

Newsroom 3.0: Managing Technological and Media Convergence in Contemporary Newsrooms

Benedito Medeiros Neto
University of Brasilia
medeirosneto@unb.br

Edison Ishikawa
University of
Brasilia
ishikawa@unb.br

Tor-Morten Groenli
Kristiania University College
tor-morten.groenli@kristiania.no

Gheorghita Ghinea
Brunel University and
Kristiania University
College
george.ghinea@brunel.ac.uk

Abstract

News consumers are changing their way of accessing and interacting with news content, of which they are now prosumers (combined producers and consumers). Consequently, communication organizations are facing great challenges posed by the decrease of paying readers and the competition imposed by emergent technologies that allow new forms to produce and disseminate news. To understand the role of the journalists and their managers in this challenge, we investigate how top news organizations are tackling this crisis. The results of this research, of a qualitative and exploratory nature, led us to propose a framework - Newsroom 3.0 - of a collaborative environment to support the production of news in an integrated, convergent and cybernetic newsroom. Newsroom 3.0 will provide support to the work of interdisciplinary teams, in respect of the coordination of the activities developed, as well as the cooperative production of content and communication between newsroom professionals and news prosumers.

1. Introduction

Change in newsrooms is nothing new. However, over the past 15 years, the pace of change has accelerated and gained a new dimension as a result of technological, cultural and economic changes. Particularly impacted has been the production process of journalistic newsrooms. These changes were summarized by Salaverría and Negrodo [34] in four central dimensions of journalistic convergence: business or economic, technological, professional and communicative.

Convergence in newsrooms has led to the presence of interdisciplinary knowledge, but it is possible to distinguish two cultures, journalistic and technological and related (production engineers, statisticians, design, sociologists, etc). Certainly, there are differences, which can start with the specific interests of each of these two

cultures. Journalism is concerned with the principles of objectivity, impartiality, and others associated with journalistic activity outside the newsroom. Technology and related people focus on issues related to readers' access devices, the process of producing news, and the construction of journalistic content. There are other more specific concerns, such as news recovery, multichannel distribution, and audience consumption analysis [6]. However, the goals of professionals tend to be the same, to inform the audience well.

Cyberspace and new forms of sociability are largely the result of new communication devices that have the potential to transform the way man relates to himself, to his work, and to the world around him. The emergence of these new devices, ICT (Information and Communication Technology) together with multiplicity of platforms and communication channels have laid the premises for the emergence of new behaviors, new forms of integration and new process of sociability at home, at school and at work [32].

The technological convergence between computing, telecommunications and the cultural industry is not an "irreversible" natural result. It is a result of the needs of economic groups that seek economies of scale in the scope of their productions and operations. As an example of Collaboration Networks and Content Exchange, the presence of social networks in the newsroom workplaces is highlighted, and in the editorial area there is the edition of e-books¹ Social networks and e-book publishing.

The research reported in this paper is justified for a few reasons, such as the new styles of being and acting in the interaction space of the essay, which is replete with interfaces with computers, digital networks, ubiquitous computing, hybridism, smartphone mobility and other artefacts. A second relevant justification is that, in the second decade of the 21st century, the techniques for the work of journalists, especially reporters and writers, diversify, and this allows for more exact texts to be written [21]. Accordingly, we adopt a technological angle and understand that convergence

and integration has as its principle the collaborative coordination of individuals, and resources [35].

In this context, our objective is the analysis and development of a newsroom model comprising: planning, content generation and publication, based on the visits to three big media organizations on three different continents. To this end, we review the need of convergence, semantic and integration in the newsroom of the future; describe the methodology to map the evolution of the newsroom in the context of convergence; based on this, we propose a conceptual framework to handle contemporary and future needs of newsrooms, and exemplify its use in different scenarios; lastly, we provide suggestions for future research and practical implications of the proposed framework.

2. Convergent, Collaborative and Semantic Newsrooms

Human development is a consequence of or is directly related to the domain of tools and their technological development. Machines, equipment or information systems, sometimes seen as platforms, allow for greater agility in the production, dissemination and access of information to a larger number of people [32]. In the context of the modern newsroom, these lead to novel convergent, semantic and collaborative dimensions, which shall now be explored in more detail.

2.1 Convergent Newsrooms

With the introduction of convergent multimedia and distinct distribution channels, newspaper companies began to require journalists to produce content for different platforms and formats. The literature highlights presence of studies related to the analysis of the process of convergence of newspaper writing, in the following aspects: planning, content generation; and publication [10] [25]. The change which occurs when a news organization had hitherto worked with traditional print media and then launches its publications on the Web has, for instance, been explored by Belochio [5]. Studies have also explored the implication of the distribution and expansion of the Zero-Hour in the context of convergence journalism, as well as of the expansion of collaborative journalism and the use of social networks internally and externally to the newsroom [14] [28].

Comparative studies, highlighting the pros and cons of convergence in Austria, Spain, and Germany have also been carried out [2], which emphasized the need for the development of convergence and integration models. Later studies comparing editorial strategies for cross-media news production in six countries: Germany,

the Netherlands, Switzerland, Austria, Spain, and Portugal confirm the increasing trend of newsroom convergence [22] [25]. Indeed, digital convergence is a worldwide trend. The reach of the Internet, social media and mobile devices reaches all citizens in all countries that rely on this infrastructure for their development and economic growth and convergence has been noted and studied in Japan [20], China [31] and Africa [23].

