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Technology Communication in English: An Engineering Approach.

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Introduction

The purpose of this project is to analyse, through an engineering perspective, how the transference of technological knowledge to the mass media takes place. Moreover, it aims to test if it is being correctly done and if it is necessary to intensify the connections between academic environments and the scientific journalistic staff. The answer to this general proposal is broken down into different questions at the end of the present dissertation. To that end, several steps have been taken, both theoretical and practical.

The theoretical ones encompass an account of the spread of scientific knowledge from its beginnings, the importance of its learning and practice within academic environments, the consideration of scientific writing as a genre, and the consolidation of International English as the language of science dissemination. The practical part presents the analysis of current news items, read against the background of the previous theoretical input and their direct or indirect connection with specific contents (that is, subjects) included in Engineering degree programmes, with special attention to those that play a crucial role in the degrees from the ETSII at the UPCT.

In the part of conclusions, this dissertation poses several questions whose answer is directly related with the contents analyzed in the previous sections, both theoretical and practical. Finally, future indications for the challenging task of scientific communication by engineers, specifically in the context of Spanish higher education, are addressed.

Part 1: State of the Art

This section encompasses the issues mentioned in the introduction in regard to the theoretical background prior to the analysis, starting with a historical overview of science dissemination.

1.1.   A Brief Review of Scientific Communication in the Media.

In order to analyse how technology and media have evolved over time, it is necessary to start looking at the way technological news have been spread since the invention of modern journalism, especially, though not exclusively, in English speaking environments.

A first approach to the history of scientific journalism, coordinated by Camirand *et al.* (2018), allows us to conclude that the impact of technology on the world is intimately based on the relationship between science and journalism throughout five different periods, starting in the first quarter of the nineteenth century and until the present time.

1870-1920

In this period, scientific dissemination refers only, and for obvious reasons, to the press. Having played the role of a medium for political opinions, most newspapers at the time sought to distance themselves from political parties, becoming independent enterprises. As a result, newspapers that looked into current events, technological progress included, became more prominent.

With the economy booming in the late nineteenth Century, therefore, the press became specifically interested in the exploration and dissemination of scientific and technological advances. Concretely, scientific information was no longer the exclusive domain of scientific societies and cultural magazines which, to that date, had been created and addressed to a learned public. As a matter of fact, science began to pave the way for daily newspapers and periodicals.

1920-1945

During this period, ranging between the end of WWI and until the end of WWII, we observe that science had become a source of wonder for the general public, and scientists were turning increasingly prominent in society. Military advances that had come about during the two words contributed, in spite of their terrible consequences, to this general mode. What is more, newspapers and popular magazines presented scientists

with great admiration. However, this passion for science led some magazines to deliberately combine science fiction with science reviews for the general public, making it difficult for non-experts to separate fact from fiction. This coalesced, for example, in further decades, in the spread belief of the existence of UFOs.

In the 1920s, a new means of mass communication emerged: the radio. Soon, an educational aspect was added through the cooperation of universities, provincial governments and some broadcasters, in the format of scientific and cultural shows for school- and college-age clienteles. This would undoubtedly raise general awareness and interest in science and technology as a popular topic related both to remote discoveries and everyday life.

1945-1970

The post-war context was favourable to the expansion of the written press. In daily newspapers, 'regular' journalists sought to devote themselves to scientific issues. They felt that they had a role to play in informing the public of the state and advancement of science because it was an important vehicle for the modernization of society, not only in the present, but also in the future: expectations were still promising and certain at this stage. On another note, space exploration generated widespread enthusiasm, contributing greatly to the popularity of science among the public and the media.

Increasing numbers of journalists were constantly highlighting the expertise of scientists. However, this new context was not free from controversy, since it actually resulted in several factors becoming sources of friction between the two groups: to start with, journalists can make errors in the interpretation of information provided by scientists; likewise, scientists are sometimes obscure and unable to get their message across outside jargon, that is, in non-technical language. In short, the two professional groups had to adapt their methods in order to learn to communicate more accurately, instead of creating further confusion.

Furthermore, from the 1960s onwards, a new medium enters home: Television. As a consequence, science found new scope in the small screen during the early years of television, coinciding, for instance, with the arrival of man to the moon, a major international event followed by millions of TV watchers. The first scientific programs were generally educational and geared to a younger audience. A case in point would be the unforgettable documentary series *Cosmos*, launched by the end of

the 1970s and starred by the scientist and communicator Carl Sagan.

1970-1990

This period marks the end of unquestioned faith in science and technological development. Since the oil crisis and until the advent of the Internet, however, science journalists were increasing in numbers and grouped into professional associations. Consequently, science journalism became now a recognized specialty, at the same time that it occupied a prominent position both socially and economically. At the same time, the market for science magazines was thriving.
In contrast, on television, as on radio, science shows no longer sought to educate. Rather, the emphasis was placed on contemporary issues having an impact on the lives of citizens, in other words, on sensationalism: the entertainment society had been born to the detriment of accurate dissemination and pure documentary style.
The emerging environmental crisis, nevertheless further heightened an increasingly critical journalistic approach related with the dramatic consequences of uncontrolled technological and economic development. The environment became the topic of the day, and many issues were of concern to both journalists and the public: energy and nuclear arms, pollution, acid rain, the deteriorating ozone layer, and industrial illnesses would be the most widely repeated.

1990-Present

Since the 1990s, the flow of information available and its grow has, and is growing exponentially. Contemporary science connects us to the entire world, announcing emerging diseases, describing planet-wide climate issues and revealing our genetic makeup, among other crucial issues. In addition, technological advances, particularly in biotechnologies, medical technologies and pharmacology are raising ethical issues within affected global communities. There is also intense competition in the scientific world, where financial interests are increasingly, and unfortunately most of the times, at the forefront.

However, science journalism has benefitted from the arrival of new media: the Internet and specialized television networks and channels. As a consequence, and as never before, scientific research allows the use of technology on human life and the environment, mostly through robotics, controlled systems, and the artificial fabrication of tissues. Several among these issues have raised controversy, in particular genetically modified organisms (GMO), assisting reproductive techniques, cloning, stem cells and nanotechnologies. In spite of this, the progress is unstoppable, but with a huge difference in relation to past decades: both experts and non-experts have learnt the difficult lesson

about the negative consequences of unregulated development, or any forms of advance that do not take into account the communities involved.

The basic form of scientific journalism, and the genre from which all the rest of modes of dissemination stem, is the scientific article, what will be dealt with in the following section, both as a genre in itself and from the point of view of learning practitioners.

1.2.   The Scientific Article.

As the present dissertation has studied, the teaching of how to write a scientific article for science dissemination is crucial in Anglo-Saxon universities, both British and American, and also from other countries from the Commonwealth (i.e. Canada, Australia and New Zealand). Such teaching is not limited to the field of journalist studies but, quite on the contrary, is deeply rooted in the curricula of scientific and technological disciplines. As a result, scientific research easily finds wider international visibility within these academic contexts. The following examples of well-established writing programmes may serve as a model:

- Massachusetts Institute of Technology (MIT). (Sciwrite.mit.edu, 2018)

  <u>Graduate program of science writing</u>. A program for English and science majors, freelance writers or journalists seeking a specialty, working scientists and others in which to learn the art and discipline of science writing. An opportunity to contribute to public understanding of science, medicine, engineering, and technology.

- University of California Santa Cruz (UCSC). (Scicom.ucsc.edu, 2018)

  <u>Science communication program</u>. The women and men who popularize science enjoy a career that satisfies their intellectual restlessness. They report on science trends, discoveries, personalities, and policies, often from the lab or in the field. This is the only graduate science writing program in the U.S. that requires a degree in science and experience in research.

