problems and provide insights and ideas, generating innovation in products, processes or services. The second, on the other hand, takes advantage of the crowd to evaluate and give opinions on the ideas generated through voting.

3.2 Evaluation of ideas

The evaluation of ideas can be understood as a multi-iteration process, also called a funnel or tournament (Kornish, L. J., & Hutchison-Krupat, J., 2017). This is of paramount importance for organizations (Blohm et al., 2016) and the success of implementing a project is greatly influenced by the decisions made at this stage (Kanexa, I. & Reiter-Palmon, R., 2011).

In the literature, almost all methods of evaluating ideas are based on the application of criteria by judges (Gabriel, A., Camargo, M., Monticolo, D., Boly, V., & Bourgault, M., 2016). The application of criteria by several authors for the evaluation of ideas in their studies can also be found, however, few justify the use of the criterion used. Still, it is on criteria that several

authors believe it necessary to be clear to ensure an appropriate assessment of ideas (Gerlach, S., & Brem, A., 2017). Table 2 presents a summary of the criteria found and their respective authors.

Table 2. Criteria applied to the evaluation of ideas. Source: own elaboration

Criterion	Authors
Novelty/originality	(Dean, D. L., Hender, J. M., Rodgers, T. L., & Santanen, E., 2006; Ebner, W., Leimeister, J. M., & Krcmar, H., 2009; Kudrowitz, B. M., & Wallace, D., 2013; Jagtap, S., Larsson, A., Hiort, V., Elian, O., & Warell, A., 2015; Cluzel, F. Yannou, B., Millet, D., & Leroy, Y., 2016. Herman, A., & Reiter-Palmon, R., 2011; Magnusson, P. R., Netz, J., & Wästlund, E., 2014; Gabriel, A. et al., 2016; Hao, N. et al., 2016.)
Viability	(Kudrowitz, B. M., & Wallace, D., 2013; Dean, D. L., Hender, J. M., Rodgers, T. L., & Santanen, E., 2006.)
Relevance	(Dean, D. L., Hender, J. M., Rodgers, T. L., & Santanen, E., 2006; Gray, D., Brown, S. & Macanufo, J., 2010; Kudrowitz, B. M., & Wallace, D., 2013.)
Specificity	(Dean, D. L., Hender, J. M., Rodgers, T. L., & Santanen, E., 2006.)
Financial opportunity	(Xie, L., & Zhang, P., 2010; Gray, D., Brown, S. & Macanufo, J., 2010; Correa, C.H. & Ferreira, A. M., 2015.)
Variety	(Verhaegen, P., Vandevenne, D., Peeters, J., & Duflou, J., 2012; agtap, S., Larsson, A., Hiort, V., Elian, O., & Warell, A., 2015; Cluzel, F. Yannou, B., Millet, D., & Leroy, Y., 2016.)
Strategic alignment	(Ebner, W., Leimeister, J. M., & Krcmar, H., 2009; Correa, C.H. & Ferreira, A. M., 2015.)
High risk	(Gabriel, A. et al., 2016; Correa, C.H. & Ferreira, A. M., 2015.)
Difficulty in implementation	(Gabriel, A. et al., 2016.)

In addition, a creative idea can be evaluated by the concept of multicriteria (Dean, D. L. et al., 2006). Still, it should be highlighted that a multi-criteria scale is superior to evaluate community-based ideas in terms of precision in the assessment and satisfaction of those involved (Blohm, I., Riedl, C., Leimeister, J. M., & Krcmar, H., 2011; Blohm, I. et al., 2016). Moreover, the application of the multicriteria rating scale leads to a higher quality of decision compared to the rating scale with unique criteria (Riedl, C., Blohm, I., Leimesiter, J.M., & Krcmar, H., 2013).

Among other forms of evaluation found in the literature the main ones are: scales of evaluation and forecast of market trend (Blohm et al. 2011; 2016); techniques to aid decision making (Gabriel et al. 2016) and the consensual assessment technique (Hennessey & Amabile, 2011). There are also studies that use hybrid models between these techniques.

Moreover, for models and techniques it is important to note that the act of evaluating an idea is the result of the evaluator's perception. Whether it be an expert or even the crowd, this process

can be attributed as a moment of decision-making, where a set of factors (Table 3), intrinsic and extrinsic, influences the quality of your result.