2.2 A model of collaborative writing environment

Journalists should be able to meet the demands of quality and time from newspaper management and at same time drafting the news production to the print and also to the cyberspace or Internet. They are required to write reasonable texts with editorial malleability. Secondly, they should favor a permanent productive work environment in journalistic writing; thirdly, they can rely on frameworks that use collaborative technologies or groupware software [11].

It is expected that these environments, most often composed of frameworks and collaborative systems, facilitate communication between people, guarantee the coordination of the same people and material resources, and facilitate the cooperation of professionals in journalistic production [34]. As collaboration involves these three aspects, it can be represented by the 3C Collaboration Model. Communication: the exchange of messages; Coordination or management of persons and resources, including technological resources; and the Cooperation of operations in a shared space. Research on the 3C collaboration model, based on the principles of communication, coordination and cooperation [16] was then continued in [8] which proposes the 4C Collaborative Model with an added dimension, namely networking, enabling people who collaborate to make Connections. This model was then enhanced by Costa et al. [9], who integrated the role of social network software in contemporary newsroom production

2.3 Ontologies of contents and the Semantic Web

From an early stage, research has explored a semantic orientation in journalistic production (e.g. the use of metalanguage, ontology and Semantic Web technologies), and how they can support the development of collaborative systems that support the functions of production within journalistic writing. Indeed, even before attempts at the use of semantic technologies, newspapers had already made significant investments in their news management systems and undertaken considerable standardization efforts in order to facilitate interoperability [33].

One of the main standardization frameworks in the journalism domain is the International Press Telecommunications Council² (IPTC), an international consortium of news agencies, editors and newspapers distributors [17]. IPTC NewsML-2 supports semantic underpinning in its standards and is an issue of great interest and relevance to our work.

In research studies of interest to us, Huovelin et al. [18] analyze data collected from the Internet and to identify information that has a high probability of containing new information. The identified information is summarized in order to help understanding the semantic contents of the data, and to assist the news editing process. In related work, Fricke and Thonsem [15] identify the necessity to integrate the department-oriented search and editing of news of a TV-newsroom, into a more integrated process, bridging this traditional division. So, they propose a news workflow modelling oriented by semantic annotated fragmented media.

More recently, Christensen and Jacobsen [7] presented a semantic news aggregator system called News Hunter, a semantic news aggregator. The system extract named entities and keywords from incoming text, and then store and use these to gather data from other resources capable of presenting journalists with up-to-date background information on incoming news messages, as well as live-updated information when writing new stories. Moreno-Schneider et al. [24] present a prototypical content curation dashboard, to be used in the newsroom, and several of its underlying semantic content analysis components (such as named entity recognition, entity linking, summarization and temporal expression analysis). The idea is to enable journalists (a) to process incoming content (agency reports, twitter feeds, reports, blog posts, social media etc.) and (b) to create new articles more easily and more efficiently. In earlier, work. Palmonari et al. [27] proposed a framework for news reading using data context to support reader interested in data-supported stories for data driven journalism and to journalists in the newsroom. To support these functionalities, they applied semantic technologies in the news domain to connect articles based on the co-occurrences of named entities or to extract relations among entities, which they called relational data journalism.

3.0 Methodology

This study focuses on the evolution of newsrooms and their support systems for news production in contemporary journalistic writing, with a look at information virtualization, social networks, cloud computing, new mobile devices such as tablets and smartphones, and the environment [19]. In so doing, we sought to identify the requirements and functionality for

constructing a framework for the provision of information in newsrooms.

This article is based on the results of field trips undertaken over sixteen months between 2015 and 2016 in the newsrooms of O Globo (Rio de Janeiro/Brasil), La Nación (San Jose, Costa Rica) and the BBC (London, UK). In each site, visits lasted around 30 hours; researchers observed journalists and editors in action as they worked on stories, conducted editorial meetings and produced news. Researchers also conducted and recorded in-depth interviews with reporters, editors and support staff of the three large media companies. The visits had the objective to collect the functional and non-functional requirements of the proposed model. Formal conversations during the visits were complemented with informal meetings outside the newsrooms, giving greater insight into journalists' professional culture and identity [36].

3.2 Comparison between the 3 main media organizations visited

Virtual collaborative work environments based on the 3C/4C model can be used in at least three different ways, one as a tool for Communication, as support for Cooperative work, or as a support for the model of journalistic production Coordination in Semi-faceted (or blended) format. Moreover, the implementation of another C, the C of Connection, is favored by ubiquitous communications.

