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Techno-Scientific Temper of Three Nigerian Newspapers

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Abstract
The culture of science and science communication in Nigeria are deemed as fragile compelling researchers to interrogate how, say newspapers contribute to creating awareness and knowledge of techno-science matters. Research data on this is scanty in Nigeria thus necessitating this study which examines the character and extent of techno-science coverage in three select Nigerian newspapers to determine the frequency of coverage, orientation of the reports, genre or formats of reporting, sourcing of information and depth of reportage. The discourse is hinged on the agenda setting theory while the research method is a content analysis of 156 issues of *The Guardian, Leadership,* and *Daily Trust* newspapers for the year 2012. The findings show that of the 329 techno-science stories captured in the study, biomedicine was the most frequently reported topic at 26.44%; routine reporting (65.96%) exceeded event-specific reporting (34.04%); the news format (54.71%) was the more common genre of reportage; foreign sourced stories (54.10%) outnumbered locally sourced reports (45.90%) and in terms of depth, 42.25% of the stories were briefs. The study recommends that for the analysed newspapers to set meaningful agenda on techno-science in Nigeria, they need to broaden their scope of coverage beyond biomedicine and the news format of presentation; deepen the discourse/content of techno-science information by becoming more deliberative; consolidate on routine science coverage as well as pay more attention to local sourcing of techno-science information.
Keywords: Science Journalism, Content Analysis, Agenda Setting, Africa.

1. Introduction

Science, technology and innovation are key aspects of a modern society. Indeed, the level of the development of science, technology and innovation is significantly related to the general development of a country. Africa, including Nigeria is not categorised as an advanced or developed continent. Much of this categorisation is due principally to the parlous state of science, technology and innovation. In the same vein, the communication of science whether in the media or outside has a great bearing on the public understanding, popularisation, and utilisation of science. More importantly, science communication helps to improve science literacy. Outlining the six parameters with which we measure science communication culture, the European Union (2012) identifies the following: the national communication infrastructure, political attention, the actors involved, the academic tradition, and the science journalism situation. Using these six parameters, a country can be said to have (a) consolidated, (b) developing, or (c) fragile science communication culture. We think that Africa including Nigeria has a fragile science communication culture. It would be interesting to see it this fragility shows up in the coverage of science and technology in three Nigerian dailies.

Science communication is an emerging multidisciplinary field of study which is gathering momentum in recent times. Its major aim is to link the science community with the public and other critical stakeholders such as government, non-governmental agencies, communities, families, individuals and the society at large. It serves to deepen public appreciation and understanding of science though science popularisation and dissemination.

We live in a techno-scientific world where science and technology assume a focal point in the lives of citizens. For, as the National Science and Technology Centre, Australia puts it, "Science is not just functional – it helps to illuminate the world in new and unexpected ways… science also offers profound challenges and uncertainties. The role of science communicators is often to help make these hidden dimensions more visible and better understood – enabling science to be seen in its social and cultural contexts, and facilitating conversations about its meaning and significance" (anzSKA 2010). It is also true that in no aspect of science are the issues of challenges and uncertainties as pervasive as in the field of nano-science and technology. Perhaps this is why Kennedy (2010) observes that, "knowledge about the natural world is a mainstream of the culture…", that, "a broadly spread citizen understanding of science and technology is a public good", and that, scientific understanding is a precious resource for society…"

Science journalism, an aspect of science communication is also fraught with challenges and matters arising as Dunwoody (2008) notes to include the following: (a) Science news is overwhelmingly print-oriented and focused on biomedical topics; (b) television science reinforces the legitimacy and sacredness of science; (c) coverage of science follows journalistic rather than scientific norms; (d) accuracy of science news stories is a contested arena; and (e) appropriate training for science journalism remains a contested topic. This study affords us the opportunity to make data-based observations about how science and technology are covered by select Nigerian newspapers.

2. Review of Related Literature

This section deals with aspects such as the issues surrounding science and technology, media coverage of the subject matter as well as related research in science communication. The import of the review is to enhance a more robust understanding and appreciation of the state of research on the subject particularly for those who are not familiar with techno-science communication.

Science writing certainly brings up several issues. Particularly concerning sciences such as stem cell research, evolution, or climate change; Kennedy and Overholser (2010) observe that there is an interweaving with moral or ethical controversy. They add that the journalistic norm of objectivity – the practice of assigning equal attention to contentious views makes the coverage of science and technology more challenging. Indeed, Hellsten and Nerlich (2008) affirm that, "moral and ethical questions… may result from increasing competition within the science, between research teams and between science communicators themselves, including scientists' increased need to seek public recognition via the mass media and the internet…"

In their study of the framing of science and technology ethics in the Chinese newspaper press, Xie, Tang and Xie (2012) explain science and technology ethics to mean, "standards or principles that the society and public use to appraise the science and technology activity as right or wrong, and the awareness of considering the sci-tech activities… . This means that science and technology do have important societal implications.