Table 3. Factors that influence the process of evaluating ideas. Source: own elaboration

Influencing factors	Description	Authors
Sensemaking	Effective degree of understanding of ideas by the evaluators	(Gutiérrez, E., 2014)
Ideas presentation	Efficiency, attractiveness and accessibility of the evaluation channel	(Onarheim, B., & Christensen, B. T., 2012) (Magnusson, P. R. et al., 2014)
Problem clarity	The degree of understanding of what it is intended to solve	(Kobayashi, M., & Higashi, M., 2009)
Work conditions	Work overload (limited time, high pressure and stress)	(Blair, C. S., & Mumford, M. D., 2007) (Eubanks, D. L., & Mumford, M. D., 2010)
Organization knowledge	Degree of knowledge of the organization and the desired objectives	(Eubanks, D. L., & Mumford, M. D., 2010)
Requirements understanding	Ability to correctly and uniformly apply the criteria	(Dean, D. L. et al., 2006) (Verhaegen, P., Vandevenne, D., Peeters, J., & Duflou, J., 2012)
Motivation	Intrinsic motivation of the individual (How much participation in the process makes sense to the individual)	(Amabile, T. M., 2012)
Ownership	Being owned by the idea	(Onarheim, B., & Christensen, B. T., 2012)
Evaluators profile	Creativity profile, regulatory focus	(Csikszentmihalyi, M., 2001) (Herman, A., & Reiter-Palmon, R., 2011)
Ideas quality	Time available for involvement in a large number of ideas	(Yang, Y., 2012)

Given this context of the UFRN and for the application of this research, the criteria used were: novelty, feasibility, relevance and specificity. The novelty criterion is seen as a key issue to measure the creativity of ideas, since it measures the degree to which an idea is original and changes an existing paradigm; feasibility can be understood by the degree to which the idea is acceptable and implementable, that is, if the restrictions are known and if there is technical feasibility; an idea is relevant if it is applied specifically to the problem and if it solves it effectively; finally, the specificity criterion is related to the explicitness, completeness and clarity of the idea, that is, whether it is communicable.

Thus, considering the (1) type of crowdsourcing, (2) the evaluation criteria, (3) the factors that influence the process of evaluating ideas and (4) the characteristics of UFRN and the model

already used by the Office of Ideas and Innovation, the article used the following elements: popular and technical filter; detailing of ideas; final evaluation by multicriteria and consensual analysis; and the influencing factors presented in Table 3.

4 Case study

4.1 UFRN and Office of Ideas and Innovation

UFRN's strategic vision, foreseen in the Institutional Development Plan (PDI) 2010-2019, states that the university must seek innovation (Universidade Federal do Rio Grande do Norte [UFRN], 2010). In the same vein, according to the Management Plan 2019-2023, the institution must disseminate the culture of technological innovation and its repercussions as social innovation, educational innovation and innovation in management processes (Universidade Federal do Rio Grande do Norte [UFRN], 2020).

In this context, with the aim of aligning its strategic vision, the University seeks to strengthen a culture aimed at improving work through participatory management based on innovative initiatives such as the Office of Ideas and Innovation.

The Office of Ideas and Innovation is a joint initiative of the Department of Production Engineering and the Pro-Rectory for People Management (PROGESP), with the aim of developing the creative potential of the university community and promoting participatory management aimed at improving services provided to the community through open innovation. Its scope is focused on issues related to People Management, taking into account some sub-areas of management, such as: Professional Development, Quality of Life and Work Safety (Pró-Reitoria de Gestão de Pessoas da UFRN [PROGESP], 2019).

4.2 Focus group

Contributions and discussions were organized using the focus group technique and based on guiding questions in which, the positive, negative aspects and opportunities for improvement, regarding the proposed model of ideas were obtained.

Thus, we sought to validate all the elements under study, namely: Popular and technical filter; Detailing of ideas; Final evaluation by multicriteria and consensual analysis; and Influencing factors.

5 Elements for using the Crowdsourcing approach in the Ideas Office

Crowdsourcing will be implemented in the Office of Ideas through a web system. The idea is to work similar to a social network. There, users will be able to access the system through their login and password already registered in the University's system database and register their ideas on a topic previously chosen by UFRN's administration. In addition, it will also be possible to vote and interact with other ideas, through likes and comments (pitacos). The Figure 1 presents the systemic view of the use of the elements.

5.1 Popular and Technical Filter

The popular filter is carried out concurrently with the stage of generating ideas via the crowd wisdom approach (Howe, J., 2008), and performed by the creators themselves when they participate with “pitacos” and likes, according to the crowd voting approach (Howe, J., 2008). Thus, each idea will have a Popularity Index (IP), calculated as a result of the formula: IP = No.

of Likes + No. of comments. At the end of this phase, 10% of the ideas with the highest IP move on to the next phase of the process. Still in this phase, the team of expert evaluators carries out the technical filter, whose objective is to select ideas that were not so popular with the crowd, but that have potential for the institution.