Accordingly, one of the objectives of the visits was to evaluate the workflows in the 3 visited newsrooms, as detailed in the previous section. Five aspects were observed: integration and convergence, channel distribution, semantic and workflow perspectives. Workflow aspects can be summarized in the following. **O Globo:** The development in 4 stages of the integration between production of printed and digital news: a) evaluation of possible news of the day; b) construction of the contents identified as possible news; c) evaluation of the news produced; and d) formatting for printed newspapers and the provision of web pages. **La Nación:** the development of new languages for the management of the production process, faces a process of comings and goings, with varying success, as highlighted by interviews during our site visit in 2016. **BBC:** The newsroom is affected mainly by the introduction of technologies and digital transformations, use of tools and frameworks capable of integrating the Internet with routines of the news production process and use of semantic technologies. The framework based on this model proposed here is intended to guarantee the future use of various digital media and convergence, but according to a humanistic and social conception.

4. From Newsroom 1.0 to Newsroom 3.0

The need for new features for content and production management is important for the digital news industry. In this article three newsroom features are proposed: Newsroom 1.0; Newsroom 2.0; and Newsroom 3.0, the aim of which is to improve news production and knowledge management.

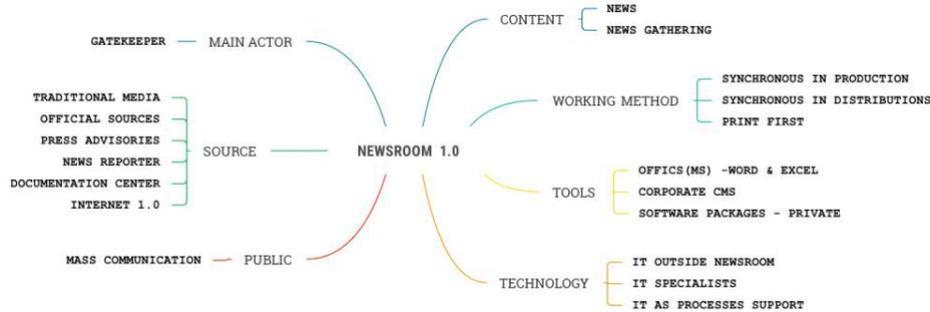


Fig. 1 Newsroom 1.0 features

the context of media convergence, but also the shifting balance between politics, economy and the media in the online era. The ethnography of O Globo, La Nación and BBC showed that traditional approaches to the political economy of the media [19], tend to privilege the power of structural forces (e.g. media ownership, professional conventions) [36]. Newsroom features are mainly composed of main actors, information sources, news audience, the content, the working methods, the tools used in the newsroom and the way technology is used in the newsroom. All these features are built to produce news that is distributed in broadcast channels. Fig. 1 shows these newsroom features, all encapsulated in the umbrella term Newsroom 1.0.

Here, the convergence of media production processes has received little attention from managers and researchers so far. While there are production processes in the development phase, there is little integration among production and distribution of different media types. The newsroom of O Globo which was visited in 2015 was an example of Newsroom 1.0, although it has since migrated to a Newsroom 2.0 structure. The requirements for journalists to work with multiple platforms and different multimedia content, to access readers on different (and predominantly mobile) devices, are pre-requisites for journalist to survive in the modern digital work. Journalists and newsroom professionals, therefore, cannot cling to traditional divisions such as print, radio, TV and digital, but should be prepared to work in any medium, and, towards this

4.1 Newsroom 1.0

The design of this first newsroom feature was the result of observation of its culture, so it is vital for understanding not only the production of knowledge in

end, master different languages and skills in ICT. Indeed, one of their key competences is to know how to integrate the user, consumer and producer in the news production process, and to understand the role of this new audience [6]. Newsroom 2.0 is a reference tool for researching the convergence of newsrooms.

4.2 Newsroom 2.0

This second newsroom features addresses the work of journalists in newsrooms producing content for multiple media: print, radio, television, the Internet and others. Specifically, the features show the change in journalistic practice and workflow in the newsrooms of media companies and business groups.

The visits to the cited newsrooms offered a useful script through which to observe the power dynamics within newsrooms and the way historical legacies shape news organizations but visits also paid attention to the role of technologies, for examples tools and information systems in use by the various journalistic agencies in news production, and how they are impacting the people, material resources and business.

The main differences in respect of Newsroom 1.0 are: a new actor (the Web Editor), whilst Wikis, Databases and Social Networks are added to the information sources, and the community is added to the public features category. In Newsroom 2.0 the content is scrutinized before being published and the working methods are synchronous processes to produce mainly

printed news. Moreover, the tools used to produce news are software packages whereas the IT used to produce the news is a distinct department outside of the newsrooms. All these features are built in order to produce news distributed through broadcast channels.

Journalistic companies that fully adopt the newsroom structure of Newsroom 2.0 adapt their news production processes through online platforms where journalists now share a much greater pool of information. This has happened largely through technological innovation by introducing a second desktop screen: most journalists now sit facing two computers, one for writing up their reports, and another which broadcast real time news of others information of the company. From this perspective, attributes such as working in teams, collaborating and transmitting knowledge are now seen as positive differentials to employees. To assist in this process, there are electronic collaborative systems that assist employees “in the different phases of social interaction within the teams: communication, coordination, cooperation/ collaboration and connection” [29].