- The University of Edinburgh. (The University of Edinburgh, 2018)

  <u>Msc in science communication and public engagement.</u> The programme gives the opportunity to learn about the contexts for science

communication, as well as how the practice of public engagement has emerged and it develops awareness about the current landscape of these fields. Moreover, through assessed work placements it aims to develop the skills, awareness and understanding to be effective in the science communication and public engagement workplace.

The above included examples are just a brief sample of a widely spread practice which, as this dissertation argues in its final stages, should be incorporated to higher education programmes in the Spanish universities. In all cases, and with minor variations, scientific writing teaching follows the rules briefly presented in the following section.

1.2.1 The structure of the Scientific Article: teaching contexts in academic environments and detailed structure. (BBC News, 2018) (Moocs course on Science Writing, 2018)

For an engineer to learn to communicate and/or evaluate science writing for the general public, it is necessary to learn the guidelines of how to write a scientific article, especially in terms of structure. Here are some of these guidelines:

Science writing needs a narrative and a structure. At the beginning, there must always be a headline. Then a second, longer, headline-like sentence must appear. This is usually known as a Standfirst and it is a concise summary of the story without repeating the headline. Afterwards, the writer must include the story itself and the most crucial part of it, the first line. In this single, apparently casual sentence, there is just one chance to involve the readers and make them want to continue reading, what is commonly known as 'audience involvement'. There are different ways to achieve this. However, the most straightforward way is to simply say what the news is or what the story is about as clearly as possible, without a too elaborated register. Hopefully, the reader will be intrigued enough to want to find out the details.

Obviously, there are different ways to tell a story: again, the most straightforward one would be to put the most interesting content at the beginning, followed by explanations of what it means. In addition, writers must try to make sure that each paragraph only discusses one aspect of the story to keep it simple. In contrast, and as the story moves on, the least relevant content generally comes at the end. A good way to introduce pause, or intervals within the whole extract, is with quotes from relevant sources.

A common practice is the inclusion of something about the implications or applications of the topic. Likewise, if there is a debate,

it is quite usual to introduce another expert voice and make the disagreement clear. Furthermore, in order to explain a complicated scientific technique or research finding, it is possible to use analogy and metaphor, resorting to everyday examples. Finally, target audience must always be considered, be it explicitly or implicitly recognized. If the receivers are like-minded, scientifically-minded individuals, they may need less explanation than someone without any exposure to science in the past.

As a general rule, it is advisable to keep data as simple as possible, and not try to include every small detail in a story or explanation, even if the scientists who did the work insist on it. The mission is to get across the most important points of something as simple as possible. Therefore, being frugal with words, that is, concise and scrupulously goal-oriented, is important.

When the story is finished, is a good time to stop. There are different ways to finish a story- a pertinent quote from an expert with a word about what happens next is one way. Another way is to end up wondering if that discovery will be relevant or not in the future, that is, leaving open questions for the reader to continue inquiring into it. This is a good measure for the enhancement of critical readers in constant search of accuracy and contrasted information.

Last but not least, it is usually recommended, especially for a longer piece, to relate the last line of the news article with the first line and the introduction to the story, bringing the reader back to where they began.

These general guidelines must be now checked against the background of real communication means. For the purposes of this dissertation, two examples have been selected: The BBC video/text pieces of news, on the one hand, and articles from *The Guardian* newspaper, on the other hand.

Specific structure of *BBC* technological news

Videos consist of brief pieces of news, lasting between two to five minutes, and with a 1-page article as a complement. They usually include images of the technological development in question (a robot, a new machine or device), and also images of their functioning in the video.

After a first approach to the news content (answering to the who/what

questions), the journalist usually deals with the "what" and "why", thus introducing gradually more data that contain technical concepts. However, this is always carried out from a general point of view, sometimes asking a couple of questions to an expert that completes the information. On other occasions, direct statements from people are gathered.

Specific structure of *The Guardian* technological news reports

Articles in *The Guardian* may contain between 300 and 400 words. The essence of the notice is text, always illustrated by related images. Sometimes, but not often, a short video is included.

As in the case of the BBC, the writer usually explains the basis of the article from a general point of view, adding technical concepts and live statements whenever necessary.

Once the analysed sources and their starting structure have been given, the scientific article as a specific genre of English oral and written communication must be approached.

1.2.2 The Scientific Article as the Sample Genre.

The sample genre on which this dissertation is based, uses the journalistic article, supported or not by illustrative videos, as the basic genre of scientific dissemination for non-experts. Therefore, personal blogs are discarded, since it is difficult to know whether they are written by and for experts or semi-experts; further delimiting the selection, as it has previously been shown, two British media with a long journalistic tradition, an audiovisual one (the BBC) and a written one (The Guardian), have been chosen. Before moving on to the analysis of the selected news items, however, certain insight upon the impact of scientific English in current societies must be gained.

English as the scientific language of greatest global impact

In the benefit of a universal language, it is argued that before English became dominant, scientific publications were roughly divided among French, German and English, as their respective countries were pioneering industrial advances on similar terms. This posed a serious problem: if scientists were not multilingual, they would miss out on others discoveries.

According to Dr. Michael Gordin, Professor of Modern and Contemporary History at Princeton University, it was never a given

that English would dominate science: "If you look around the world in 1900, and someone told you, 'Guess what the universal language of science will be in the year 2000?' You would first of all laugh at them because it was obvious that no one language would be the language of science, but a mixture of French, German and English would be the right answer".

In his 2015 book Scientific Babel, in which Dr. Gordin explores the history of language and science, he states that German was the dominant language in 1900: "So the story of the 20th century is not so much the rise of English as the serial collapse of German as the up-and-coming language of scientific communication".

As a matter of fact, dealing with a universal language, researchers know what to expect, and how to find information. They know what language to publish in and how to search for other researchers articles that support their own work. Beyond published research, a universal language also helps make sure that all science readers, whether experts or not, have access to information in presentations, guidelines and standards.

Nevertheless, this fact poses a major challenge for millions of researchers: if they are not-native English speakers, they need to learn a new language alongside their scientific studies. The implications of such circumstance are especially significant nowadays, since English-speaking countries no longer dominate science: Brazil, Russia, India and China are the fastest growing countries in terms of the number of research publications they produce, according to Elsevier's book World of Research (2015).

Evidently, whether the language of science will be the same in 100 years' time cannot be foreseen. China is outpacing the world in its published research output and, just like the rise in US science did a century ago, this could have a large impact on how we communicate about science. However, it is unlikely that the Chinese language replaces English as an international mode of scientific communication, since Chinese is considerably inefficient in terms of average learning pace in comparison with English, a language that poses quite a few problems in terms of pronunciation but has a comparatively simple grammatical and syntactic system.

