Communication and Digital Content in Research Network Collaboratories

Tércia Zavaglia Torres[1,2], Marcia Izabel Fugisawa Souza[1,3], Nadir Rodrigues Pereira[1,3], Bruno Gâmbaro[3], Vanessa Maia Aguiar Magalhães[4].

[1]Embrapa Informática Agropecuária, Av. André Tosello 209, Caixa Postal 6041, CEP 13083-886, Campinas, SP, Brasil
[2]Faculdade de Paulínia – FACP, Brasil
[3]Universidade Estadual de Campinas, Av. Bertrand Russell, 801, CEP 13083-865, Campinas, SP, Brasil
[4]Embrapa Gado de Leite, Av. Eugênio do Nascimento Street, Dom Bosco, CEP 36038-330, Juiz de Fora, MG, Brasil

{tercia.torres, marcia.fugisawa, nadir.rodrigues, vanessa.magalhaes}@embrapa.br; brunogambaro@gmail.com

Abstract. In this paper, we explore Collaboratories as a space of communication for research networks between institutions whose focus is on research, development and technological innovation (PD&I). Collaboratories are used to promote communication, increase learning, encourage collaborative construction of knowledge and share information, knowledge and technologies. We also conduct a discussion about communication as a guiding process of the relationships between the participants of the research networks in the Collaboratories. Based on a model of digital content organization, which is part of a transmedia perspective, we also identify the media and the content that can be exchanged.

Keywords: collaboratories; communication; content organization; digital content; research networks.

1 Introdução

We live in the Knowledge Society, whose socio-economic development is based on three foundations: information, knowledge and learning. These factors represent the conditions for the companies to overcome technological boundaries and to move forward in the construction of innovative knowledge.

In this scenario, institutions whose focus is on research, development and innovation (RD&I) try to implement management policies and instruments to improve their abilities in taking strategic and safe decisions in a relatively short amount of time. Accordingly, policies about business communication and research networks construction have become the center of attentions. These research networks demand a

systemic and integrated communication approach to maximize the expected results from research, development and innovation[1] (RD&I) institutions.

These networks are faced as an inter-institutional arrangement that emphasizes the individual and organizational competences of companies. It is also as an attempt to find out aggregated and systemic solutions through the use of integrated resources. These networks are based on collaborative, participative and collective premises that are established and materialized on interactions/relationships/communications between the individual participants involved in this process.

This conceptual paper explores Collaboratories as a space of communication for the research networks of the RD&I institutions. We discuss communication as a guiding process for the relationships between the different participants involved in these research networks, identifying the media that can be used and the content that can be exchanged. So, we adopt a model of digital content organization that was proposed by [1], whose perspective of study can be qualified as transmedia. We assume, then, that the way the contents are arranged in virtual collaborative spaces encourages the participants to communicate and exchange information. Consequently, they construct knowledge and learn collaboratively.

Beyond this introduction, this paper is divided in four more sections. In the second section, we discuss the importance of communication through digital technologies for research networks. We present Collaboratories as an alternative to conduct a communication approach, which is simultaneously integrated and systemic, to promote the construction of new knowledge and learning by the participants. Afterwards, the third section discusses the relevance of content organization in Collaboratories, identifying media and the way content can be adapted to the model of digital content organization, proposed by [1]. In the sequence, the forth section presents the model of digital content organization and the process of planning the structure of contents so that they can be organized in different media, which are available in the Collaboratories. Finally, in the last section we present the conclusions about what was discussed.

2 Communication in Research Networks of Collaboratories

Nowadays, most of RD&I institutions have a management model to develop technological innovations. This model is grounded on the basic premises of collaboration between the scientists and their partners and the contribution between different institutions. This point of view is grounded on the fact that research problems are significantly more complex and demand conceptual, theoretical and methodological contributions from different areas of knowledge. It requires, from these institutions, the ability to integrate and join different types of knowledge and the respective scientists' competencies in order to maximize the chances to achieve effective results.

To maximize these results, the RD&I institutions have adopted an institutional network arrangement. This type of application is more appropriate to the dynamics or relationship that these companies need to establish to solve the complex problems that

[1] Translation of Instituições de Pesquisa, Desenvolvimento e Inovação.

come up in the "Knowledge Society". In addition, the network arrangement provides these companies with the opportunity to expand their chances to achieve integrative results, knowledge and, obviously, learning. This network concept not only makes reference to the idea of flow, circulations, alliances, movements, but also is more representative of what really happens with scientists when they interact with each other to find out solutions for the research problems which they are involved with.