Furthermore, in Newsroom 2.0, digital media open up a space of experiments and actions for communication. Artificial intelligence embodied in automated journalism manifests itself through processes of data access, interpretation, writing and distribution, is already a fact in the major newspapers and news agencies [30] is going to practice in newsrooms. The visited news organizations, La Nación and the BBC could fit the Newsroom 2.0 model. However, projects under development in these organizations allow us to say that they are migrating to a Newsroom 3.0 model, which will be described next.

4.3 Newsroom 3.0

A new leap forward, a new structure in terms of complexity, begins to happen as new news-producing agents present themselves via blogs and personal pages - all accompanied by a greater connection of people to the social networks using smartphones, a radical increase in the number of interconnected sensors, all whom produce and seek information, everywhere and at any time. Newsroom 3.0 features are thus established by “the digital transformation of the interconnection of people and networks that exchange information in two-way flow whenever possible” [13]. Technologies now facilitate editing, curating from various sources, and developing, through mash up practices, other products that were not originally from a single platform. This creates not only a job market, but also a very interesting digital experience.

The third newsroom feature shows how real-time technology is dramatically changing journalism. Due to

the speed of information, one does not have time to build a report in days or weeks, as might have been previously the case. However, at the same time, journalism guided by data, with the possibility of abundant data and information, allows us to practice more accurate journalism. On the other hand, production of news is only informative and not reflexive. These perspectives force us to use a collaborative environment to accelerate news production in newsrooms.

A new mode of news production thus emerges that incorporates new agents, with an increase of information flows generated precisely by these agents and IoT devices, all of which are now news prosumers [13]. These changes create openings for new ways to collect, create and disseminate news as well as to interact with news audiences in different ways [12].

A new step in terms of complexity, represented in part by Newsroom 3.0, begins to happen as, in addition to the original inhabitants and newcomers, the prosumers of news content appear on the scene. The characteristics that reflect its evolution from Newsroom

Table 1: Newsroom evolution

| Dimensions of the collaborative model | Version 1.0 | Version 2.0 | Version 3.0 |
|---------------------------------------|--|--|--|
| Communication | Low within and low outside of the Newsroom | High inside of the Newsroom and medium outside of the Newsroom | High within and outside of the Newsroom |
| Coordination | Synchronous of contents (average) | Synchronous and Asynchronous | Asynchrony of contents (high) |
| Cooperation | Industrial production process is rigid | Sharing production between printed and online news | Collaborative production environment, online first |
| Connection | Very low | Average inside and outside | High inside and outside |
| Business Model | By access by users and advertising space of the Journal. | By access by users and advertising space of the Journal and hit on site. | By online advertising and views. |
| Profile | Group of companies; Multinational Corporations; Local and Global Communities | Individual and Group of companies; Local, Regional and National | Few Group and Multinational Corporations; Individual, Local and Global |

2.0 are: the primacy of digital over print media, the presence of asynchronous processes, an increased curatorship (content created by the audience), as well as an increasing tendency to use social networks and IoT devices as news sources, all coupled with an incipient but growing use of augmented reality to convey news content.

After the consolidation of social network software in Newsroom 3.0, the connection has become an essential function, by “*allowing people to make connections with the content and among others*” [29] This context considers that collaboration occurs when people, who have at their disposal great autonomy and responsibility with the collective, work together sharing goals and commitments while motivating themselves intrinsically.

At this point the amount of information available to journalists is considerable and they have to handle all this in a very short time. Therefore, this new newsroom needs to use tools exploiting semantic web technologies into the world of professional journalism, in order to improve quality and productivity in the newsroom. Table 1 synthesizes and summarizes the evolution Newsroom 1.0 to Newsroom 3.0, with the application of the 4C collaborative model, in terms of use of the communications, coordination, connections and business model in the newsrooms.

Newsroom convergence is a multidimensional process that, facilitated by the widespread deployment of IT and telecommunications, affects the technological, business, professional and communicative spheres of the news production means, providing an integration of tools, spaces, working methods and languages previously disaggregated, so that the journalists elaborate contents that are distributed through multiple platforms, through the languages proper to each one [34]. At the *communication dimension* the increasing ubiquity of the internet and the multiplicity of mobile communications applications and their use in the work environment allows the evolution of the low communication from the old newsrooms to the high common of the contemporary newsrooms. In a similar way the *connection dimension* is increased by the virtual face-to-face communications applications (social media). At the *cooperation dimension* the traditional newsrooms follow the industrial revolution model to press the news (paper), which imposes rigid restrictions (viz. a high division of labor and high synchronization to produce the news), but in the transition (2.0) traditional press systems co-exist with the online press, creating challenges with their mutual coexistence. The management (*coordination*) differences between the two types of newsrooms leads to drastic reduction of the print media and open to the news possibilities of online *cooperation and coordination*, i.e. Newsroom 3.0.

Analyzing the evolution from Newsroom 1.0 to Newsroom 3.0 we conclude that the basic elements that remain in all 3 newsroom features and are the core of all newsrooms are: human beings (knowledge); the process to produce news (workflow) and the elaboration of the news (content). These basic elements were observed in the visits to the three media organizations and confirmed in the literature review. The managers in these news organizations always identified how good management of these elements led to satisfactory results.