All in all, the following table may help to see the progress of scientific dissemination in different languages:
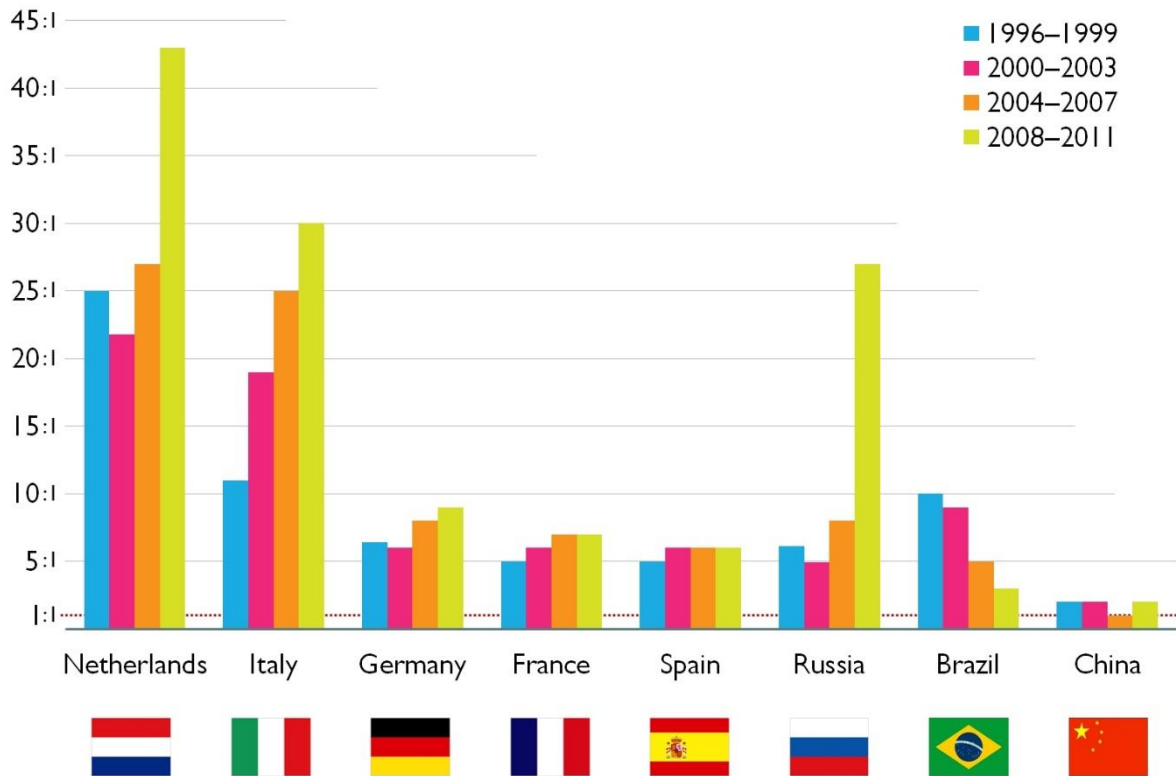
Ratio English to local language journal articles

Figure 1: *Ratio of the number of journal articles published by researchers in English to those in the official language of eight different countries, 1996–2011 (Source: Scopus). (Researchtrends.com, 2018)*

On another note, and different from English in research environments (i.e. for academic purposes), English for scientific dissemination is what is known as **"International English".** Concretely, this makes reference to a use of English words and phrases generally understood throughout the English-speaking world as opposed to localisms. What is more, structures and terms in principle alien to local speakers, but with strong international resonance, are gradually incorporated into this mode of speaking and writing that constitutes a kind of jargon in itself, and that is incorporating its traits within the domain of scientific journalistic dissemination. (En.wikipedia.org, 2018)

International English reaches towards cultural neutrality. This has practical consequences: First, a type of English that saves practitioners from having to re-edit publications for individual regional markets.; secondly, teachers and learners of English as a second language find it an attractive idea, since any regional variety of English has a set of political, social and cultural connotations attached to it, even within the so-called 'standard' forms.

As it always happens with crucial changes like this one (i.e. the predominance of English over any other language in the international spread of scientific knowledge, be it for experts or non-experts), the advantages go alongside some important drawbacks. The most important one is the loss of a high-level register of communication in other languages. Of course, many of those English-based sources are translated to the rest of languages for the purposes of dissemination. This, however, cannot hide the fact that they are not written in the translated language in first place. Although there are some voices already dealing with this issue, only in future decades will society be able to consider the consequences of this move.

As conclusion, it may be claimed that the development of International English often centres on academic and scientific communities, where formal English usage is prevalent, and creative use of the language is at a minimum. Although the communication means chosen for the limits of this dissertation are British and, therefore, clearly indebted to the interests and affinities of their own culture, the impregnation of global discourses, scientific or other, make them reliable sources for our purposes.

Part 2: Analysis of sample news.

2.1.   Detailed analysis.

For this section, some engineering pieces of news are going to be analysed. They need to test the following features:

a) If the structure of the piece is the usual one in the scientific article.

b) With which subjects of a Mechanical Engineering degree and other engineering degrees it is related, and how deep that relation is.

c) Whether technical language is used or not.

d) Whether the message that is transmitted to society is complete / incomplete / may cause uncertainty or, on the contrary, tries to provide reassuring knowledge.

BBC

- Are electric cars ready to go mainstream?
  http://www.bbc.com/news/technology-35940172

  The piece shows an interview with the firm's founder and chief executive of Tesla, Elon Musk. In it, they talk about the importance of an electric car for a wider audience than the usual one, that is, one that most people can afford. They also discuss the transformation they have made of attitudes in the automobile industry, as well as of their losses. Finally, they ponder whether the new scope really entails a massive market, and on the costs of the charging infrastructure and the batteries; in short, whether Tesla is the dominant carmaker of the electric age or simply a footnote in its history.

  a) In fact, there is a headline, but not a standfirst. The writer uses the first line to put the story in context. It is divided in two parts. First, an interview is held, and secondly, some data are giving. It is concise and it finishes wondering if this discovery will be relevant in the future.

  b) The article is related with the following subjects of the Mechanical Engineering degree: Physics, Materials science, Machine design, and Manufacturing engineering in regard to car manufacturing; Environmental technology concerning pollution issues; and especially, Fundamentals of electronics, Automatic regulation and Electrical technology in reference to how to design and make the electrical system of the car.

  Engineers know that the electrical motor is a device that converts

electrical energy into mechanical energy by means of the action of the magnetic fields generated in its coils. Electrical motors are rotating electrical machines composed of a stator and a rotor. They are also up to three times more efficient than an internal combustion engine and with greater efficiency and torque from 0 revolutions and the total absence of gears, which translates into better response in acceleration, and the regenerative braking can recover up to one fifth of the energy normally lost during braking too. They do not produce atmospheric or sound pollution, maintenance is less than mechanical engine (because electricity is so cheaper than the fuels).

However, in certain cases, the electricity used to recharge the batteries is produced by polluting raw materials such as carbon. That would make the electric car useless in this section. There are still problems with the need to charge the batteries frequently and the high cost of purchase both the batteries and the car. Solving these problems would be necessary to convert the electric cars market in a mass market. Currently, the hybrid motor market is much more competitive than the electrical motor.

These engineering concepts are not taken into account in the article, nor are they presumably known, nor does the author try to create a simpler piece of news, so that readers who do not know about technological issues may understand the information.

c) Technical language is not used. In fact, the register is plain and colloquial (*but, the other big question, is still a pain…*). Evidently, the article focuses more on telling the evolution of Tesla than on technical specifications.

d) It is clearly a necessary article in the discussion of the environmental concerns from the car industry. Arguably, electrical cars are the future, but the way they are being developed is still subjected to further improvement. In this sense, the article transmits uncertainty. Another important factor that is highlighted is that technology is linked to the economy: cost reduction, mass production and end-user issues are tackled.

For a general, non-expert reader, the message received is basically founded on two lines: a) electric car technology is still being tested from a technological point of view, and b) production and purchase costs must be reduced alongside technological improvement.

For an engineer, the message received includes everything previously stated and deeper issues, such as: that present and future technological research must have environmental concerns as a priority issue; getting the energy from renewable energies to use a completely clean energy; and finally, that we must follow this example in our working environments from these companies,

which prioritize human development to immediate economic benefits.