The concept of the theory participant-network was established by [2] and he admitted that when scientists interact with their partners in order to find out a solution for a common or interdependent research problem, they negotiate and produce numerous interpretations about it, generating new knowledge.This knowledge conceived by scientists, a result of the dynamic communication, is considered a social product instead of a result achieved simply with the application of a scientific method [3].

According to [4] pose that the institutional network arrangement has more appropriate responses to the problems of RD&I because it consists of a more dynamic approach, which incorporates simultaneously the analysis of social, economic, technological, technical, intellectual and apprenticeship elements, in order to explain what occurs between the subjects who belong to the knowledge network of the specific institutions.

We can infer that sharing and disseminating knowledge in RD&I institutions must be directly associated with the premise that it is in the moment in which scientists interact with each other, to generate resolutions for the research problems in a network arrangement, that the possibilities to maximize the communication process to increase the social applicability of the results should be constructed [5]. The key elements for generating new knowledge in these institutions are people and the relationships and interactions established with partners.

Therefore, communication in research networks supports the creation of new knowledge by scientists and requires special attention from RD&I institutions. We assume that this process has always been understood as strategic by these institutions because, besides the support that it offers to other organization processes, it is essential for the interaction of every company with internal and external public. [6] admits that today, with the information and communication technologies (ICT) rush, the acts of informing and communicating are much closer. In this perspective, communication is also seen as an act that "… enables the subjects to generate and share information that provides them with thinking tools and guidelines to cooperate and organize their routines"[2].

According to [7], communication in institutions nowadays is effective due to the use of ICT, which serves as an intermediary instrument between the companies and the public. These technologies have the power to change interpersonal relationships and, consequently, the way they perceive reality. Today, more than in a recent past, the function of communication is to create, keep and expand, continuous and dynamically, the flow, instruments and formal and informal spaces of dialogue and the reciprocal influence between companies and their internal and external publics.

[2] Translation of "... possibilita aos sujeitos gerarem e compartilharem informações que lhes proporcionem ferramentas de pensamento e direção para cooperar e organizar suas rotinas".

All this process consolidates the competitive intelligence and establishes participative and inclusive policies with all the participants.

Communication through digital technologies enlarges the chances of people to exchange information, knowledge, learning and experiences as long as the intermediary media has technological contributions that offer more interaction and indulge the development of a communication style, which is horizontal and dynamical. Consequently, new knowledge is created.

In RD&I institutions, communication through digital technologies, specially the Web 2.0-based technologies, must be a priority, especially for network researches, because they encourage a dialogical, interactive and direct relationship with society. As a matter of fact, [8] characterizes the Web 2.0 structure based on the principles: a) social network (it has tools to create spaces of interaction between people); b) contents (it offers tools for producing, editing, sharing and disseminating information, knowledge, experiences and learning, i.e., contents); c) social and intelligent organization of information (it provides tools to index and store organized information that is collaboratively and collectively produced by users); and d) applications of services (it uses tools that add value for the users). These four principles promote a dynamic communication and the result is a 'live' and continuous communication between RD&I institutions and their public.

In this perspective, research networks can be defined as a set of social actors who get together with a common purpose, exchange and share information and knowledge about themes related to their research interests, aiming at a resolution for social problems that are gradually more complex. They have a horizontal, inter-relational and non-hierarchical structure that provides the participants with fluid, dynamic communication [9].

Communicative actions in research networks are digital and promoted by Web 2.0 tools, and it enables the participants to establish a dialogical relationship. In this dialogical relationship, the diversity of ideas, logic and rationality brought up by the subjects involved in the network is maximized due to the fact that they search for a unanimous thought. The intentional purpose is the solution for the issue that is being studied. The achieved results, therefore, come from the enlargement of the knowledge that was collectively built. So, we can assure that there is learning within research networks since people change their perceptions about a phenomenon, constructing new meanings and values. Web 2.0 provides the subjects the opportunity to be, simultaneously, transmitters, receivers, producers and co-producers of content. It serves as an intermediary tool to exchange information, knowledge, experience and learning. Web 2.0 creates also a collaborative environment and it emphasizes their participation in the networks, bringing up meaningful results since they represent communication and interaction dynamics that people undertake in these collaborative spaces [10].

The actions of communication through ICT are an important process for the consolidation of research networks in RD&I institutions. It is clear how the relationships between scientists and other subjects are established. ICT also enable the dynamics of these relationships aiming at interaction, creation, share and dissemination of new knowledge.