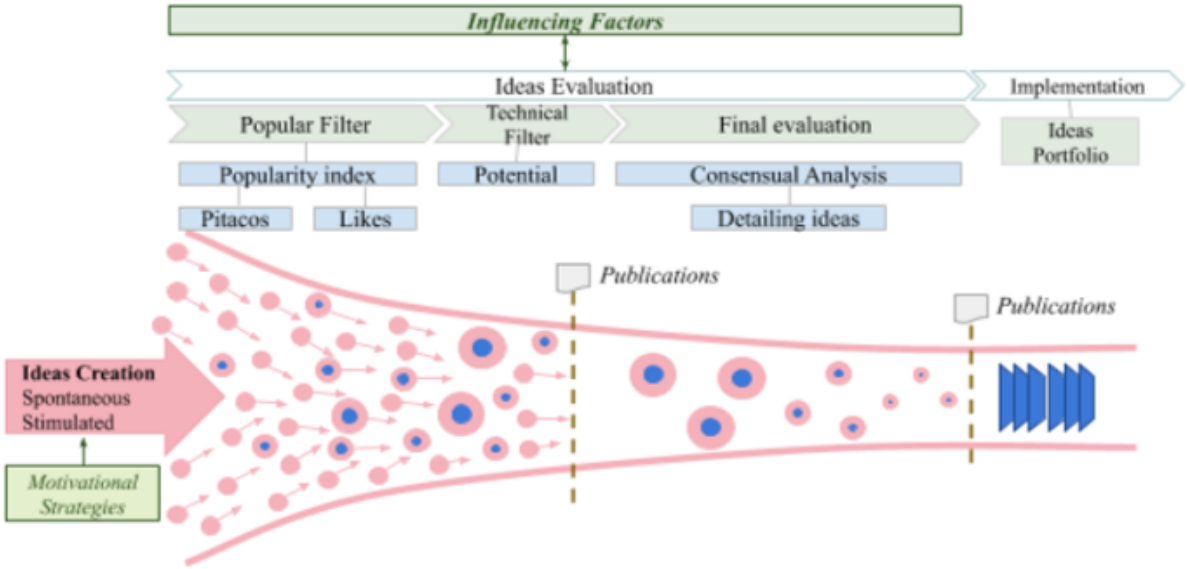

Figure 1. Idea evaluation system. Source: own elaboration

5.2 Detailing of Ideas

In order to minimize the factors that influence the evaluation process (see table 4), the expert evaluators will accompany this detailed element in order to study the ideas more deeply and to solve, during the process, all doubts about their specifications. This element will be coordinated by members of the Office of Ideas and Innovation, and the creator and co-creators, if any, will be able to improve their ideas.

5.3 Final Evaluation by consensual analysis multicriteria

At the end of a process, the evaluators must carry out a final evaluation. The same will occur through consensual analysis, using multicriteria. The criteria used in the model are: novelty, feasibility, relevance and specificity.

The consensual analysis is valid when there is agreement between the evaluators. Those ideas that obtain a degree of agreement above 0.7 will be considered and the final result should be classified according to the general average obtained by the ideas (Hennessey, B. A., & Amabile, T. M., 2011).

5.4 Influencing factors

Composing a transversal element, the whole process of evaluating ideas, more specifically the people who compose it, are influenced directly and indirectly by some factors, which must be studied and considered by organizations. These are: Ambiguity of ideas, presentation of ideas and clarity of problem, working conditions, knowledge of the organization, historical and cultural context, understanding of the criteria, motivation, ownership, profile of the evaluators and number of ideas (Table 3).

6 Final considerations, limitations and recommendations

In a reality where organizations often need to apply improvements and innovation in their products and processes, open innovation has emerged as a new way of generating solutions, using the integration of people outside the organization.

Moreover, with the evolution of technological resources, several initiatives began to emerge under the practice of crowdsourcing, which systematizes the innovation process through the online network, rewarding in some way those interested in participating with ideas.

When applying this approach in a public institution, the Office of Ideas and Innovation seeks to receive ideas from the university community at UFRN to solve strategic problems, empowering those involved, who in addition to contributing will evaluate the proposals.

However, the challenge of crowdsourcing will be assertiveness in selecting the ideas to be developed. For this, in a focus group session with representatives from several departments of the University, the elements that should compose an evaluation system were validated, considered as a process and not an isolated step, using constructive and integrative tools, such as the detailing tool of ideas and consensual analysis.