- Fast fibre: A community shows the way.
  http://www.bbc.com/news/technology-21442348

  The article tells the story of a group of neighbours in a remote area of the United Kingdom who come together to bring fibre optics to the town. Concretely, they have come up with this initiative because companies are constantly making excuses, as they do not find it profitable to bring broadband to rural areas. They began with a DIY effort, digging channels across the fields and laying fibre optic cables. Now, they want to extend their idea. The hope is that many will sign up for the service to implement the complete network.

  a) This piece begins with a mysterious headline. There is a standfirst so clear and attracting that it undoubtedly invites the reader to continue reading. However, it does not include a first line that "hooks" the reader. Like the structure of scientific article, the most interesting content is at the top of each paragraph, and it discusses every single aspect of the story, that is, one at a time, in order to keep it simple.

  b) Some engineering subjects are related with this article, concretely, Electrical technology and Fundamentals of Electronics in regard to cable design. More deeply, Optical Communications and Optical communications laboratory are brought to the forefront. These are taught in Telecommunications Engineering degrees, for the implementation optical fibre.

  An optical fibre is a flexible and transparent fibre made by drawing glass or plastic, with a diameter slightly thicker than that of a human hair. Optical fibers are used in sensors, power transmission and, especially, as a means to transmit light between the two ends of the fibre. They find wide usage in fibre-optic communications, where they allow transmission over longer distances and at higher bandwidths than electrical cables. Inside a fibre optic cable, the optical fibres share their space with aramid yarns that give it the necessary tensile strength.

  The main advantage of fibre optics over copper wiring is broad bandwidth: A single optical fiber can carry over 3,000,000 full-duplex voice calls or 90,000 TV channels. In addition, it presents immunity to electromagnetic interference, low attenuation loss over long distances, electrical insulation, material cost and theft prevention and security of information passed down the cable. However, it has disadvantages too, for example the high brittleness of the fibres. Furthermore, the joints between fibres are difficult to make, especially when repairing is made on the spot,

what makes repairs difficult in case of cable breakage. In addition, the optical fibre does not transmit electrical energy; this limits its application where the receiving terminal must be energized from a power line. Finally, cables come in a wide variety of sheathings and armour, designed for applications such as direct burial in trenches and insertion in paved streets. The need to use more expensive transmitters and receivers makes it difficult for companies to make this investment in rural areas.

This last disadvantage connects with the content of the news item. In fact, Internet rural connections are usually carried out by satellite communication. The attempt of the rural community shown at the BBC video, however, is understandable: satellite communication is considerably less reliable, and remote, 24-hour connected businesses could not exist without a solid fibre optic coverage. In this regard, the news item shows another important factor of present-day technologies: the relevance of social, community support and initiative when standardized, traditional channels and services of production, implementation and distribution are scarce. It also appeals to the necessity of equally meeting the technological demands of populated and depopulated places: A reliable Internet connection, the same as health or education services, should be considered a utility in first place, and not mere consumer goods. To this end, a social code for investors, engineers and workers involved in network design and implementation companies should be adopted, aiming at considering "the big picture" of communication, and not only the short-term entrepreneurial benefit.

c) It is a very simple topic, a piece of news without scientific language, containing no technical words and for the general public. However, there are some words in the text that sounded very strange before advent of the Internet (bandwidth, fast fibre, network, broadband), and which have become completely naturalized in everyday routines.

d) A very positive piece of news. It focuses on telling a curious story. Moreover, it depicts the empowerment of people and collaborative economy based on the commons. Thus, BBC tries to introduce new insights in the world of technology news, making them part of current affairs instead of just expert-bound information.

When a general, non-expert reader, receives the message, the ideas transmitted are: a) Optical fibre is ultra-fast, but companies do not implement it in rural areas because it is not profitable, and b) through local initiatives like this, and with a joint effort, technological problems can be solved without relying on large companies.

When an engineer receives this message, it includes everything said before. In addition, it reminds us of the reality that development does not reach all sides equally, and that we have to establish the channels for it to be carried out. Specifically, in democratic countries the right to equal access to services and utilities must be guaranteed, and engineers are not exempt from this rule, regardless of the particular interests of the companies they work for.

- Humber 'envy of world' for offshore wind energy.
  http://www.bbc.com/news/uk-england-humber-43808806

This text gives information about the electric activity at Humber estuary, a leader in offshore wind energy. The company involved has made giant offshore wind turbine blades. Investment, innovation and collaboration are consolidating the Humber as a major hub for offshore wind. The investment has brought much-needed jobs to the town of Hull, and may have helped to attract other firms to the city.

a) At the beginning, there is a headline and a very similar standfirst, almost repeating the headline. There is no attracting first line for the reader. There are some quotes from relevant sources and the implications of the topic. It is concise, telling the most important points.

b) This piece of news is connected with Mechanical Engineering through some topics. The subjects involved are Physics, Manufacturing Engineering, Industrial Design, Materials Resistance and Industrial Constructions. All of them hold knowledge that can be applied to the making of blades and wind turbines. Apart from this, Fluids Engineering and Hydraulic Machines can be put to characterize the movement of the air. Finally, Environmental Technology seems once again crucial for the correct implementation of a type of renewable energy.

Offshore wind energy makes reference to the use of wind farms constructed in bodies of water, usually in the ocean on the continental bedrock, in order to harvest wind energy to generate electricity. Compared to inland sets, higher wind speeds are available offshore, at the same time that they have a longer lifespan; furthermore, the wind speed is constant, due to the absence of obstacles, it is less turbulent and turbines have a higher work period, thanks to the constancy of the wind mentioned above.

However, there are disadvantages too, related to more expensive costs of installation, difficulty of access, and harder climate conditions. Projections for 2020 estimate a capacity of offshore

wind farm of 40 GW in European waters, which would provide 4% of the electricity demand of the European Union. Likewise, scale innovation could deliver 25% cost reduction in offshore wind energy. They have very low global warming potential and limited noise and landscape impact compared to land-based projects.

Regarding blade design, the number of blades is selected for aerodynamic efficiency, component costs, and system reliability. In addition, it is proved that the lower the number of blades, the higher the rotational speed can be, and the lower the manufacturing costs. The requirements for blades materials hold an easy processing and maintenance, low weight or density to reduce gravitational forces, high strength, high stiffness, plus the ability to withstand environmental impacts. That leaves fibre-reinforced composites as ideal for the design of wind turbines.

From an engineering point of view, the non-explicit impact of this news item is certainly its dependence on the development of what is known, since the beginning of the 21st century, as the quaternary economic sector, also known as the knowledge sector. Building offshore wind farms, alongside other current energy-extracting methods such as tidal barrages, is a challenge to the limits of the engineering science, involving cutting-edge research in areas like properties of materials, measurements, storage and distribution capabilities and, of course, cost-effectiveness. It is a present-based piece of news for a current reader, but with a powerful future-projected resonance for any expert.

c) Being strongly local-based, it includes technical expressions (however, be crucial, ecostructure), although they are inserted within the colloquial register (However, the city still faces a challenge to attract more high-skilled firms and jobs that would "be crucial for boosting wages in the city - which are among the lowest in the country").

d) The text shows some data about the conditions of the company. The message is incomplete because technical data about offshore wind energy and blades are not given. A local notice aimed at the population and those interested in renewable energy, this is, therefore, another example of technology linked with economy.

For a non-expert reader, the message received is that there is a company in the UK revolutionizing offshore wind energy field. It has plenty of activity and development, and it is creating many jobs.

For an engineer, the message received includes everything said previously and deeper implications such as: whether offshore wind

energy is expanding, whether it is developing at a gradual pace, and whether it is becoming more efficient and if in the future it could be an energy source of reference.

As has been seen, in all cases there is a strong focus on national technological and economic development, that is, science is a topic of interest as long as it is related with the UK. In the following pages news items taken from another means will be tackled.