A way to improve this rationality is to institutionalize virtual collaborative spaces to help scientists from specific research networks to interact. In this sense,

Collaboratories appear as an alternative because they are spaces that adopt a set of digital tools and, among them, Web 2.0. Collaboratories are virtual spaces in which important content about the central theme of the research network is explored. It enables the subjects to exchange, share, disseminate and transform information and knowledge into new information and knowledge (content).

Collaboratories can be defined as "A meeting point open to academic, researchers, students and the general public interested in the conformation of network learning spaces, flexible and participative"[3] [11]. It is considered one of the most accurate ways of representation of collective knowledge production and it serves as a space to construct new knowledge and learning. They are understood as a space in which multiple computational tools can be put together to enhance the exchange and share of huge databases and information (cloud computing), in a way to use them collectively by many participants of the research network. For this, the contents to be approached in the Collaboratories must be organized in a way to promote interaction and learning between scientists and other participants of the network.

In spaces as Collaboratories, the act of thinking and constructing knowledge is a social, collective and dialogical action. It provides the participants with more opportunities to create new perceptions about reality [12], and learn together based on the information, knowledge and experience that is shared and disseminated.

3 Content Organization in Collaboratories of Research Networks

The technological resources that characterize Web 2.0 tools instigate people to interact more. It means that they exchange experiences and construct new concepts in a different way when they use ICT as a source and instrument for communication. [13] pose that this type of interaction is understood as a function of communication produced from the dynamics that people establish and promote when they are exchanging information, knowledge and experiences in virtual spaces of collaboration. Thus, communicating is an intentional act that enables the construction of other meanings, perceptions and cognitions, and the development of new reflections about the reality that is common to the subjects involved.

The condition for communication to occur as an intentional action, in Collaboratories, is the definition of the role and function of the different media used in these spaces. It is also necessary to establish ways to make the content congruent and integrated, in order to promote the participant's learning [14].

According to [15], contents used in virtual collaborative environments are considered aesthetic elements and, therefore, their organization is essential. These contents foment the interaction among people and make them mobilize their cognitive systems, instigating them to get interested and to comprehend other contents. [16] also follows this perspective based on the assumption that contents are the starting point for interactions to occur among people in virtual environments, and these contents are called social objects. Contents available in Collaboratories of research

[3] Translation of "Un punto de encuentro aberto a académicos, investigadores, estudiantes y público en general interesado en la conformación de espacios de aprendizaje en red, flexibles y participativos".

networks should, therefore, be an attractive element to encourage the subjects to discuss it. It is a common sense that contents instigate subjects to search for new discussions, questions, doubts and/or polemics, which will require other interactions, information, knowledge, experiences, etc.

In this sense, the way those contents are organized and adjusted to the interests of a research network, aiming at the construction of new meanings between participants who interact in Collaboratories, should be an object of special attention in RD&I institutions. [13] and [17] pose that the organization of contents in virtual collaborative environments must follow the communication logic that incites the participant to learn. Moreover, they must be available in different media so that exchanged information can be considered complementary and interdisciplinary. It is attributed a broader and more general concept to the word *media* because it makes reference to all the processes of communication that occur through computer and its technological tools [18].

Collaboratories are virtual spaces that make available content that is directly related to the participant's interests, instigating them to search for more information and make connections with each other. It makes reference to the concept of convergence, which corresponds to a state of communication achieved when many people are involved in the use of content indexed in virtual spaces, in different ways, in different media [19].

The concept of convergence reinforces the idea that content must be organized in a way to incite people to analyze it according to different perspectives and angles, to reflect and create new relationships with other contents learned previously. The use of this concept in Collaboratories allows the subjects, when interacting with each other and using organized contents, to understand the variety of concepts inherent to each content. So, they can add thoughts, interpretations and representations, mobilizing their knowledge and experiences to construct others. The convergent organization of contents can be named transmedia because it is available in different languages and forms of transmission in different media, based on a pedagogical approach to integrate them intentionally. Thus, the participants that have access to these contents are able to extract from them new rationalities, meanings, perceptions and cognitions.

4 Model and Process of Organization of digital content

Based on the model of digital content organization developed by [1], we propose that Collaboratories of research networks should be constructed with two dimensions that interact with each other: a) documentary/structural; b) collaborative/experimental. In Figure 1 we can observe media and the respective content that can be available in each of these two dimensions of the model, considering the transmedia perspective as a way to make the participants of the research networks learn.