5. A Framework for Contemporary Convergent Newsrooms

To develop our News Production Framework based on the evolution of Newsroom 1.0 to Newsroom 3.0 we extend the Interactive Knowledge Stack (IKS) [4]. The IKS is an open source community, whose projects are focused on building an open and flexible technology platform for a semantically enhanced CMS. With the resulting framework, one can design a virtual newsroom where the news flows among the newsroom stakeholders (chief journalists, journalists, press officer, news agencies, independent journalists, citizen media, etc.) in a custom-made process that adapts to the newsroom environment. Our framework extends IKS and uses IPTC News-ML2 and other journalism domain ontologies to deal with 4C by adding a new dimension to IKS that allows for flexible business processes in the newsroom. That is, it is not a matter of comparing frameworks, but that the IKS framework and the journalistic domain ontologies constitute building blocks of our proposal. Fig. 2 presents our proposed framework, structured along 3 dimensions:

The News Content Dimension – Under this dimension, the framework handles the elaboration of articles and documents. Moreover, the journalists can also semantically annotate their work, retrieve works semantically related with their work to better base their articles and put links to semantically related articles that may be interesting to the reader [3] [26]. The news content dimension is implemented by a CMS. The framework works with conventional content (text) and may be easily extended to handle images and videos (multimedia documents) or even mulsemmedia documents. It also may work with information/knowledge extracted from big data expressed as infographics or tables.

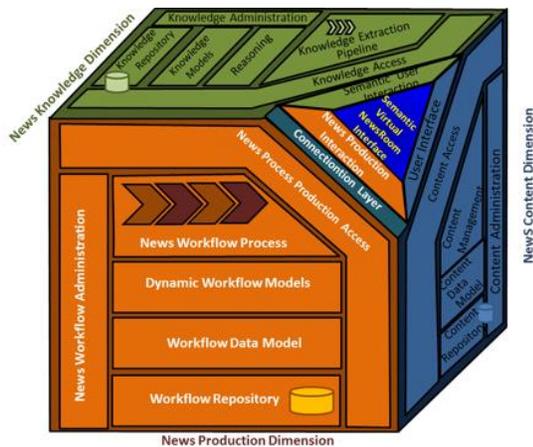


Fig. 2. Contemporary Convergent Newsrooms

The News Production Process (workflow) Dimension – this follows the Business Process Management Notation standards [10] and was modeled based on requirements gathered at the 3 newsrooms visited: O Globo, La Nación and the BBC. This dimension was designed to be flexible and to configure processes dynamically according to evolving newsroom scenarios and to also support content production in a potentially chaotic context. The news production dimension is implemented by a Workflow Management System (WMS).

The News Knowledge Dimension – follows semantic standards of the World Wide Web Consortium (W3C) like the RDF and OWL standards [1]. This dimension handles the annotation made in the news content dimension and news workflow dimension, persists that semantic information on a database and retrieves them through SPARQL queries, helping journalists to write content and build new newsroom process, respectively. The news knowledge dimension is implemented by a Knowledge Management System (KMS).

Apart from the three dimensions described above, the proposed model also comprises a connection layer and interfaces. The Connection Layer is an interface that connects the newsroom environment to the cyberspace allowing external communications to other applications such as WhatsApp, e-mail, Tweeter, Facebook, telegram and so on. These external communications are new channels of communication to publish customized content. The Semantic Virtual Newsroom Interface is an interface to journalists that integrates the three dimensions of the framework. At this user interface the journalists access the CMS, the WMS and the KMS. At the WMS they can model the process to produce high quality and reliable news. To help journalists in the modelling process the KMS offered semantic annotations of available processes and activities.

Finally, the CMS follows the process build at the WMS. So, every journalist involved in this news production have a task and it appears to him with a deadline. At the end of the process, the news is available in the appropriate channel with opportunity.

6. Scenarios of Use

6.1 Three Prospective Newsrooms Scenarios

Whilst printed news is in a process of a rapid obsolescence and profit margins of news organizations are narrowing as a consequence, traditional news readership is also changing and even more so as youngsters are exposed to new ways of accessing information. The fact is that news sector experiences a crisis never seen before, and multiplatform journalism seeks new business and production models [34].

However, news information will exist and increase in the future. Not only in the old fashioned printed way, with a tendency to decrease, but in a more ubiquitous, customized way and provided for free for many consumers. To show the usefulness of the proposed framework model, described in Section 5, in this not so distant future, three future newsroom scenarios were built, structured along three categories: Business model; Journalism professionals and Technology.

6.2 Applying the framework model

The production of news inside newsrooms is analyzed through the lens of 3 different newsroom structures, evolving from Newsroom 1.0 to Newsroom 3.0.

6.2.1 Newsroom 1.0 vs. Scenarios A, B and C. This first feature of Newsroom 1.0, presented in Section 4, may coexist in the versions of the identified scenarios (A, B, and C). Here, the news may be printed and sometimes digitally accessible, through the institutional site or, indeed, through social networks.

Scenario A) A conventional news organization could be structured in four levels (operational, knowledge, management and strategic levels) and has many functional divisions (sales & marketing, financial & accounting, production and human resources divisions), as any organization of the industrial age. In this scenario, the heart of a news organization is the newsroom, which is analogous to the production division of a factory. The newsroom is where the newspaper content is produced and in a conventional newsroom the process of producing news in the knowledge/operational level is generally very structured and highly synchronized.