THE GUARDIAN

- Could new technology help older people in Barcelona create stronger networks?
  https://www.theguardian.com/cities/2014/oct/28/could-new-technology-help-older-people-in-barcelona-create-stronger-networks

  This piece of news tells us about a mobile app that tries to connect older people from Barcelona among them and with their social environment; an initiative which tries to use the technology to link and not to separate, creating collaborative care networks. The initiative is still being tested, and it is expected for it to become massive in the future. The hope is that, as well as helping the older people meeting their basic needs, it will also encourage them to try new things.

  a) A simple-style, direct and concise article. There are a very compelling headline and a standfirst that explains the story. The first line gives us more information. The complete text tries to explain the operation of the app. It has quotes from relevant sources and at the end a few lines are added where a reflection is made upon the development will be relevant in the future.

  b) Mechanical Engineering is related with this article through the subject called Applied Computer Science, in relation to the use of a programming language. However, it is more deeply related with Telecommunications Engineering and Computer Engineering degrees, especially with subjects such as Mobile communications or Application of mobile devices, to program the app.

    A mobile application is a computer application designed to be executed on smartphones, tablets and other mobile devices. The applications allow the user to perform a set of tasks of any kind (professional, leisure, educational, access to services), facilitating the efforts or activities to be developed. Applications in the devices are written in some compiled programming language, and their operation and resources are directed to provide a series of advantages such as a faster and easier access to information, a storage of personal data in a secure way, a great versatility in terms of its use, the attribution of specific functionalities,

improvement of the connectivity capacity, and availability of services and products.

The programmer, depending on the type of application designed, is responsible for giving life to the designs and creating the structure on which the operation of the application will be supported, also creating the functional code through a programming language.

The technical issues involved in this news item are also transferable to the philosophical reflection: It is assured that mobile technology separates us from the people around us and that, in short, makes us asocial. But many other times technology can make distances shorten, enable the integration of the physically and mentally impaired, assist ageing populations, enhance educational opportunities, and create social urban networks that make our cities more friendly environments.

For this reason, applications like this can be a key for a healthy future of society, insofar as a minimum social network accessible to everyone is guaranteed (again, the keyword in this issue would be its consideration as a utility, rather than a cog in the consumer market).

c) This piece of news does not use technical language. Writing about a new social app is for the general public, who needs a closer language. However, there are some new words related to the world of internet and mobile development (app, tablet, multimedia content) which would have been completely unknown decades ago. This proves that technological vocabulary enhancement comes about naturally, and alongside the development of technology itself.

d) A very thorough article. The message is complete, it transmits uncertainty (because it highlights an invisible subject), and in spite of this, reassuring knowledge is transmitted (because it shows us there are solutions). It is one of the few pieces of news more specifically related to the common benefit than to the economy.

For a general, non-expert reader, the message received is basically founded on three lines: a) the development of mobile applications is booming more than ever before, b) technology can be used for social purposes other than the usual ones, and c) older people need more support from their friends and family, so as not to be isolated.

For an engineer, the message received includes everything said previously and also the idea that technology tends to disunite and, consequently, it is necessary to establish methods to alleviate this. Hence, social apps that are newly designed have the responsibility to really connect people, and not only to create channels of

communication, thus focusing on the social aspect of technology.

- UK researchers lead effort to design climate-proof refugee housing
  https://www.theguardian.com/world/2017/may/01/uk-researchers-design-climate-proof-refugee-housing-healthy-housing-displaced-bath-university

  This text shows an initiative stemming from the collaboration of some universities to design climate-proof refugee housing capable of withstanding extremes of temperature. This project aims to improve living conditions for refugees by creating low-cost and easy-to-construct housing. The research will be the largest global study into thermal, social and air-quality conditions in camps housing displaced people. The researchers will use novel combinations of conventional and unconventional materials to ensure that the shelters naturally stay warm in winter and cool in summer.

  a) At the top, there is a clarifier headline with a brief standfirst. An attracting first line starts the article telling about extreme temperatures. The most important information is at the beginning. Some relevant quotes and applications of the topic are included. The explanation is as simple as possible and it finishes with a pertinent quote from an expert with a word about what happens next.

  b) There are some subjects of Mechanical Engineering connected to this article: Materials science, Elasticity and Materials Resistance, Heat transmission and Structure theory are all focused on the design, planning and building of resistant and comfortable houses. Finally, Environmental Technology is destined to evaluate environmental conditions.

  The house is a building whose main function is to offer shelter and habitation to people, as well as protecting them from inclement weather and other threats. The right to decent housing is considered one of the fundamental human rights. To design climate-proof refugee housing is very important to use building insulation materials, that is, building materials which form the thermal envelope or coating of a building or otherwise reduce heat transfer (such as fiberglass, polyurethane, polystyrene or rock wool).

  Factors affecting the type and amount of insulation to use in a building include thermal conductivity, moisture sensitivity, compressive strength, and ease of installation, durability, ease of replacement, cost effectiveness, toxicity, flammability, environmental impact and sustainability. The considerations

regarding building and climate are the average climate conditions in the geographical area where the building is located, alongside the temperature the building is used at. It is necessary to attend also to the air quality, that is, the concentration of contaminant that reaches a receiver, more or less away from the source of emission, to implement control and improvement or filtration methods. However, the most crucial issue would be to design a good structure whose elements resist mainly to traction, flexion and compression, as well as having an adequate foundation, that is to say, the set of structural elements of the building whose mission is to transmit their loads or elements supported on it to the ground.

Obviously, all these detailed engineering implications are not necessary for the reader. In contrast, and in this particular case, a wider effort could be made, from the part of the scientific journalists, to emphasize the importance of advanced research on materials, since improvements in this regard result in quicker and more efficient refugee housing interventions. Consequently, this is a clear case of engineering technology at the service of urgent social targets; technology that could, in the long run, contribute to regular housing techniques, outside refugee housing.

c) The register in this article is partially higher than in the previous ones, although there are no technical words or information about the materials of the refugee's shelters. It is a piece of news that everyone could understand. At the same time, their awareness about the importance of researching on materials science can be indirectly raised.

d) The piece of news reports on a current problem, and conveys ways to improve the life quality of the refugees. This is a message that seeks to reassure and inform at the same time, with a fairly complete description of the initiative. In sum, it is an example of an interesting article not directly related with economy and more socially oriented.

When a general, non-expert reader, receives the message, the ideas transmitted are: a) refugees have problems of comfort in their homes due to extreme temperatures and lack of privacy and security, b) a model of shelters is being investigated with different materials needed to solve the problem.

When an engineer receives the message, it includes everything said before, and also the responsibility to develop new materials to face the new challenges posed by progress (insulating and resistant materials that are economically accessible or, for example plastic substitutes that do not pollute).

- Flat-pack heaven? Robots master task of assembling Ikea chair
  https://www.theguardian.com/science/2018/apr/18/defeated-by-ikeas-flatpack-call-in-the-robots

  The piece shows us through a video how two robots assemble an Ikea chair in twenty minutes. For this, engineers used a 3D camera and two industrial robot arms fitted with grippers and force sensors. More than half of the time was spent planning moves, with the execution taking nine minutes in total, although the robots did not work out what to do from scratch. They were programmed to know what the parts of the chair looked like, how they should go together, and in what order.

  a) As can be seen at the beginning, there is an impressive headline, accompanied by a very simple standfirst. The first line is very ambitious and tries to attract the reader. In the first part of the text, it talks about chair assembly, while the second part discusses future advances. Some relevant quotes are included. It is not frugal with words, including a wide range of small explanation details. The article finishes wondering if the discovery will be relevant or not in the future.

  b) Some mechanical engineering topics could be related with this piece of news, among them, Industrial Design and Machine Design for the creation of the arm-robots; Mechanical Components and Fundamentals of Electronics for the design of the electronic part, and Automatic Regulation to program these robots to perform the movements necessary for the assembly of the chair parts.