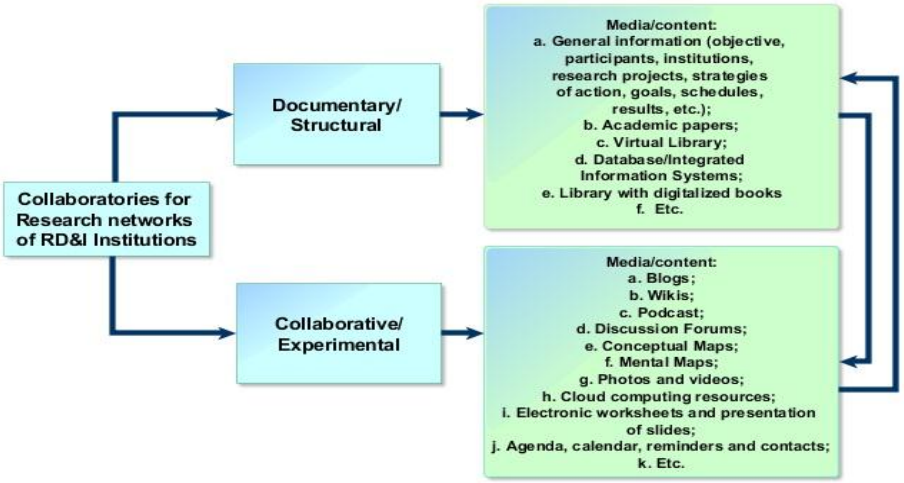

Fig. 1. Proposal of Digital Content Organization Model in Collaboratories.
Source: [1] adapted by authors.

The documentary/informational dimension gathers a corpus of knowledge of diverse spectrum, circumscribed to the central theme of the research network that provides the participants with the chance to construct a broader conceptual comprehension than the one related to the field of study in which they work. It enables them to learn/refine their ability in making convergent analysis; elaborating complementary critics about the problem; sharing common and/or different ideas about the problem; and developing common linguistic structures about it. In this dimension, content organization follows a linear communication logic, since the media used to support it are texts and academic paper repositories and files; virtual libraries; database, integrated information systems; library with digitized books etc. Thus, in this dimension the contents related to specific areas of knowledge and to the central theme of the research network must be available.

Let us suppose the creation of a Collaboratory for a research network about Climate Change, in its documentary/informational dimension. Many organized content repositories would be available for the participants and they would be categorized as: a) general information about the Collaboratory (objective, members of the Network Climate Change, institutions to which it belongs, functions/activities in the research network, research project the network is conducting and its respective plans of actions/subprojects, goals, action strategies, schedules, expected results etc.); b) scientific texts distributed according to the area of knowledge; c) virtual libraries with collections of journals, e-books, books, articles, reviews etc.; d) database/information system integrated as information agencies, production systems, agricultural and meteorological systems; e) Libraries with digitized books, and so on.

The second dimension proposed is entitled collaborative/experimental and gathers contents generated from interactions between the participants of the network while they are exchanging information, knowledge and experiences, or producing a new rationality to solve a task/activity through the use of diverse Web 2.0 media. In this dimension, we highlight the media that organize the common tasks for participants as

blogs, wikis, podcast, discussion forums, conceptual maps, mental maps, photos, audios, videos, cloud computing resources, electronic worksheet and presentation of slides. They promote social interaction in a collective and collaborative way and contribute to the achievement of the objectives and results. Moreover, we can mention the use of agendas, calendars, reminders and contacts. These media enable strategic, tactic and operational management of the research network. [20] points out that it is in this dimension that occurs the process of collective and collaborative production of new content and knowledge because that is where exchanged information becomes congruent parts of the communication dynamic among the participants of the Collaboratory.

Therefore, it is in the collaborative/experimental dimension that we should put in practice the transmedia perspective in terms of content organization, in accordance with what [13] propose. To make sure it happens, it is necessary to adopt a pedagogical approach to integrate contents and make media available in this dimension, attending interests required by the research network. In the example of the Collaboratory of the supposed research network about Climate Change, the contents of the collaborative/experimental dimension could be organized in:

a) blogs, which are a type of web page that serves to produce and publish contents that are organized according to a chronological structure. Blogs can be structured according to an area of knowledge and are used by the participants of the network to get connected with their partners to produce content about these areas and make an interdisciplinary reflection about their personal and professional experiences. The content generated is called post. So, the comments that the participants make in each blog of each area of knowledge serve as a starting point to instigate dialogues that will be beneficial in terms of construction of new perceptions about the approached content;