To Roco and Bainbridge (2005), the aim of the societal implications should be that of maximizing human benefit. Considering the communications angle, they observe that, "media analyses show that groups with views at the extremes of the spectrum of opinions, either exaggerating the benefits of or mistrusting nanotechnology, have a disproportionate voice in the mass media, which impedes public understanding of both potential benefits and possible risks". They caution that nanoscientists, engineers, and technologists must show true respect for inter-disciplinary discussion of ethical and social dimensions. Additionally, reputable science-savvy organisations are required to articulate clearly the diverse methods and principles of nano-technology as well as their short and long term benefits and uncertainties of nano-technology to engender public trust and encourage people to make reasonable nano-technology decisions.

In the earlier days of the development of nano-science and technology, the Royal society of and The Royal Academy of Engineering (2004) pointed out that developments in science and technology hardly occur "in a social and ethical vacuum". They state that, "some nano-technologies will raise significant social and ethical concerns" some of which include:

(a) Disagreement about how much of an economic impact, nano-technologies will have.
(b) The potential for nano-technologies to intensify the gap between rich and poor countries because of their different capacities to develop and exploit nanotechnologies – a 'nanodivide'.
(c) Nano-technologies e.g. sensing devices… used to achieve greater safety, security and individualised healthcare…might be used in ways that limit individual or group privacy by covert surveillance, etc.
(d) Nano-technologies that enhance human capacities e.g. improved cochlear and retinal implants to improve or restore hearing and eyesight worry disability rights groups on the grounds that this might lead to stigmatisation of those without enhanced capacities.
(e) Military developments in the area of nano-technologies raise obvious social and ethical issues e.g. manipulation of biological and chemical agents using nano-technologies resulting in new threats difficult to detect and counter.

The significance of this knowledge is so that the discerning science communicator may become alive to the issues of communicated messages which must be complete and effective.

2.1 Media Coverage of Science and Nano-Technology

The media see themselves as having the obligation to inform, create awareness, influence opinion, affect perception, increase knowledge though media education and play an advocacy role to influence policy and decision making for individuals, groups, and society. The media do this by giving attention, according prominence, setting and building agenda on a wide range of issues including science and technology. Let us now take a look at the character of this coverage in Africa and elsewhere.

A team of researchers led by George Lugalambi, domiciled at the Makerere University, Uganda and sponsored by Unesco (2011) conducted a study on the coverage of science and technology in Africa. The study content-analysed newspapers in Cameroon, Ghana, Kenya, Namibia, South Africa, and Uganda. Some of the results of the study were that, about 85% of the articles were in the news category while 15% were features. Also, 69% of the stories were written by local journalists and 6% by foreign writers. As to the origin of the stories, 68% originated locally while 25% and 6% had foreign and mixed origins respectively.

Other findings were that, of the 15 fields of science and technology categorised, environment/ecology accounted for 19%, biomedicine 15%, technology 13%, and food and nutrition 9%. The majority of the stories (43%) had a positive tone, 15% was negative and 28% neutral. Also, 52% of the articles emphasised benefits, 17% risks and 31% mixed; 80% of the stories were on controversies; 72% were event-based while 25% were process-

based; 45% of the stories were attributed to local sources; 30% to foreign sources and 25% mixed sources. Also, 40% of the stories had male sources while 9% featured female sources. The study recommended among others a close working relationship with, "training institutions to introduce science curricular as a way of improving the understanding of science and technology… and coverage."

In Germany, Guenther and Ruhramnn (2013) focused on science journalists' selection criteria and depiction of nanotechnology in the German media. It was a face-to-face survey of science journalists from different German media outlets. The findings showed that professional role conception, personal interest, news factors, and organisational process were the major influences. Journalists also showed high, positive attitudes towards nanoscience and technology. However, an observation was that, the coverage of scientific evidence was mainly dictated by the science journalists' focus on beneficial or risky aspects of the emerging technology. They were more likely to stress scientific uncertainty in their coverage of risk. The authors made use of the five levels of gate keeping influences namely: individual factors, communication routines, organisational level, the social and institutional level as well as the society system level, all visualised with the help of Weischenberg's Onion Model.