  A robot is a virtual or mechanical artificial entity. In practice, this is usually an electromechanical system that is commonly driven by a computer program or by an electrical circuit. At present, commercial and industrial robots are widely used in jobs that are too dirty, dangerous or tedious for humans. The most common manufacturing robot is the industrial robot, and among the industrial robots, the most common one is the articulated arm, also called the robotic arm.

  A typical robotic arm is composed of seven metal segments, joined by six joints. A computer controls the robot by turning individual step motors connected to each joint very precisely. The robot uses motion sensors to make it move the right amount of stuff, and force sensors to check or measure the amount of surface unit pressure that is exerted in a test. These force sensors transform the mechanical magnitude into electrical magnitude.

  The movements of the robot can be automated through automatic regulation, a branch of engineering that deals with the control of a process in a given state. A control system may be defined as the combination of elements that, acting on a plant or process, tries to

fix some of its parameters or to cause them to vary, in the course of time, in a certain way that is predefined.

The relevance of this piece of news, both for an expert and for a non-expert reader, is undeniable: robots are becoming increasingly part of our everyday lives, and a correct regard of their advantages, shying away any fears brought about mainly by science-fiction, is crucial. To serve this purpose, constant communication between scientific journalists and robotics engineers, either informal or formal (e.g. through conferences and public debates) should be enhanced. The more robots are integrated in society, the better we will interact with them.

Furthermore, traditional fear of losing jobs that ultimately are repetitive and uninteresting for humans must be transformed into the expectations for new, technology-related jobs we are still unaware of. Such message must be clearly transmitted to society.

c) It is a popular topic, a piece of news without scientific language. Concretely, there are no technical words, and the register is aimed at a very broad range of public. The most probable reason is that robotics is already a familiar technology for everyone, and the news item has chosen a playful tone to get its message across.

d) As for the nature of the content, it is a complete article in its descriptive way. However, it may transmit a nuance of uncertainty, because an example of success among many attempts does not automatically mean effectiveness in everything concerning robots. The piece of news uses the concept "rebellion of the machines" too much, what makes it sometimes miss the importance of the content and raises the connections already mentioned with science-fiction issues.

For a non-expert reader, the message received is about the idea that the robots are already capable of performing many tasks and that the evolution in robotics is taking place even though it is slower than we would like (knowing that this idea is misleading, as it is influenced by science fiction).

For an engineer, the message received includes everything said previously and deeper implications such as: whether these experiments start to develop successfully, and if it is our responsibility to start using robots in more complex tasks, because through good programming they could do anything.

2.2.   Contextualized analysis.

In this section, an in order to acquire a more general view of what kind of topics are usually covered by engineering news items, it is necessary to revise the selected news within the larger context of the the engineering news published along the year 2017.

Six news items about different topics have been analysed:

-Electric cars
-Fast fibre optics
-Offshore wind energy
-Mobile apps
-Structures
-Robots

All these must be considered in relation with the following table:

Statistical frequency of topics in 2017 (BBC & THE GUARDIAN):

Physics	Materials	Infrastructures	Transports & motor	Fluids	Renewable energies
2	4	26	46	4	5
Machines	Energies & fuel	Robots	IT & electronics	Business & economy	Space
7	7	4	14	13	10

Attending to the analysed topics and the table, we can observe that the most frequent ones have been Structures and Electrical cars. Mobile apps and Fast fibre show good frequent attention. Robots seem surprisingly not important enough for media.

If a more general approach is done, it is observed that the most important topics are Transports & motor, Infrastructures, IT & electronics, and Business & economy.

<u>Statistical frequency of engineering degrees subjects in the analysed news:</u>

Electric cars	Fast fibre optics	Offshore wind energy
-Physics, Materials science, Machine design, Manufacturing engineering, Environmental technology Fundamentals of electronics, Automatic regulation and Electrical technology	-Electrical technology, Fundamentals of electronics, Optical communications and Optical communications laboratory	-Physics, Manufacturing engineering, Industrial design, Materials resistance, Industrial constructions, Fluids engineering and hydraulic machines, and Environmental technology
Mobile apps	**Structures**	**Robots**
-Applied computer science, Mobile communications and Application of mobile devices	-Materials science, Elasticity and materials resistance, Heat transmission, Structure theory and Environmental technology	-Industrial design, Machine design, Mechanical components, Fundamentals of electronics and Automatic regulation

Regarding to the subjects included in the table, it may be observed that those with a higher recurrence are Environmental Technology and Fundamentals of Electronics. Automatic Regulation and Fluids Engineering and Hydraulic Machines for example, usually show less recurrence.

On the other hand, there are also subjects that are important and should have been present too, such as Applied Thermodynamics and Thermal Machines. This is because news about engine processes, water conditioning or heating systems are also less frequent in the means.

Therefore, through these tables a more global view of the type of engineering news items that predominate can be seen. The subjects that raise more interest in scientific journalism are those related to environment and electronics (issues that are becoming increasingly important), infrastructures and transports (topics that have always been very important) and of course, the transversal impact of economics (the engine of today's society).

Part 3: Conclusions.

Through the traditional question/answer method, in the following pages the conclusions to the previously presented study will be dealt with.

What kind of news items do predominate?

Technology has always been associated with economy. The news items analysed show in all cases (with the exception, perhaps, of refugees housing), although in different degrees, the importance of such connection. This can also be interpreted in relation with the predominant topics appearing in the 2017 media (Transports & motor, Infrastructures). Clearly, they are the most strongly linked to economy and, due to this fact, this link enhances their more frequent dissemination.

What kind of products or innovations does receive more attention?

Transport products and innovations, especially the electrical ones, followed by bridges and other building and infrastructure projects, and finally, electronic devices, above all mobile devices. Again, it seems quite telling that robots (the only topic of our analysis that cannot be included in any of these categories) is not singled out.

And which ones receive less attention, even if they are very important from the point of view of engineering?

Those directly related with the development of materials, physics or some other concepts traditionally difficult to explain, or with components still unproven, such as those linked with nanomaterial science or grapheme. Thus, consolidated services dating from previous industrial eras (infrastructures and communications, physical or distant) seem more appealing both for scientific journalists and readers, whereas potentialities rising from the already mentioned quaternary economic sector are still insufficiently conveyed and discussed.

How does this way of transmitting technological news differ from previous times?

In the nineteenth century, for example, science was thought to advance without limits; today, we are more worried about the optimization of resources, the environment, mass production, economic viability... Financial interests are increasingly at the forefront, but they cannot elude environmental issues. Science news is more focused on the economic aspect than on the technical development, and it must be explored whether this is due to a lack of sound technical knowledge from the part of both writers and readers. Nowadays, curious news is also included, primarily for the sake of entertainment and not so much as educating material. However, communication techniques have been greatly improved, and scientific news pieces are increasingly accessible to all citizens, even if they do not understand about science and technology. Thus, the inevitably partial answer to this question is ambivalent.

What is the relationship between engineering and the dissemination of technological news?

Technological dissemination cannot be understood without engineering. The developments of engineering are those that appear in the technological media. Engineering developments, being also linked to cost-effectiveness requirements are based on the economic side of the issue. Therefore, the news that fills the scientific media has a very intense relationship with the economy.

Would it be necessary to change this relationship for a more adequate mode of communication? In what sense? And what is the role of the engineer in this?