News production in Newsroom 1.0 has a traditional media ecosystem basically comprised of few sources and large communication companies. In this scenario A the hierarchy is very rigid. However, the hierarchy has a minor role in small companies (scenario B) and in the communities of practices such as the scientific communities (scenario C).

Scenario B) In scenario B, that of a local and regional newspaper network, the newsroom's management level may have many levels and the most important is the gatekeeper who selects the news which will be printed or even published on the news web site. The newsroom's strategic level establishes the editorial line, regardless of the feature.

As the available information grows at an exponential rate, it is a counter-productive process; moreover, it doesn't guarantee high quality news as a single version is produced through the sole gatekeeper who is responsible for the selection of published news and its distribution to the readership. In this scenario, the team is in a place (newsroom) where people work together in a synchronous manner; therefore, this system needs to be strongly connected.

Scenario C) Through analyses it is possible to understand how each scenario can adopt technologies for Newsroom 1.0 as well as the variations that occur regarding the use of the framework model's CMS, WMS and KMS. In this scenario, the operational level of the CMS is very intertwined with the relationship level of the WMS, and thus the newsrooms knowledge level of the KMS is hypertrophied.

6.2.2 Newsroom 2.0 vs. Scenarios A, B and C. Here we illustrate how each scenario (A, B and C) adopts features of Newsroom 2.0.

Scenario A) As the web evolved, new types of news media content were brought to the market: printed newspapers, radio, television, the Internet 2.0 and so on. Although the newsrooms were restructured to integrate the cited communication channels, the process to handle the new news media content, the basic production of content remains quasi similar to that of Newsroom 1.0. The production of narrative news almost always follows a synchronous process. A concrete example of news organization where multiplatform integration is a reality in Scenario A is La Nación (Costa Rica). Another example is O Globo where we identified many success cases of newsroom convergence and integration. Also, in this scenario, the data journalism occurs more frequently than in other scenarios, since it requires a team of specialists that only big media companies can afford. The loosely integrated and asynchronous cooperative environment can produce many versions of the same news, each one for a different media content type.

Scenario B) The integrated and convergent newsrooms of the small newspapers had to be restructured to handle many different types of media content and media sources, such as those stemming from news agency, big data, as well as to identify other confidential sources. The gatekeeper team guarantees the quality level of the news. As the team is in a place (newsroom) where people work together in synchronous ways, this operation system is still strongly connected. Also, smaller newspapers have an integrated newsroom to produce content to many channels with different communication languages (printed news, digital news, radio, TV, customized news (info services). In this Scenario, there are few divisions of the tasks and responsibility, and consequently some people can do various activities. Also, the media organizations use many technologies in their information systems (IS for marketing & sales, financial & accounting, human resources, etc.), which is implemented with different technologies. In consequence, they all demonstrate a loosely integration.

Scenario C) Newsroom 2.0, a convergent newsroom, presented in section 4, may coexist with production of news for a specific community. Normally, these type of newsroom are small and they resolve the problems of quality well, since speed is not always a priority. The use of semantic technologies can occur with the use of KMS to support a CMS or a WMS. The enormous quantity of articles produced in this scenario forces the use of semantic tools in order to enable search and research based on evidence. In this scenario, the production and edition of a specific article is a peer dialogue within the community, improving quality and productivity. It is thus possible to understand why Scenarios B and C can adopt a free or economical CMS.

6.2.3 Newsroom 3.0 vs. Scenarios A, B, and C.

Scenario A) The evolution in the production of journalistic contents, which comprises the retrieval of data and information, and the distribution of the news goes through the said digital transformations (activities, processes, competencies and models to fully leverage the changes and opportunities). The said digital transformations are already well practiced in several business segments and markets. The first challenge for New Journalism, sometimes called Cyber journalism, is to continue producing content with quality, in a scalable manner and with the dynamism and speed characteristic of the Internet. The said challenge must be achieved with minor costs in this Scenario A for big players. To achieve these goals, many technologies are aggregated in the Newsroom 3.0 model, in order to create a more dynamic newsroom virtual environment, where any journalist from any country could collaboratively contribute to produce any content at any time.

Scenario B) The second challenge is to solve the increase in the volume of news to be produced and the diversity of content (almost customized for each reader/client). In this Scenario, we find the local and regional newspapers occupying this niche. However, news quality still remains as a valuable asset, even if it is for short and objective news. Here, quality can be achieved through a curator (watchkeeper) journalist, which is quite different to a gatekeeper: the former decides whether a given message will be distributed to the readers, for example, while the latter decides what will be produced and published.

The activities related to data journalism have been more difficult to establish in this Scenario than the other two because small companies usually cannot afford a specialized team to undertake it

Scenario C) The Newsroom 3.0 model applied to Scenario C needs to be adapted yet, however this will be faster than in the other scenarios. The variations in the use of technology and semantic approaches occur in the same way as at the two previous scenarios, but with more intensity. The potential to use of a semantic CMS is not only strong here, but also a necessity, especially in the health/biology research area. The news quality based on ontologies stored in KMSs will be intensively used for scenarios A and C. Finally, in this Scenario C, the workflow for production of news (WMS) will be increasingly distributed.