b) wikis, which are web pages that allows us to produce texts, reports, scientific papers, documents, reviews, opinions etc. that, once published, can be continuously edited through the contribution of all the participants of the research network. Wikis, differently from blogs, have a hypertextual structure in the contents produced by the participants, with a non-linear organization of contents. The navigation through the content enables the users to go through other complementary information, increase their comprehension of contents and feel motivated to write collaboratively. The collectivity and collaborative inherent to this tool instigates interaction, communication, participation and social production of contents, as well as their dissemination. [21] asserts that the use of wiki in virtual environments contributes both to information management and organization and to the encouragement of those subjects to work collaboratively, to reflect about the concept of community, to learn collaboratively and to construct knowledge with others;

c) podcast is a web tool which can be used to manage audio, text, images, videos and hypertexts that can be downloaded automatically to mobile

devices. This tool has been considered an important resource to promote a collective and collaborative process of information and knowledge exchange between the participants of the research network. Additionally, it complements and increases the comprehension of other contents which were approached in other devices with the ones presented in the documentary/informational dimension of content organization proposal;

d) discussion forum is a very dynamic web tool that aims at encouraging the construction of a dialogical and interactive process of communication between the participants. The contents of the discussion forums can be organized based on a specific discussion theme. There are two sections of contents organization in the forums: the first takes into consideration the theme and the second, a specific topic within each theme. In both sections, discussions between participants are exhibited in descending chronological order. Normally, in each theme a moderator is called up. This person has the role to encourage and direct discussions and also to motivate other participants to contribute with their opinions about what is being discussed. The moderator can avoid, move, delete and adapt whatever is necessary to the themes and the topics of the forum, taking into consideration the achievement of the objectives and the expected results. The discussion forums in the Collaboratories are very important because they are the tool through which participants socialize their points of view and opinions about proposed themes, debating them dialogically with other subjects and, so, contributing to the creation of new understandings, knowledge and learning;

e) conceptual maps are tools that contribute to organize hierarchically the relations between concepts as diagrams of meanings. In a conceptual map, the most inclusive concepts are represented on the superior part and the others, on the inferior part. This tool serves to point out the meanings attributed by the subjects to the concepts and relationships they establish between the concept and the corpus of knowledge from a certain area of knowledge. In this sense, they have a strategic relevance for the network research because it contributes to the collective construction of new knowledge and to collaborative learning. In the Collaboratory of a research network, it can be used the software CmapTools (<http://cmap.ihmc.us/>) that allows the user to construct, navigate and share conceptual maps from anywhere on web. It is a public tool, independent from the platform;

f) mental maps are tools that diagram information, data, facts and/or textual knowledge (content), in an organized and synthetic way. The purpose of it is to group broad ideas, offer a general mapping and contextualize people about a specific theme. Mental maps can be placed anywhere in the Collaboratories to help participants of the research network to plan, organize, synthesize, create and/or disseminate information and/or knowledge about a theme or to comprehend better

the interfaces with other themes. It is a strategic tool for the research network because it allows sharing of information, contributing to the generation of new knowledge and learning. Some of these web tools are free, as MindMan Personal, FreeMind and Xmind;

g) photos, audios and videos can be indexed in Collaboratories with the purpose of promoting another way of interaction between the subjects. The contents approached in these resources can be organized, as in the discussion forums, by themes and/or topics inside the themes or according with the chronological order they were produced. The central point of these contents is to serve as another web object capable of instigating the understanding of concepts and discussions that occurred among the subjects of the network in other media available in the collaborative/experimental dimension of the Collaboratory. Nowadays, there is a variety of web platforms that are not proprietary, as: <http://flickr.com>;<http://www.riya.com>;<http://picasa.google.com/>; <http://www.blinkx.com>;<http://jumpcut.sourceforge.net/>; <http://youtube.com>, and they allow the user to store, publish, share and edit photos and digital videos, and also to classify them using tags or other taxonomies;

h) cloud computing resources can be available in the Collaboratories of the research networks in a repository and/or link for this purpose. The idea is that the participants of the network have permission to access results of complex calculations with huge volumes of data, in which all of them are interested, through an access rule that can be established. This is relevant as long as the necessity of manage effectively computational resources increases, and since it is increases the importance of extracting as much information as possible from these data. It means that the use of the distributed computational model, besides allowing the share of computational resources (memory, storage, processing, bandwidth etc.), serves to promote interactive collaboration too. They have a satisfactory performance, low cost, and fast content process. The use of this resource encourages participants to develop a culture of sharing data and information and increases the possibility of creating new knowledge and learning.