The predominant opinion from scientific-technological environments, without forgetting the importance of the cost-effectiveness tandem, is that the pure engineering nature and content of communication should be separated from the economic insight. Furthermore, and after dealing with journalistic sources from an engineering view, we think that a more rigorous, truthful and useful approach of journalism to science should be more specifically based on teaching science and technology to the population. The role of the engineer in this would be that of the technological adviser, preferably through an explicit, sustained and collaborative relationship with the scientific journalist staff. In this way, priority to technical content over economic factors could be guaranteed. The main commitment of the engineer is to applied science and, through this, to society. Economy must be an intrinsic consequence of both, never a previous condition.

What can Spanish Engineering graduates do to contribute to the purpose explained in the previous answer?

Following the model of Anglo-Saxon universities, it would be desirable that Spanish technical colleges and universities included specific courses on technical and scientific communication, oral and written, both in Spanish and in English. This would be the easiest way to raise linguistic awareness and capabilities in engineering students, that is, to make them responsible not only for the knowledge development they will produce in their future jobs, but also for its correct dissemination, both at expert and non-expert level. Present and future complexities and challenges, both technological and social (and the issue of "fake news", among the latter, is not a minor issue), make of effective communication an indispensable tool in the hands of engineers.

Annexes

<u>News items</u>

- **Are electric cars ready to go mainstream?**

    Back in January, I visited the Tesla Design Studio in Hawthorne, California, to interview the firm's founder and chief executive, Elon Musk.

    The design team were welcoming, but nervous about what we filmed - and in the background, as we sat down for the interview, were a number of cars draped in black sheets.

    One key reason for the secrecy was that Tesla was just a couple of months from unveiling the product on which its entire future now depends. Perhaps the Model 3 was under one of those sheets.

    The importance of a car that would reach a wider public was underlined in our interview.

    "Unless there's an affordable car we will only have a small impact on the world," Mr Musk told me.

    "We need to make a car that most people can afford in order to have a substantial impact. If we could have made an affordable car straight off the bat we definitely would have, it's just that it takes time to refine the technology."

    But building a car that most people can afford is not just about fulfilling Mr Musk's mission to create a more sustainable form of transport.

    The Model S and Model X have won rave reviews and are credited with transforming attitudes in the motor industry - and amongst drivers - to electric vehicles.

    But all the while, Tesla has stacked up huge losses. While its sales nearly doubled in 2015, its losses nearly tripled to $889m (£618m).

    They may continue to rise as the company gears up for the Model 3, which involves building one of the world's biggest buildings, the Gigafactory, and ramping up production tenfold.

    But what Tesla and its investors are betting on is that the car will sell in such numbers that the company can drive forward into the sunlit uplands, where revenues start leaping ahead of costs.

    The eager customers who have been queuing up outside Tesla showrooms to pre-order the car are a good sign, though early excitement may fade if the

company is as slow in delivering the Model 3 as it has been with previous models.

The other big question is whether there really is a mass market for electric cars, and if so whether Tesla is the company that will benefit.

Two issues are holding back mass adoption of electric driving: cost and charging infrastructure.

And they are linked. Wealthy owners of the current Tesla models are very likely to have a garage or drive where they can plug in to charge overnight.

The motor industry analyst Jay Nagley told me the Model 3 could be a tipping point for electric vehicles, and said Tesla had done the whole industry a favour.

"They've massively improved the image and made people feel they are the future," said the managing director of the Redspy consultancy.

But he thinks progress will now be steady rather than spectacular.

"The cost of batteries is coming down and the range is going up, but battery management systems - the technology around them - won't get much cheaper," he noted.

"And charging in the big cities is still a pain."

Others are also targeting the electric vehicle mass market.

In the US, the Chevrolet Bolt - about the same price as Tesla's new car - is already in production and should be delivered by the end of this year, 12 months before the Model 3.

In the UK, we have a quarter of Europe's electric vehicle production and a fifth of all sales.

The production is mostly the Nissan Leaf, made in Sunderland - though at around £25,000 for a car with a range of around 100 miles (161km) it may begin to look expensive when the Tesla arrives.

What Tesla has achieved is already remarkable, forcing the likes of BMW, Porsche and GM to move their electric vehicle efforts from sideshows into the mainstream.

But now we will find out whether the pioneer can end up as the dominant carmaker of the electric age - or merely a footnote in its history.

- **Fast fibre: A community shows the way.**

How fast is your home broadband? Seventy to 80 Mbps if you're one of the few with the very fastest fibre broadband services? Perhaps 10Mbps if you've got an average connection, maybe under 2Mbps if you live some miles from your nearest exchange. So how would you fancy a 500Mbps download scheme?

That is what I've seen on Harry Ball's quite ancient computer - not in the heart of London but in a village in rural Lancashire. Arkholme is hardly a teeming metropolis but Harry is one of the first local residents to be hooked up to the B4RN community broadband network.

After deciding that they were never likely to get a fast broadband connection from one of the major suppliers, a group of local people across this sparsely populated area decided that sitting around moaning about it was not an option. Instead they began a DIY effort, digging channels across the fields and laying fibre optic cables.

They have exploited all sorts of local expertise - from the Lancaster University professor who is an expert in computer networks to the farmer's wife who has just retired from a career in IT support. The cooperation of local landowners has been vital - free access to fields has made it much cheaper to roll out the network. BT and other companies which have to dig up the country roads to lay fibre networks reckon it can cost as much as £10,000 to hook up one rural home - the people at B4RN reckon they can bring that down to around £1,000.

And people like Harry and Susan Ball are now entering the superfast broadband era. The retired couple told me they knew little about computers and had got used to the fact that it was almost impossible on their slow connection to watch video or use Skype. Now Harry is able to watch the iPlayer streaming in HD, and Susan has become a B4RN volunteer, helping to dig trenches for the fibre.

But, after raising half a million pounds from locals who bought shares on the promise of a fast connection, the project now needs to move to the next stage. In the Arkholme village hall this afternoon, B4RN is holding an open day, inviting anyone to drop in and test the broadband connection on their phones or computers.

The hope is that many will sign up to the £30 per month service, but that some will also buy shares in B4RN. Another £1.5m is needed if the full 265KM network is to be rolled out. That sounds ambitious - but having spent 24 hours watching the volunteers digging trenches, blowing fibre and learning a process called fusion splicing I can see they are a very determined bunch.

As Barry Forde, the networking expert who is the chief executive of B4RN explained to me, fast broadband is not a luxury now, whether in the town or

the country. "Farmers are being told they have to fill in forms online," he says. "If you haven't got broadband you are severely disadvantaged."

And despite the £530m government money to bring fast broadband to rural Britain, many communities face a long wait to get connected. In the meantime, others may learn the lesson from B4RN - if you want it in a hurry, just get out and start digging.

- **Humber 'envy of world' for offshore wind energy**

The Humber estuary has become "the envy of the world" for offshore wind energy, according to an industry manufacturer.

Ray Thompson, of Siemens Gamesa, is to tell a conference "the Humber is seen as the benchmark location for offshore wind - it's the envy of the world".

The company makes giant offshore wind turbine blades in Hull, East Yorkshire.

Hull and Grimsby now "support the manufacture, installation and service, or cradle-to-grave of the offshore wind energy", said the University of Hull.

Mr Thompson is to address the Offshore Wind Connections conference in Hull next week.

He said: "Investment, innovation and collaboration is consolidating the Humber as a major hub for offshore wind.

"Ten years ago if you wanted to see how the wind industry worked you went to Bremerhaven in Germany.

"Now everybody wants to come to Hull to see how it's done."

David Wells, the university's wind sector specialist, said: "There is now an ecostructure of investment across the Humber that covers the breadth of the sector."

Paul Swinney, of the think tank Centre for Cities, said the investment had "brought much-needed jobs to Hull, and may have helped to attract other firms to the city".