7. Conclusion

Since the post-war era, the same business model has remained unchanged around the world: producing single media content by selling media products and advertisements, spaces on media. The main feature was broadcast and its diffusion or the broadcast journalism. But the last three decades the challenge is being to transform a traditional, stagnant production branch into an environment integrated and convergent. Today, many journals already this feature. At least for a good part of its productions changed to Integrated Journalism. However, the arrival of the digital transformation is not only to replace an old or operational strategy of communication with a new, as consequence the mobile on the life of almost all people, but the introduction of a feature of new production of the news more flexible, innovation-friendly with use or support of Web 3.0.

We propose a framework model for newsrooms that captures both journalistic and technical considerations, and compared these features based on the 4C collaborative model. And it doesn't forget the business model, the knowledge and skills of the Journalism professionals and technology for propose three perspectives scenarios. The framework model that has been proposed in this paper has emanated as a result of

visits to 3 newsrooms of highly respected journalistic organizations throughout the world. It is worth mentioning that the 4C model of collaborative has not yet been applied to the context of convergent newsrooms, which is a task what we have undertaken in the present research.

We have elaborated a framework model based on main facets, which translates to the dimensions of the newsrooms, in the present and the future: News Content Management; News Production Process (workflow); and News Knowledge Management. It has been derived in the context of 3 scenarios, which have been devised as a result of our newsroom visits.

The intention is for this framework to help journalists and news organizations to increase their productivity, engage prosumers and also aids to produce high quality timeous news. However, this is part of our future endeavors, which will also involve an implementation the framework in a proof-of-concept application, which will be evaluated in the real-world context of a newsroom.

10. References

- [1]. Antoniou, G., Van Harmelen, F., Hoektra, R. (2012). *A Semantic Web Primer*. The MIT Press; third edition.
- [2]. Avilés, J. A. G., Prieto, M. C., Kaltenbrunner, A., Meier, K., & Kraus, D. (2009). Integración de redacciones en Austria, España y Alemania: modelos de convergencia de medios. *Anàlisi: quaderns de comunicació i cultura*, (38), 173-198.
- [3]. Baños-Moreno, M. J., Felipe, E. R., Pastor-Sánchez, J. A., & Lima, G. A. B. (2015). Metadatos en noticias: un análisis internacional para la representación de contenidos en periódicos. En XII Congreso ISKO España y II Congreso ISKO España-Portugal.
- [4]. Behrendt, W. (2012). The interactive knowledge stack (IKS): A vision for the future of CMS. In *Semantic technologies in content management systems* (pp. 75-90). Springer Berlin Heidelberg.
- [5]. Belochio, V. D. C. (2012). Jornalismo em contexto de convergência: implicações da distribuição multiplataforma na ampliação dos contratos de comunicação dos dispositivos de Zero Hora. Doctoral thesis. Fed. Univ. of Rio Grande do Sul.
- [6]. Canavilhas, J. (2017). Novos atores na redação: como muda o jornalismo? In *Performance em ciberjornalismo. Tecnologia, Inovação e eficiência*. Campo Grande, MS: Ed. UFMS.
- [7]. Christensen, O.A. & Jacobsen, V. K. (2017) <http://bora.uib.no/handle/1956/16192>. Accessed Dec 10, 2017.
- [8]. Cook, N. (2008). *Enterprise 2.0: how social software will change the future of work*. Gower Publishing, Ltd., Aldershot: England.
- [9]. Costa, A. P., João Loureiro, M., Reis, L. P. (2014). Do Modelo 3C de Colaboração ao Modelo 4C: Modelo de