In Slovenia, Groboljsek and Mali (2012) sought to, "explore the ways national newspapers in Slovenia cover issues on nano-technology and how scientists in the field of nanotechnology in Slovenia perceive media coverage of the issues." They conducted a content analysis of articles in three key Slovenian newspapers from 2004 to 2009. They concluded based on their findings that, "nano-technology is poorly presented in Slovenian newspapers…. A significant proportion of articles were identified in science section coverage, but in general, the articles were dispersed across different sections of the newspapers and merely emphasised positive aspects of nano-technology. Yet the overall impression was that news concerning this area receives an insufficient amount of media attention". On the perceptions of media reporting of nano-technology, the authors state: "their responses reflect considerable dissatisfaction with the level and quality of media reporting…". The rationale for this state of affairs is that, "nano-technology seems to be still a novelty…partly due to the fact that this emerging technology is significantly converging with other research fields and hence in Slovenia, has not yet received the status of a scientific discipline.

Concerning the European media generally, Murphy and DelleCave (2010) examined the ways in which concepts of risk are excluded from nano-technology discourses in policy and news media domains via discursive techniques with consensus as the assumption. They analysed their sample based on a five-point dialogicality model of openness to difference, conflict emphasised, conflict resolution, conflict downplayed and consensus. The study involved 488 articles from the UK, Italian, French, and Irish newspapers. The results indicated a general increasing coverage trend though with national differences, twice as many background articles as foreground, a greater tendency to source nano news from the scientific field and a small amount of articles featuring risk. The main issues under the risk subject are human health, environmental pollution, ethics of science and economic consequences. One of the notable conclusions of the study is that, "there is a marked absence of NGOs, or risk experts as sources or experts in risk talk, these places taken instead by business leaders.

In a multinational study involving the United States, Japan, Germany, the United Kingdom and France, Peters (2013) studied the gap between science and media. He noted that, "the relationship between science and the public – or, more specifically, that between science and the media – has been characterised by "… terms such as …distance…gap…barrier… fence…". The study noted among others that researchers from the humanities and social sciences tend to have more interactions with the media than those from the sciences.

It is true as seen above that scientists, the media and the public are key elements in science communication. Kurath and Gisler (2009) give detailed expression to the notion of upstream public engagement. In their article: Informing, involving or engaging? Science communication, in the ages of atom-, bio and nanotechnology, they used literature analysis, participant observation and document–based analysis of communication and participation process as well as documented public engagement projects in the US, the UK, Switzerland and the EU. The authors saw upstream engagement as aiming at engaging public knowledge as a central factor in emerging science and technology related decision making and it entails a genuine and democratic science–society interaction enabling mutual learning". They concluded that in spite of promoting upstream engagement as a more participatory method, most projects "did not go beyond the epistemic basis of consensus formation or measuring public opinion." The solution is to, "create collective or socially robust knowledge and consider all actors as members of sophisticated civic cultures".

Regarding how scientific uncertainty of nano particle research is communicated by journalists and scientists, Heidmann and Milde (2013) observe that, "the fast growing area of research concerning the environmental fate of nano particles and the high level of uncertainty creates a high challenge for describing clearly the recent state of the current scientific knowledge". The result of this study showed that nanotechnology, "was often framed as rather certain and the media coverage emphasises positive aspects and benefits".

In an earlier study, this time a comparison of the UK and US newspaper articles on whether nanotechnology risks were discussed; Friedman and Egolf (2005) found a low coverage of nano-technology,

health and environmental risks. They also observed that UK articles were a little more negative and included some higher levels of concerns about nano-technology's effects on society. Their conclusion was that, "U.S. or UK newspapers and wire services published articles from 2000 and 2004 that would negatively influence public opinion about nano-technology.

In Faber's (2006) study of written popular media representations of nanoscale science and technology, the period of study was much earlier: 1986 to 1999. Faber stated that during this period, nano-technology was introduced to the public through articles in newspapers, magazines, and other general interest publications. At this time, the field had a fragmented public image as promoters of different representations of the field competed for legitimacy through a transitional social-rhetorical process mediated by biographical and other social renderings of the research.

Besides media coverage of nano-technology, Leinonen and Kivisaari (2010) also dealt extensively on nano-technology perceptions. Domiciled in Finland, the study also conducted an indepth literature review of public opinion and NGO perspectives including those of Friends of the Earth, Greenpeace, ETC group, Which? etc. They noted the importance of the ethical, financial, social, political, environmental and health/safety implications of nano-technology observing that, "general knowledge of nano-technology among lay people is very low," Leinonen and Kivisaari (2010) challenge science communicators to: (i) provide a clear definition of nano-technology in order to establish a common ground for building the conversation; (ii) limit the number of key concepts to two or three as more concepts tend to over-whelm and confuse the audience; (iii) clearly distinguished between fact and fiction in communicating nano-technology; (iv) make use of analogies, demonstrations, and animations as well as interactive engagements to achieve better understanding; (v) effective message framing, as well as contextual, qualitative and dialogical approaches which work better on opinion, attitudes, and perception.