i) electronic worksheets and presentation of slides are web tools that help the participants of the network to produce and manage the structure of research data (graphics, worksheets, slides, etc.), conducting analysis for technical meetings, seminars, symposiums, conferences, workshops, academic meetings, project elaborations etc. They enable the participants to edit, publish and access these contents, increasing the generalized use of data and information and consolidating a culture of sharing. The content generated with these tools can be organized in the Collaboratories of research networks according with type or themes/topics or chronological order. There are many free tools on web

and the most popular can be accessed in: <http://docs.google.com>;<http://www.zohosheet.com>; <http://online.thinkfree.com/>; <http://www.slide.com>; <http://www.empressr.com>; <http://www.slideshare.net>;

j) agendas, calendars, reminders and contacts are also web tools used to organize collective works that involve a numerous group of participants, as in the research network of the Collaboratories. These tools simplify the planning and the organization of the activities of people in the virtual environment, keeping them in contact and/or remembering them of their important appointments. The inclusion of these tools in the Collaboratory favors the strategic, tactical and operational management of the research network, and, thus, it improves its performance.

However, the process of organization of these contents in the digital media must take into consideration the principles of immersion, agency and transformation discussed by [13]. Under these principles, the contents are adapted to the transmedia perspective, whose characteristics can be perceived by the participants of the network as social objects that instigate them to other forms of interaction. The premise of immersion is the one that offers the opportunity to the participants to construct new meanings, as long as the diverse media that support the contents afford different perceptions, perspectives and ways of comprehending them. On the other hand, the principle of agency allows the participants to consider themselves as agents, producers of new contents organized in a non-linear path. They search for much more information in the different media available in the collaborative/experimental dimension of the Collaboratory. It is the intentional organization of contents under a non-linear, interdisciplinary and complementary construction, with a pedagogical/didactic logic, that maximizes in participants the capacity to be active producers of new contents. The premise of transformation is the one that helps the participants of networks to reflect collectively and collaboratively, during the process of production of new contents. That is when they become conscious about the knowledge they evoke and mobilize when they are engaged in a dialogical process with their partners.

The integration of contents within each media used in the collaborative/experimental dimension of the Collaboratory must be conducted based on a structured process that takes into consideration the principles immersion, agency and transformation. Thus, it must be performed by professionals from various areas of knowledge using the resources entitled ‘transition path’. These resources are based on the construction of aspects that imply the existence of other information and complementary and interdisciplinary contents. The transition allows the participants of the network to follow a non-linear plan of action when they are searching for other information.

In the example of the Collaboratory about the supposed Climate Change research network, whose theme requires a cross-cut and interdisciplinary approach, the task of integrating contents in their respective media would begin by the formation of an editorial team to organize and to construct the transition paths between the contents available in the different media. So, in a video which contains a report made with a

researcher from Embrapa, for example, about socio-economic aspects involved in the climate change issue, it would be adopted the transmedia perspective to establish transition paths that could bring the participants of the network to many other contents exposed in various media of the Collaboratory, as texts, conceptual and mental maps, etc. The transition paths should be established in all the contents available within each media in the Collaboratories. So, even though the flow of the communication path would be completely diffuse and non-linear, it would have something as a thread to keep their attention focused on the interests of making this content more congruent and integrated. So, learning and production of new knowledge would take place.

In this sense, the Collaboratory editorial team has a very important role because they are responsible for the execution of this non-linear communication process, which requires that the participants of the research networks navigate through the contents available in different media. The participants will complement and expand cognition so that these contents mobilize and instigate them to search for new information and knowledge. Due to all this, we propose a planning process for the content structure[4], as presented in Figure 2, based on [22] ideas.