As a result of the analysis of the literature and the validation session, the elements presented to compose an evaluation system are:

• Popular and technical filter - considering the type of crowdsourcing (Howe, J., 2008): crowd wisdom and crowd voting;

• Evaluation criteria - considering multicriteria analysis and consensus analysis: novelty, feasibility, relevance and specificity; with an agreement index of 0.7 or more;

• Factors that influence the evaluation process - considering Table 3, with the analysis of several authors: ambiguity of ideas, presentation of ideas and clarity of the problem, working condition, knowledge of the organization, historical and cultural context, understanding of the criteria, motivation , ownership, profile of the evaluators and quantity of ideas;

• Characteristics of UFRN and the model used by the Office of Ideas and Innovation: tool for detailing ideas.

The limitations of this study was did not put in practice the ideas evaluation, thus we suggest to future researches, in more depth, the relationship between the indicators - likes and comments - used in the popular evaluation to structure the evaluation system, and how the weighting between these indicators influences the quality of the evaluation.

Acknowledgement

This study was financed in part by the Coordenação de Aperfeiçoamento de Pessoal de Nível Superior – Brazil (CAPES) – Finance Code – 001.

References

Amabile, T. M. (2012). Componential Theory of Creativity, Working Paper, no. 12096.

Blair, C. S., & Mumford, M. D. (2007). Errors in idea evaluation: Preference for the unoriginal?.The journal of creative behavior, vol. 41, no. 3, pp. 197-222.

Blohm, I., Riedl, C., Leimeister, J. M., & Krcmar, H. (2011). Idea evaluation mechanisms for collective intelligence in open innovation communities: Do traders outperform raters?. Proceedings of 32nd International Conference on Information Systems.

Blohm, I., Riedl, C., Füller, J., & Leimeister, J. M. (2016). Rate or Trade? Identifying Winning Ideas in Open Idea Sourcing. Information Systems Research, vol. 27, no. 1, pp. 27-48.

Brabham, D. C. (2008). Crowdsourcing as a model for problem solving an introduction and cases, Convergence: the international journal of research into new media technologies, vol. 14, no. 1, pp. 75-90.

Chiu, C., Liang, T., & Turban, E. (2014). What can crowdsourcing do for decision support?, Decision Support Systems, vol. 65, pp. 40-49.

Cluzel, F. Yannou, B., Millet, D., & Leroy, Y. (2016). Eco-ideation and eco-selection of R&D projects portfolio in complex systems industries. Journal of Cleaner Production, vol. 112, pp. 4329-4343.

Correa, C.H. & Ferreira, A. M. (2015). Method for decision making in the management of innovation: criteria for the evaluations of ideas. Presented at the International Association for Management of Technology, pp. 2151 - 2169.

Csikszentmihalyi, M. (2001). *A systems perspective on creativity* . London, England: Sage Publications.

Dean, D. L., Hender, J. M., Rodgers, T. L., & Santanen, E. (2006). Identifying quality, novel, and creative ideas: constructs and scales for idea evaluation. Journal of the Association for Information Systems, vol. 7, pp. 646-698.

Ebner, W., Leimeister, J. M., & Krcmar, H. (2009). Community engineering for innovations: the ideas competition as a method to nurture a virtual community for innovations. R&D Management, vol. 39, no. 4, pp. 342- 356.

Eling, K., Langerak, F., & Griffin, A. (2015). The performance effects of combining rationality and intuition in making early new product idea evaluation decisions. Creativity and Innovation Management, vol. 24, no. 3, pp. 464-477.

Eubanks, D. L., & Mumford, M. D. (2010). Leader errors and the influence on performance: An investigation of differing levels of impact. The Leadership Quarterly, vol. 21, no. 5, pp. 809-825.

Forbes, H. L., & Schaefer, D. (2018). Crowdsourcing in product development: current state and future research directions. Proceedings Of The Design 2018 15th International Design Conference. pp. 579-588

Gabriel, A., Camargo, M., Monticolo, D., Boly, V., & Bourgault, M. (2016). Improving the idea selection process in creative workshops through contextualisation. Journal of Cleaner Production,

Geiger, D., Rosemann, M., Fielt, E., & Schader, M. (2012). Crowdsourcing information systems: definition, typology and design. Orlando, FL: Thirty Third International Conference on Information Systems.

Gerlach, S., & Brem, A. (2017) Idea management revisited: A review of the literature and guide for implementation. International Journal Of Innovation Studies, v. 1, no. 2, pp.144-161.