Addressing another key point in communicating with citizens about nano-technologies, Petersen, Seear, and Bowman (2010) who studied the views of key stakeholders in Australia note that, "while the popular press – in all its forms…have a role to play in conveyance of information to the public, the majority of respondents noted that the media was (sic) only one of the many avenues that should be utilised to provide the public with information about nano-technology". Additionally, the European Union (2010) in its Code of Conduct for responsible nano-research outlined a set of principles for stakeholders to respect. These deal with meaning, sustainability, precaution, inclusiveness, excellence, innovation and accountability. Those who communicate nano-science and nano-technology including science journalists would do well to study those principles and adapt them to their work.

A fitting conclusion to this section and harping on the need for effectively communicating nano-scale science and engineering concepts may be captured in these words of Castellini *et al*. (2007), "engaging the public in conversations about nano-technology research can be valuable and rewarding experience for both researchers and their audience. Not only will it bolster public science literacy, and understanding of nano-technology, but it will also pave the way for more favourable public policy on nano-technology-related issues". And on science communication generally, Wilson and Batta (2013) state that, "a knowledgeable corps of science journalists, a surfeit of media of communication, communication-savvy scientists, and a vibrant public interest in science are the conditions needed for science communication to blossom.

3. Objectives of the Study and Research Questions

The main purpose of this study was that of examining the character and extent of science and technology coverage in three select Nigerian newspapers. The specific objectives included the investigation of (a) the frequency of coverage of science and nano-technology issues, (b) the news orientation of science reports, (c) the format of reporting science and technology reports, (d) the sourcing of science information in the newspapers, and (e) the depth of reportage of science and technology issues in the newspapers. To realise this purpose and objectives, the following research questions were set:

(i) What is the frequency or incidence of science and technology news in *The Guardian, Leadership* and *Daily Trust* newspapers?
(ii) How are science and technology reports in *The Guardian, Leadership,* and *Daily Trust* oriented? Are they event-specific or routine?
(iii) In which formats are science and technology reports mostly presented in *The Guardian, Leadership,* and *Daily Trust*?
(iv) How is science and technology information sourced in *The Guardian, Leadership* and *Daily Trust*?
(v) What is the depth of coverage of science and technology issues in *The Guardian, Leadership,* and *Daily Trust*?

4. Statement of the Problem

It is indubitable that we live in a world of science. The role, import, significance and contributions and perhaps

the dysfunctions of science in society are well documented. Most countries of the world strive to accord science and technology a prominent spot in the scheme of things. The European Union (2010) defines a science communication culture and delineates countries in the region into consolidated, developing, and fragile science communication cultures.

In Africa, the state of science and technology is less than salutary yet there are attempts to boost science and the public understanding of the field. In Nigeria, science education is paid some attention in terms of funding, enrolment of learners, recruitment of teachers, and establishment of science learning centres. There is a Science, Technology and Innovation Policy (2012) which places a certain role on the media for science information dissemination and popularisation.

On their part, the Nigerian media, particularly the print press have been known to engage in science communication. However, studies on print media coverage of techno-science issues are said to be fraught with problems generally. Dunwoody (2008) writes about science news being overwhelmingly focused on biomedical topics, a coverage that follows journalistic rather than scientific norms, the accuracy of science news being a contested arena and the appropriate training for science journalists remaining a contentions topic.

Similarly Kennedy (2010) quizzes: "is science writing a disappearing culture?" This laments the decline of sections or departments dedicated to science in major American metropolitan dailies. In Africa, a UNESCO (2011) concluded that there is the dearth of science and technology issues in the African media.

Given the above background, and having observed the paucity of studies on science coverage by the Nigerian press, this study sets out to determine the extent to which techno-science is accorded place in three Nigerian newspapers. The foci of investigation are frequency of coverage, format of stories, sources of stories, field of science covered, orientation of the reports, and depth of coverage.

5. Theoretical Framework

It is a recurring reality that the communications media including newspapers in modern times are pivotal in organizing all segments of contemporaneous life (Deacon, Pickering, Golding and Murdock 2010). This explains why researchers invest enormous resources to investigate the media in order to understand how man interacts, uses and learns from them. One of the ways researchers employ in probing the media including newspapers is the content analysis.

In carrying out content studies as the present one, researchers are guided by some theoretical framework. This is, "an abstract system of concepts and their relationships that helps us to understand a phenomenon" (West and Turner 2010). Indeed, Kirby (2008) observes that science communication researchers, "have relied mainly on content analysis of newspapers to determine what science, and how much of it, appears in the news media".