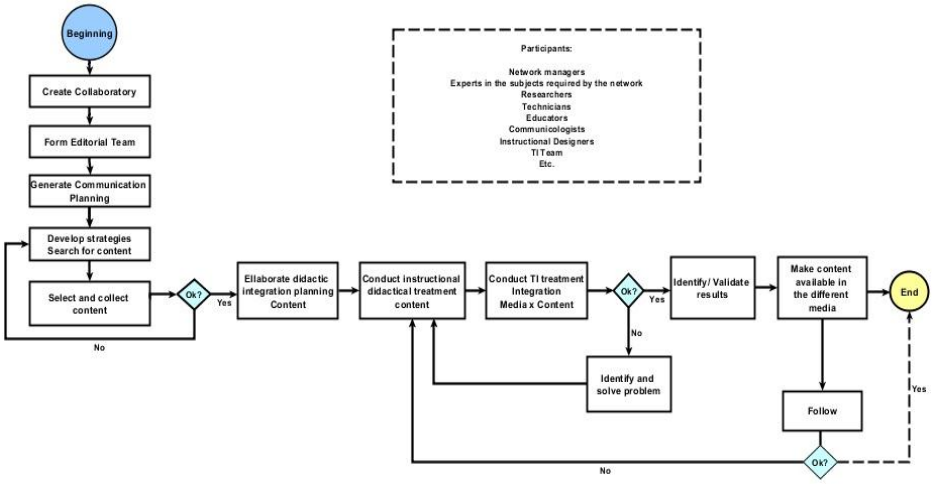

Fig. 2. Structure of Contents Planning for Collaboratories.
Source: [22].

Figure 2 presents the main steps/activities that compose the planning process that makes reference to information and didactic management of contents to be adapted to the different media. This process consists of a critical factor of success for the interactions that will occur among the participants of the research networks in Collaboratories.

This process aims at organizing the contents according to specific purposes, to increase the participant's comprehension about the central theme of the network and to encourage them to learn and construct collaboratively new knowledge. Thus, the formation of the editorial team is essential because these people are the ones who

[4] Translation of Planejamento de Estrutura de Conteúdos (PEC).

produce communication paths to implement interaction between the participants and they determine the extent to which the results will be applied on society.

The editorial team of the research network must be responsible for managing the communication path that best addresses the research networks interests and that allows interaction between participants. It must be formed by different professionals from complementary areas of work, since the whole communication planning and the development of strategies to search for contents must be conceived by this team as complementary and interdisciplinary. Another important point to be taken into consideration in this process is its dynamic essence. In some media as wiki, blogs and discussion forums, the contents will be produced by the participants of the network themselves. It means that the editorial team does not have only to organize, but also to manage information and contents introduced by participants, integrating and adapting them to the diverse media in a very didactic and instructional way, and making them available again in conformity with the transmedia perspective.

5 Conclusions

The implementation of Collaboratories, characterized as virtual environments that demands communication in research networks, presupposes the development of an innovative organization culture that can encourage sharing of information, experiences and knowledge among the participants. In addition, it offers support for the collaborative practices whose goal is the collective construction of knowledge.

The conceptual model that was presented in this paper can make the organization and data management produced by scientists effortless. The result is that their communication interactions occur in a virtual space called Collaboratory. The contents are understood as cognitive objects that offer information and knowledge sharing between the participants of the research network. It privileges the metacognitive capacity, i.e., the ability of being perfectly self-conscious about what they know and what they did in the past to build what they know. Thus, both institutions and agents who are connected to research networks will achieve more effective, accurate and satisfactory results, in a process that guides them to relevant learning.

Referências

1. Torres, T. Z.: Colaboratórios em instituições de PD&I: compartilhamento e disseminação do conhecimento. In: Congresso Internacional de Administração, Ponta Grossa. Gestão estratégica: inovação colaborativa e competitividade: anais. Universidade Estadual de Ponta Grossa, Ponta Grossa. Não paginado. (2011)
2. Latour, B.: Jamais fomos modernos. Ed. 34, Rio de Janeiro. (1994)
3. Freitas, H. C. A.: A rede sócio-técnica: uma proposta metodológica de análise de cursos construídos em parcerias. In: Conferência Internacional Educação, Globalização e Cidadania: Novas Perspectivas da Sociologia da Educação, João Pessoa. *[Anais]*. International Sociological Association, João Pessoa. (2008)
4. Senker, J., & Marsili, O.: Literature review for European Biotechnology Innovation