Gray, D., Brown, S. & Macanufo, J. (2010). Gamestorming: A playbook for innovators, rulebreakers, and changemakers. O'Reilly Media, Inc.

Gutiérrez, E. (2014). Managing Ambiguity When Evaluating and Selecting New Ideas in Project Portfolio Management. International Journal of Innovation and Technology Management, vol. 11, no. 05, pp. 1450030.

Hao, N., Ku, Y., Liu, M., Hu, Y., Bodner, M., Grabner, R. H., & Fink, A. (2016). Reflection enhances creativity: Beneficial effects of idea evaluation on idea generation, Brain and cognition, vol. 103, pp. 30-37.

Hennessey, B. A., & Amabile, T. M. (2011). Consensual assessment. Encyclopedia of creativity, vol. 1, pp. 253-260.

Herman, A., & Reiter-Palmon, R. (2011). The effect of regulatory focus on idea generation and idea evaluation. Psychology of Aesthetics, Creativity, and the Arts, vol. 5, no. 1, pp. 13.

Howe, J. (2008). Crowdsourcing: How the power of the crowd is driving the future of business. Random House.

Jagtap, S., Larsson, A., Hiort, V., Elian, O., & Warell, A. (2015). Interdependency between average novelty, individual average novelty, and variety. International Journal of Design Creativity and Innovation, vol. 3, no. 1, pp. 43-60.

Kanexa, I. & Reiter-Palmon, R. (2011). The Effect of Regulatory Focus on Idea Generation and Idea Evaluation. Psychology Faculty Publications. Paper 18.

Kobayashi, M., & Higashi, M. (2009) Collaboration Support System for Analyzing Individual Differences Based on Designers' Idea Evaluation. Proceedings of ICED 09, the 17th International Conference on Engineering Design, vol. 5, Design Methods and Tools (pt. 1). Palo Alto, CA, USA, 24.-27.08.

Kornish, L. J., & Hutchison-Krupat, J. (2017). Research on Idea Generation and Selection: Implications for Management of Technology. Production and operation management, vol. 26, no. 4, pp. 633-651.

Kudrowitz, B. M., & Wallace, D. (2013). Assessing the quality of ideas from prolific, early-stage product ideation. Journal of Engineering Design, vol. 24, no. 2, pp. 120-139.

Magnusson, P. R., Netz, J., & Wästlund, E. (2014). Exploring holistic intuitive idea screening in the light of formal criteria. Technovation, vol. 34, no. 5, pp. 315-326.

Onarheim, B., & Christensen, B. T. (2012). Distributed idea screening in stage-gate development process. Journal of Engineering Design, vol. 23, no 9, pp 660-673.

Pró-Reitoria de Gestão de Pessoas da UFRN. (2019). Plano 2019. Retrieved from https://www.progesp.ufrn.br/storage/documentos/GYsljAPLdaC5RIauTvzsFkrgBApmtfrO9vNCgKJD.pdf.

Riedl, C., Blohm, I., Leimesiter, J.M., & Krcmar, H. (2013). The effect of rating scales on decision quality and user attitudes in online innovation communities. International Journal of Electronic Commerce, vol. 17, no. 3, pp. 7-36.

Saxton, G. D., Oh, O., & Kishore, R. (2013). Rules of crowdsourcing: Models, issues, and systems of control. Information Systems Management, vol. 30, no. 1, pp. 2-20.

Universidade Federal do Rio Grande do Norte. (2010). Institutional Development Plan. Retrieved from https://ufrn.br/resources/documentos/pdi/PDI-Institutional-Development-Plan-2010-2019.pdf.

Universidade Federal do Rio Grande do Norte. (2020) Plano de Gestão 2019-2023. Retrieved from https://ufrn.br/resources/documentos/planodegestao/Plano_de_Gestao_2019-2023.pdf.

Verhaegen, P., Vandevenne, D., Peeters, J., & Duflou, J. (2012) Refinements to the variety metric for idea evaluation. Design Studies, vol. 34, no. 2, pp. 243-263.

Wilson, K., Bhakoo, V., & Samson, D. (2018), "Crowdsourcing: A contemporary form of project management with linkages to open innovation and novel operations". International Journal of Operations & Production Management, vol. 38 no. 6, pp. 1467-1494.

Xie, L., & Zhang, P. (2010). Idea Management System for Team Creation. Journal of software, vol. 5, no. 11, pp. 1187- 1194.

Yang, Y. (2012). Open innovation contests in online markets: idea generation and idea evaluation with collective intelligence. Temple University Graduate Board.