Clearly, in the study of science coverage in newspapers, the agenda setting theory becomes handy. Baran and Davis (2006) explain that the press is great at giving readers what to think about based on the map that is drawn for them by the writers, editors and publishers of the papers they read. By doing this, the media help people learn about a given issue, and the importance attached to such issues is judged by the way the issues are framed, displayed, positioned or quantified.

What this means is that the reading public that gets much of its information, knowledge, opinion, and perspective from newspapers may be helped to do so for science, technology and nanotechnology from the way the issues are reported, couched, framed, displayed, placed or given depth. It means that if newspapers place science and technology matters high on their news agenda, the readers may be constrained to view them as important and if the issues are low on their agenda, the public may interpret them as unimportant.

6. Method

This study adopted the content analysis research technique to determine the manifest (visible) content of science and technology issues in *The Guardian, Leadership* and *Daily Trust* newspapers in terms of frequency, news orientation, format of presenting information, sourcing and depth of reportage. The relevance of content analysis is to, "quantify salient and manifest features of a large number of texts, and the statistics are used to make broader inferences about the politics of representation" (Deacon, Pickering, Golding and Murdock, 2010).

The three newspapers mentioned above were selected purposively. *The Guardian* is a national (flagship) newspaper with its base in southern Nigeria. It has a serious tone and tends towards the elite, the business, upper and middle classes. The *Leadership* and *Daily Trust* newspapers are based in northern Nigerian and tend to popular readership. The study covered the period between January 1 to December 31, 2012. That year was deliberately selected given that it was the year Nigeria revised its Science, Technology and Innovation Policy, it was reasoned that science and technology issues would attract increased media attention.

The newspaper article in the form of news, column, feature, or interview constituted the unit of analysis. Science and Technology issues were categorised into ten areas namely: nano-science and technology, health/medicine, natural sciences, energy/environment, space/astronomy, agric/crop/animal sciences, etc. for the

purpose of determining their frequencies. To gauge the orientation of science reports, the contents were sub categorised into event-specific and routine reports. For format of report presentation, the sub categories were news, opinion/column, and feature/interviews. The sub-categories for determining news sourcing were foreign and local while those for determining depth were full page, half page, quarter page and brief reports.

In all, 52 weekly publications of science pull outs, sections or dedicated page(s) were involved in the study. The total amounted to 156 issues of the three newspapers while the sum of science and technology stories which occurred was 329.

7. Data Presentation and Discussion of Findings

The data presented here and the ensuing discussions are in tandem with the objectives and research questions formulated earlier in the study.

7.1 What is the frequency or incidence of science and technology issues in *The Guardian*, *Leadership* and *Daily Trust* newspapers?

Table 1: Fields of Techno-Science and Frequency of Coverage in *Three Newspapers*.

Fields of Techno-Science	**Newspapers**						**Total**	
	The Guardian		***Leadership***		***Daily Trust***			
	n	***%***	***n***	***%***	***n***	***%***	***n***	***%***
Nanotechnology	4	3.60	2	1.08	0	0	6	1.82
Biomedicine	28	25.23	27	14.67	32	94.12	87	26.44
Natural Sciences	21	18.91	6	3.26	0	0	27	8.20
Energy/Environment	10	9.00	23	12.5	0	0	33	10.03
Space/Astronomy	20	18.01	17	9.23	0	0	37	11.24
Agric, Crop, Animal Science	0	0	14	7.60	0	0	14	4.25
Geology Earth Science	7	6.30	2	1.08	0	0	9	2.73
ICT, Biotech Robotics, HTec	13	11.71	53	28.80	1	2.94	67	20.36
R/D, SC Policy, Funding, Training	6	5.40	29	15.76	1	2.94	36	10.94
Others	2	1.80	11	5.97	0	0	13	3.95
Total	**111**	**33.74**	**184**	**55.93**	**34**	**10.33**	**329**	**100**

Table 1 gives a clear indication of the fields of techno-science frequently covered by the three newspapers. Overall, the most frequently covered field was biomedicine which dealt with health and medical issues at 26.44 percent. This was followed by ICT, biotech and robotics which polled 20.36 percent. Science matters concerning space and astronomy occurred at 11.24 percent to position third while issues on science research and development, policy, funding and training took the fourth position at 10.94 percent. Energy and environmental issues had the incidence of 10.03 percent making the fifth rank in science coverage in the three newspapers. On the other hand, nano-science, the natural sciences, agric sciences and the earth sciences received lower frequency of coverage. Looking at the individual newspapers, the data show that *The Guardian*, Nigeria's flagship daily, accorded more attention to biomedicine (25.23%), natural sciences (18.91%), space sciences (18.01%) and ICT, biotech, and robotics (11.71%). On its part, *Leadership* gave prominent coverage to ICT, biotech, and robotics (28.80%), research and development, policy, funding and training (15.76%) followed by biomedicine (14.07%), and energy/environment sciences (12.5%). However, *Daily Trust* focused its coverage mainly on biomedicine at 94.12 percent and scarcely accorded other areas of science meaningful newshole.