- Análise de Processos de Desenvolvimento de Software Educativo. *Revista Lusófona de Educação*, (27).
- [10]. Dailey, L., Demo, L., Spillman, M. (2005). The convergence continuum: A model for studying collaboration between media newsrooms. *Atlantic Journal of Communication*, 13(3), 150-168.
- [11]. Davies, J. (2017) *The BBC is using 'slow news' to fight fake news*. Available from <https://digiday.com/uk/bbcs-slow-news-focus-changing-newsroom-dynamics/> Accessed 17 March 2017.
- [12]. Deuze, M. (2006). Global journalism education: A conceptual approach. *Journalism studies*, 7(1), 19-34.
- [13]. dos Santos, M.C. (2016). *Comunicação Digital e Jornalismo de Inserção*. São Luis: UFMA-Labcom Digital.
- [14]. Filippo, D., Pimentel, M. & Wainer, J. (2011). Metodologia de Pesquisa Científica em Sistemas Colaborativos. *Sistemas Colaborativos*, 1, 379-404.
- [15]. Fricke, R. and Thonsem, J. (2014) <http://community.mediamixer.eu/documents/ucnewsroom>. Accessed Dec 10, 2017.
- [16]. Fuks, H., Raposo, A.B. and Gerosa, M.A. (2012) "Teorias e modelos de colaboração", In: *Sistemas Colaborativos*, Organized by Mariano Pimentel and Hugo Fuks, Elsevier, Rio de Janeiro, p. 16-33
- [17]. García, R., Perdrix, F., Gil, R. (2006). Ontological infrastructure for a semantic newspaper. In *Semantic Web Annotations for Multimedia Workshop, SWAMM*. Available from: <http://citeseerx.ist.psu.edu/viewdoc/summary?doi=10.1.1.97.9865>. Accessed 22 May 2017.
- [18]. Huvelin, J., Gross, O., Solin, O., Linden, K., Maisala, S. P. T., Oittinen, T., Toivonen, H., Niemi, J. & Silfverberg, M. (2013). Software newsroom—an approach to automation of news search and editing. *Journal of Print Media Technology research*.
- [19]. de Mendonça Jorge, T., Cardoso, S. G., Oliveira, E. C., & Neto, B. M. (2016). Experiencias de convergencia en Brasil y Costa Rica. Análisis del proceso de integración en redacciones periodísticas. *Los casos de Correo Braziliense, O Globo y La Nación*.
- [20]. Kostic, Z. (2009). The challenge of digital broadcast media: NHK (the Japanese broadcasting corporation), satellite, internet, mobile technologies and the future role of public broadcasting. In *Proc. ANZCA09 Communication, Creativity and Global Citizenship*
- [21]. Laje, N. (2012). Ideologia e técnica da notícia. *Série Jornalismo a Rigor.V.5*. Florianópolis: Insular, pp. 148.
- [22]. Larrondo, A., Domingo, D., Erdal, I. J., Masip, P. & Van den Bulck, H. (2016). Opportunities and limitations of newsroom convergence: A comparative study on European public service broadcasting organisations. *Journalism Studies*, 17(3), 277-300.
- [23]. Mabweazara, H. M. (2014). Digital technologies and the evolving African newsroom': Towards an African digital journalism epistemology. *Jour. of Digital Journalism*, 2,1.
- [24]. Moreno-Schneider, J., Srivastava, A., Bourgonje, P., Wabnitz, D. & Rehm, G. (2017). Semantic Storytelling, Cross-lingual Event Detection and other Semantic Services for a Newsroom Content Curation Dashboard. *Proceedings of the 2017 EMNLP Workshop on Natural Language Processing meets Journalism*, pp. 68–73.
- [25]. Menke, M., Kinnebrock, S., Kretzschmar, S., Aichberger, I., Broersma, M., Hummel, R. Kirchoff, S., Prandner, D. & Salaverría, R. (2016). Convergence Culture in European Newsrooms: Comparing editorial strategies for cross-media news production in six countries. *Journalism Studies*, 1-24.
- [26]. Oliveira, E. C., Ishikawa, E., Horinouchi, L. H., Granja, T. H., de A Nunes, M. V., Rodriguez, D., Menegassi, R.B. Gois, L. & Ghinea, G. (2016). Designing an ontology-based Zika virus news authoring environment for the Semantic Web. In *Proc. 8th Int. Conference on Management of Digital EcoSystems* (pp. 197-203).
- [27]. Palmonari, M., Uboldi, G., Cremaschi, M., Ciminieri, D. & Bianchi, F. (2015). DaCENA: serendipitous news reading with data contexts. In *European Semantic Web Conference* (pp. 133-137). Springer Int. Publishing.
- [28]. Rublescki, A., Barichello, E. (2013). Jornalismo colaborativo e redes sociais no mainstream: estudo comparado do jornal zerohora.com e do washingtonpost.com. *Rumores*, 7(14), 99-118.
- [29]. Schauer, B., & Zeiller, M. (2011). E-Collaboration Systems: How Collaborative They Really Are. In *Proc. of COLLA 2011—The First International Conference on Advanced Collaborative Networks, Systems and Applications*.
- [30]. Squirra, S. (2016). As tecnologias mergulham a comunicação em uma cerebralidade artificial. In *Cibertecs: conceitos, interações automações futuras*. Organizador S. Squirra. São Luís, MA : LabCom Digital.
- [31]. Sparks, C., Wang, H., Huang, Y., Zhao, Y., Lü, N. & Wang, D. (2016). The impact of digital media on newspapers: Comparing responses in China and the United States. *Journal of Global Media and China*, Volume 1 Issue 3, September 2016. SAGE Journals.
- [32]. Temer, A. C. R. P. & Nery, V. C. A. (2009). *Para entender as teorias da comunicação*. Uberlândia: Edufu.
- [33]. Troncy, R. (2008). Bringing the IPTC news architecture into the semantic web. *The Semantic Web-ISWC 2008*, 483-498.
- [34]. Salaverría, R., Negredo, S. (2008). Periodismo integrado: convergencia de medios y reorganización de redacciones. *Sol90*.
- [35]. Schwingel, C. (2012). Jornalismo convergente através de plataformas de altíssima resolução: o projeto 2014K. *Jornalismo convergente: reflexões, apropriações, experiências*. Florianópolis: Insular, 255-267.
- [36]. Undurraga, T. (2017). Making news, making the economy: technological changes and financial pressures in Brazil. *Cultural Sociology*, 11(1), 77-96.