Systems (EBIS). University of Sussex, Sussex. (EC TSER Project, Science and Technology Policy Research Unit). (1999)
5. Torres, T. Z., Pierozzi Junior, I., & Pereira, N. R.: Gestão do conhecimento em Instituição de Pesquisa, Desenvolvimento e Inovação (PD&I): abordagem processual integrada. In: Conferencia Iberoamericana en Sistemas, Cibernética e Informática, 8.; Simposium Iberoamericano en Educación, Cibernética e Informática, 6.; Simposium Internacional en Comunicación del Conocimiento y Conferencias, 4.; Simposium iberoamericano en Generación, Comunicación y Gerencia del Conocimiento; Conferencia Ibero-americana en Ingeniería e Innovación Tecnológica, Orlando. Memorias... International Institute of Informatics and Systemics, Orlando. v. 3, p. 233-238. (2009)
6. Soares, V. D.: Informação como fonte para a gestão do conhecimento nas organizações. In: Congresso Brasileiro de Ciência da Comunicação, 28., Rio de Janeiro. Anais… Intercom, São Paulo. pp. 4. (2005)
7. Corrêa, E. S.: Comunicação digital e novas mídias institucionais. In: Kunsch, M. M. K. (Org.). Comunicação organizacional: histórico, fundamentos e processos. Saraiva, São Paulo. v. 1, pp. 317-335. (2009)
8. Cobo Romaní, C.: Intercreatividad y Web 2.0: la construccion de un cerebro digital planetario. In: Cobo Romaní, C., & Pardo Kuklinski, H. Planeta Web 2.0: inteligencia colectiva o medios *fast food*. Universitat de Vic., Grup de Recerca d'Interaccions Digitals, Barcelona. cap. 2, pp. 43-59. (2007)
9. Costa, L., Junqueira, V., Martinho, C., & Fecuri, J. (Coord.): Redes: uma introdução às dinâmicas da conectividade e da auto-organização. WWF-Brasil, Brasília, DF. Disponível em: http://www.aliancapelainfancia.org.br/pdf/redes_wwf.pdf. Acesso em: 14 maio 2013. (2003)
10. Primo, A.: O aspecto relacional das interações na Web 2.0. E-Compós, Brasília, DF, 9, pp. 1-21. Disponível em: http://www6.ufrgs.br/limc/PDFs/web2.pdf. Acesso em 10 mar. 2013. (2007)
11. Cobo Romaní, C.: Mapa de aplicaciones: una taxonomía comentada. In: Cobo Romaní, C., & Pardo Kuklinski, H. Planeta Web 2.0: inteligencia colectiva o medios *fast food*. Universitat de Vic., Grup de Recerca d'Interaccions Digitals, Barcelona. cap. 3, pp. 61-88. (2007)
12. Jeong, H., & Chi, M. T. H.: Construction of shared knowledge during collaborative learning. In: Hall, R., Miyake, N., & Enyedy, J. (Ed.). Annals of the 2. International Conference on Computer Support for Collaborative Learning. Toronto. pp. 1-5. (1997)
13. Torres, T. Z., & Souza, M. I. F.: Cultura da convergência e a perspectiva transmidiática na produção de conteúdos pedagógicos. In: Congresso Brasileiro de Ciência da Comunicação, 34., Recife. Anais... Intercom, Intercom. pp. 1-15. 1 CD-ROM. (2011)
14. Schlemmer, E., Saccol, A. Z., & Garrido, S.: Um modelo sistêmico de avaliação de softwares para educação a distância como apoio à gestão da EAD. Revista de Gestão USP, São Paulo, 14(1), pp. 77-91, jan./mar. (2007)
15. Santaella, L.: Estética de Platão a Peirce. Experimento, São Paulo. (2000)
16. Weller, M.: Social objects in education. Disponível em: http://nogoodreason.typepad.co.uk/no_good_reason/2008/01/whats-a-social.html. Acesso em: 15 fev. 2013. (2008)
17. Gâmbaro, B., Pereira, N. R, & Torres, T. Z.: Organização pedagógica de espaços colaborativos de aprendizagem. In: Congresso Brasileiro de Ciência da Comunicação, 34., Recife. Anais... Intercom, Recife. pp. 1-15. 1 CD-ROM. (2011)
18. Santaella, L.: Culturas e artes do pós-humano: da cultura das mídias à cibercultura. Paulus, São Paulo. (2003)
19. Faccion, D.: Processos de interação na cultura da convergência. Comtempo, São Paulo, 2(2), dez. Disponível em: http://www.revistas.univerciencia.org/index.php/comtempo/article/view/7289/6884. Acesso em: 10 abr. 2013. (2010)

20. Henline, P.: Eight collaboratory summaries. Interactions, (3), 66-72. (1998)
21. Patrício, M. R. V.: Tecnologias Web 2.0 na formação inicial de professores. 182 f. Dissertação (Mestrado em Multimédia) - Faculdade de Engenharia, Universidade do Porto, Porto. Disponível em: http://bibliotecadigital.ipb.pt/bitstream/10198/1971/1/Tese_MM_RaquelPatricio.pdf. Acesso em: 25 abr. 2013. (2009)
22. Torres, T. Z., & Souza, M. I. F.: Metodologia de organização de conteúdos para a transferência de tecnologia na Web 2.0. In: International Symposium on Innovation and Technology, 2., Lima. Proceedings... International Institute of Innovation and Technology, Lima. pp. 28-33. (2011)