The full import of these findings is that the three analysed newspapers did not spread their reportorial attention to all areas of techno-science. While prominence was accorded health/medicine, ICTs/biotech, energy and environment, space sciences and research, policy, funding and training issues, other important areas of techno-science were neglected principally nano-science and nanotechnology, agricultural sciences, natural sciences and the earth sciences.

The observations of this study can be placed in the context of other studies. Dunwoody (2008) noted that, "the bulk of what passes for science writing is about medicine and health". Dunwoody cites studies by Bauer (1998) which tended to confirm the notion of the medicialisation of science news; Pellechia's (1997) study which found that a set of elite US newspapers focused on medicine and health in over 70 percent of their science based stories; Jerome's' (1992) and Einsiedel's (1992) studies equally demonstrated the dominance of health issues in an analysis of science stories in seven Canadian newspapers. Dunwoody also noted that in spite of television's eclectic nature and their proclivities for covering natural history and the ecology, Gregory and Miller, (1998) also discovered the preponderance of biomedical topics. However, the UNESCO–sponsored (2011) study on the media coverage of science and technology in Africa found that in a classification of 15 areas of science, the four must covered sciences were environment and ecology (19%), biomedicine (15%), technology (13%) and nutrition and food sciences (9%).

The reasons for this character of reporting science are attributable to knowledge deficits among journalists (Khan 2006), the demise of science page due to the decline in the section/department dedicated to science (Kennedy 2010), as well as the complexity of science and technology, minimal investment by the media to improve the capacity of journalists, and lack of cooperation and trust between scientists and journalists (UNESCO 2011). To these we may add the lack of interest, passion, curiosity and enthusiasm for science journalism among correspondents, lack of commitment on the part of editors to assign and allot space, and the (mis)conception that science does not interest the public and may not improve sales or attract advertisers.

7.2 How are Science and Technology reports in The Guardian, Leadership and Daily Trust oriented? Are they event- dependent or routine?

Event-dependent coverage relies on occurrences whether spontaneous or planned and in that sense, the report is reactive. On the other hand, routine reports are presented as of course, deliberately offered at regular or frequent periods by the news organisation. In this sense, they are proactive. The following table shows data to help us determine the orientation of science reports in the three Nigerian newspapers.

Table 2: Orientation of Techno-Science Reports

Fields of Techno-Science	**Newspapers**						**Total**	
	The Guardian		***Leadership***		***Daily Trust***			
	n	***%***	***n***	***%***	***n***	***%***	***n***	***%***
Event-specific reports	36	32.43	76	41.30	0	0	112	54.04
Routine Reports	75	67.57	108	58.70	34	100	217	65.96
Total	**111**	**100**	**185**	**100**	**34**	**100**	**329**	**100**

Table 2 shows that the majority of science reports in the three analysed newspapers were carried as routine reports at the rate of 65% percent whereas the reports which were instigated by events amounted to 34.04 percent. For the three individual newspapers, routine reports out-numbered event-generated ones. This finding is significant in the sense that there was a deliberate attempt by the three newspapers to initiate science and technology reports without waiting for events, functions, speeches, conferences, and pronouncements to trigger them. This orientation is proactive and positive and spells good for techno-science journalism. However, UNESCO (2011) found out in its study on media coverage of science and technology in Africa that 72% of the science and technology-based stories were event-based whereas process-based stories scored 28%.

7. 3 What formats are techno-science reports mostly presented in The Guardian, Leadership and Daily Trust?

The formats of presenting journalistic messages are instrumental in determining the rationale, motivation, and utility of the messages. News articles are often written as reports of all past or future events to share information and intelligence and to enlighten. Editorials, opinions and columns are often scripted to contest, argue, persuade, disagree, agree and generally deepen discourses through analysis, interpretation, synthesis, backgrounding, localisation, forecasting, etc. Features, supplements, sections, interviews, and pullouts have the additional aim of exploration of the subject, education, and entertainment. Table 3 depicts how techno-science contents were presented in terms of format in the three newspapers.

Table 3: Format of Presenting Techno-Science Reports

Formats of Reports	**Newspapers**						**Total**	
	The Guardian		*Leadership*		*Daily Trust*			
	n	%	n	%	n	%	n	%
News	57	51.35	119	64.67	4	11.76	180	54.71
Opinions/Columns	10	9.01	2	1.09	1	2.94	13	3.95
Features/Interviews	44	39.64	63	34.24	29	85.30	136	41.34
Total	**111**	**100**	**185**	**100**	**34**	**100**	**329**	**100**

Table 3 indicates that the three newspapers presented techno-science stories through the news format at the rate of about 55 percent whereas the feature/interview format scored 41.34 percent and 3.95 percent for opinion and column formats. The data also show that apart from *Daily Trust* which presented more features/interviews (85.30%) than news and opinions, the two other newspapers: *The Guardian* and *Leadership* formatted their techno-science stories as news (51% and 64.67%) respectively.

The significance of this finding is that the three newspapers tended to give more information (news) than discussion, deliberation, analysis (features, opinion, column, etc.). This indeed has implications for depth. In a departure from this finding, the UNESCO (2011) study found, "evidence of a significant relationship between the articles and nature of stories, implying that news article were more likely to be event–oriented (82.3%) while features were more likely to be process–oriented (85.7%). Similarly, Anderson, Allan, Peterson and Williamson (2005) investigating the framing of nanotechnologies in the British press observed that, stories

were not typified as belonging to a specific news genre, but rather were positioned across a range of … hard news, science, health, educational, and business sections".

7.4 How is science and technology information sourced in The Guardian, Leadership and Daily Trust?
Journalists obtain information from several sources. Similarly, science correspondents obtain information for their stories from a variety of sources – scientists, other experts, publications, other media, and conferences, both foreign and local. This study concentrated on foreign and local variables. News sourcing provides a template for determining the participation, involvement and engagement of stakeholders in science communication. Table 4 gives specific insights into sourcing of techno-science issues in the three newspapers.

Table 4: Sourcing of Techno-Science Reports

Sources of Reports	**Newspapers**						**Total**	
	The Guardian		*Leadership*		*Daily Trust*			
	n	%	n	%	n	%	n	%
Foreign	68	61.26	76	41.30	34	100	178	54.10
Local	43	38.74	108	58.70	0	0	151	45.90
Total	**111**	**100**	**185**	**100**	**34**	**100**	**329**	**100**

The data in Table 4 indicate that cumulatively, the three newspapers obtained their techno-science stories from foreign sources at 54.10 percent while the local sources accounted for 45.90 percent. It is also clear from the data that *The Guardian* and *Daily Trust* obtained more of their stories from abroad whereas *Leadership* generated more of its science stories locally. It is fair to conclude that the three newspapers drew inspiration for the science stories almost equally from both foreign and local sources. What it means is that there were both local and foreign voices in science journalism in the three papers.

This finding can be compared with Dutt and Garg (2012) who conducted a study on science and technology coverage in English language Indian dailies. They found out that science news stories were sourced 50 percent from Indian news agencies and the other 50 percent from Europe and America. They also found out that science was not accorded prominent placement in the Indian newspapers and that dominant topics of coverage were health, environment, space science and technology and astronomy. In a related study involving the British press, Anderson *et al*. (2005) found out that general correspondents most often authored articles with only 13 percent of the sample written by science correspondents or editors.

In the UNESCO (2011) study, 45% of the articles included local sources, 50% foreign sources and 25%, a combination of the two sources. Also in terms of gendered sourcing, 40% were males, 9% females, 30% of mixed gender.

7.5 *What is the depth of coverage of techno-science issues in The Guardian, Leadership, and Daily Trust?*
Depth is a measure of seriousness, importance or prominence accorded an issue. Kobre's (1981) idea of depth reporting means revealing new aspects, giving perspectives, presenting causes, showing recommendations, etc. To MacDougall (1977), a much earlier writer, it means giving substance, factual background, localisation, interpretation, forecasts, etc. Table 5 presents the data on the depth of techno-science coverage in the three newspapers.

Table 5: Depth of Techno-science Coverage

Depth of Reports	**Newspapers**						**Total**	
	The Guardian		*Leadership*		*Daily Trust*			
	n	%	n	%	n	%	n	%
Full pg	3	2.70	42	22.83	6	17.65	51	15.10
Half pg	39	35.14	28	15.22	16	47.05	83	95.23
Quatre	14	12.61	35	19.02	7	20.50	56	17.02
Briefs	55	49.55	79	42.93	5	14. 70	139	42.25
Total	**111**	**100**	**185**	**100**	**34**	**100**	**329**	**100**

Data in Table 5 show that the three newspapers had a greater portion of their techno-science stories in brief measures. Stories were evaluated on the basis of full page, half-page, quarter page, and brief reports. It can be seen that 42.25 percent of the science stories were brief reports of several paragraphs. For *The Guardian* and *Leadership* newspapers, the measures were 49.55 percent and 42.93 percent respectively. However, *Daily Trust* had 47.25 percent of its science reports in half the pages of the paper.

Depth of coverage does have consequences for agenda setting and framing of issues in the press. The quantum of space or airtime allotted an issue, where, and how often it is placed allows the public to gauge its relevance, salience, prominence, significance and importance. Dekel (2010) lamented that one sees more coverage of the modern dance than science in Israeli newspapers. In India interestingly, Dutt and Garg (2012)

concluded that about half of the science news articles had a depth of three or more columns and were enriched with paragraphs or other illustrative devices to attract readers.

8. Summary of Findings and Conclusion

It is apparent that techno-science journalism is steeped in problems not only in Africa or Nigeria. To buttress this point, Claassen (2011) writing on science and the media in South Africa notes as follows: (a) the coverage of science and technology in the South African press is insufficient, (b) citing Rooyen (2004), less than 2% of editorial space in South Africa's top publications is awarded science and technology topics, (c) citing Mooney and Larshenbaum (2009), the number of U.S newspapers featuring weekly science or science related sections shrank by nearly two-thirds between 1989 and 2005, (d) only one South African newspaper (*Business Day*), magazine, broadcast station or Internet news site has a properly programmed science desk. In the light of these realities the present study is summarised as follows:

(a) For the period of this study, a total of 329 techno-science stories occurred in the three Nigerian newspapers analysed. Of the 10 science fields classified in the study, biomedicine (26.44%), ICTs, biotech, robotics (20.36%), research and development, policy, funding and training issues (10.94%), space science (11.24%) and energy and environment received more than 10% coverage. Other important areas of science such as nano-science/technology, agricultural sciences, natural sciences and earth sciences were accorded less attention.

(b) In the coverage of techno-science issues, the newspapers oriented their stories towards more of routine reporting (65.96%) than event-specific reporting (34.04%). This can be said to be a positive tendency because it conveys a proclivity for proactive rather than reactive techno-science coverage.

(c) Concerning the genre in which techno-science reports are formatted and presented in the three analysed newspapers, the study shows that the news genre was more common at 54.71% followed by the feature/interview format at 41.34% while the opinion/column genre occurred the least at a mere 3.95%. This means that the three newspapers tended to provide straight information more than engaging in more deliberative discourse afforded by depth opinion/editorial columns. This latter genre is critical in a democracy and a techno-scientific world where the citizen is expected to participate in the national science discourse as well as make informed choices.

(d) Regarding the sourcing of techno-science information for reportorial offerings, this study found that the three newspapers were almost equally given to sourcing their science stories from foreign (54.10%) and local (45.90%) sources. What needs to be said here is that in as much as it is necessary to present a cosmopolitan flavor of the news, it is critically important to give local authorities, scientists, experts, publications, and other such sources more voice in the news.

(e) In terms of how the three Nigerian newspapers gave depth or otherwise to techno-scientific stories, the study shows that 42.25% of published stories were in the form of brief reports. Full page stories amounted to 15.50%, half page stories got 25.23% while quarter page scored 17.02%. The conclusion that can be drawn from this finding is that more frequent full page, half page or quarter page stories would conduce to better, deeper, fuller, and more significant coverage of techno-science.

9. Implications for Theory and Practice

Following the literature reviewed in the course of this study and the findings that have become apparent herein, it can be deduced that for the newspapers involved in this study to set meaningful agenda on techno-science in Nigeria, they would require to broaden the scope of their coverage of techno-science beyond biomedicine, ICTs, biotech, space science and ecology to other important science topics including crop, animal, and agricultural sciences, nano-science and technology, natural sciences, the earth sciences, etc. For, as far as the tenets of the agenda setting/agenda building theory/hypothesis go, the public appears to take more seriously what the media pay more attention to.

This study also implies that for newspapers to be seen to contribute significantly to techno-science awareness, understanding, and knowledge, they should move beyond mere provision of information in news articles to deliberative discourses afforded by features, opinions, editorials, supplements, and columns. They should also engage local sources in the reportorial process to facilitate national public involvement, participation and engagement in techno-science.

Apart from this, sundry stakeholders – governments, scientists, research institutions, non-governmental organisations, communities, international agencies, professional bodies should commit to training, funding, research and all other activities that should generally help to uplift the science communication culture of Nigeria from its fragile state to a consolidated one. This naturally, according to the European Union (2012) involves improving the national science communication infrastructure, greater political attention to science, deeper commitment of all science and science communication actors and more solid academic tradition in science communication, an improved public attitude to science knowledge acquisition, and a more congenial science

journalism situation.

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