However, the city still faces a challenge to attract more high-skilled firms and jobs that would "be crucial for boosting wages in the city - which are among the lowest in the country", he said.

A 2017 report commissioned by the University of Hull suggested UK offshore wind jobs could reach 21,000 by 2032, up from about 10,000 full-time equivalent jobs.

The bulk of that employment should be along the east coast of England, with a concentration around the Humber, it said.

- **Could new technology help older people in Barcelona create stronger networks?**

Ageing populations are increasingly prone to feeling lonely and isolated in modern, anonymous cities around the world. A new app from Barcelona might have the answer.

As life expectancies grow ever greater, cities around the world are being forced to face up to the challenges posed by social isolation and deteriorating health among their ageing populations.

More than 20% of Barcelona residents are 65 or over, according to city data and that is expected to rise to 25% by 2040. To combat the problem the Catalan capital has come up with VinclesBCN – an app which helps at-risk elderly people, and their families and helpers, create collaborative care networks. The project won the Bloomberg Philanthropies Mayors Challenge 2014 last month, scooping the top prize of €5m in funding.

"People in cities tend to be anonymous, while in a rural context they look after each other and relationships are closer," says Josep Maria Miró, who is head of the social innovation department at Barcelona city council and has been part of the multidisciplinary team working on VinclesBCN. "This also worries other European cities because most of their population is living in urban areas where solitude and isolation are intensified."

Fernando García Bernal, a mobile developer and project contributor, explains that the app generates a trusted network of people who can organise activities for elderly users: "It can be installed on a tablet or mobile – allowing the elderly to make calls, send and receive multimedia content, share a calendar and transfer money easily and safely." The hope is that, as well as helping the older people meet their basic needs, VinclesBCN will also encourage them to try new things, adds Josep Maria.

The city council – which is currently trialling the initiative with 20 elderly people in Barcelona – will provide training and help to users, who will be able to invite up to 10 close family members, friends, neighbours, social or healthcare employees to be part of their private circle. These network members can then respond to the user's alerts, reminders and needs, interact with other people in the circle and organise activities.

The initiative hopes to reduce the isolation felt by some older people and provide careworkers with a network of support. Fernando believes that the app will give both groups improved connections to wider society and a better quality of life.

The app is expected to reach 20,000 over-65s, and integrate about 100,000 people in total through their trusted networks. "Barcelona can do it," says

Josep Maria. "People are receptive and my intuition is positive … Our hypothesis is that VinclesBCN overcomes urban isolation. We believe this but we need to find data that corroborates it. If the tests give us good results, the project might be replicated in other European cities."

- **UK researchers lead effort to design climate-proof refugee housing**

Bath University staff head an international team working on shelters capable of withstanding extremes of temperature

Researchers will today begin a three-year project to design housing for refugee camps in extreme climates where temperatures range from 45C to -10C. The international team behind the Healthy Housing for the Displaced project, led by Bath University, aim to improve living conditions for refugees by creating low-cost and easy-to-construct housing.

Their 20 shelter designs will moderate extremes of temperature and ensure the privacy, comfort and dignity of residents. The research will be the largest global study into thermal, social and air-quality conditions in camps housing displaced people.

Princess Sumaya University for Technology in Jordan, the German Jordanian University and Mersin University in Turkey are collaborating on the work. Those living in the refugee camps, as well as aid agencies, will be asked for their views on how housing and social care can be improved.

Jason Hart, senior lecturer in the anthropology of development at Bath University, has worked with refugees in Jordan and the Middle East for 20 years. "I have witnessed first-hand the daily struggles of displaced people to lead dignified lives in difficult conditions, and decent housing can make an immense difference," he said. "I am therefore excited to collaborate with colleagues from the fields of architecture and civil engineering in a process of shelter design that meaningfully engages the views and aspirations of refugees themselves."

A recent pilot study conducted by the research team found that shelter design can create problems for refugees, increasing demands on humanitarian organisations. Health can be undermined when poorly insulated shelters fail to moderate extremes of temperatures, while design that fails to meet privacy and security needs can harm wellbeing.

The researchers will use novel combinations of conventional and unconventional materials to ensure that the shelters naturally stay warm in winter and cool in summer.

Of the 20 designs, six will be built in the UK to test construction times, and be thermally tested in a climate chamber at Bath University. The most promising will then be transported to Jordan to be tested in local conditions, with camp occupants and aid agencies providing feedback.

Refugee camps were originally seen as a short-term solution to mass migration, but many across the world end up persisting for decades. The world is currently witnessing the highest ever recorded levels of human displacement, with conflicts such as that in Syria leading to the creation of a new generation of refugee camps.

Prof David Coley of Bath University said: "The extreme climates experienced by those living in refugee camps inspired me to propose this project, which will truly push the boundaries of my research into low-energy building design."

As well as Jordan, research will be conducted in refugee camps in three other countries selected to provide as wide a range of climatic, cultural, social and political conditions as possible. The team currently envisage working in Thailand, Turkey and Tanzania. They will also create a manual to explain the benefits of each shelter design, provide guidance on matching design to context and offer guidelines on construction.

Prof Abdallah al-Zoubi, vice-president of Princess Sumaya University, said: "Our involvement in the project represents a tiny bit of the greater efforts Jordan is exerting in hosting the unfortunate children of Syria who are facing extreme conditions living in the desert. We hope that the results and outcomes of the project will ease the suffering of refugees and lead to a dignified stay in Jordan before their final short journey back home."

The project has received £1.5m of funding from the Engineering and Physical Sciences Research Council.

- **Flat-pack heaven? Robots master task of assembling Ikea chair**

Machines programmed by engineers in Singapore complete job in just over 20 minutes

Those who fear the rise of the machines, look away now. In a laboratory in Singapore two robots have mastered a task that roundly defeats humans every weekend: they have successfully assembled an Ikea chair.

Engineers at Nanyang Technological University used a 3D camera and two industrial robot arms fitted with grippers and force sensors to take on the challenge of building an £18 "Stefan" chair from the furniture company.

Working together, the robots completed the job in 20 minutes and 19 seconds after having the parts placed in front of them. More than half of the time was spent planning moves, with the execution taking nine minutes in total. Typically, the job takes a person 10 to 15 minutes, an Ikea spokesperson said.

Lead researcher Quang-Cuong Pham said he wanted to test whether robotics equipment already on the market was capable of pulling off such a complicated job. It requires the machines to recognise the chair parts, work out how to pick them up and move them without causing damage, and then perform the moves flawlessly. "Our aim was to bring all these capabilities together and push them to the limit," he said.

It took a few attempts to get it right. Early on, the robots dropped wooden pins, let go of parts too soon, and performed moves that did more to dismantle the chair than assemble it. Some moves required a part to be held by both robots at the same time, and since industrial robots are far stronger than Ikea furniture, a number of mistakes ended badly. "We bought four chair kits and broke a few of them," said Pham.

The robots did not work out what to do from scratch. They were programmed to know what the parts of the chair looked like, how they should go together, and in what order. "What it works out on the fly is how to do it," said Pham.

So far the robots can only assemble the chair frame, which is held together with wooden pins. To put each one in place, the robot finds roughly the right spot and then moves the pin around in a spiral until it locates the hole. The next step is to have the robots finish the job by bolting the various parts together. "That could take a few more months," said Pham. "It's not significantly more difficult."

Reported in the journal Science Robotics, the work is a reminder that engineers are making progress in the field despite a recent flurry of videos that show robots falling over at every conceivable opportunity, being defeated by a door, or simply having a bad day at the office.

Pham believes the work paves the way for robots to move on from industrial assembly lines where they perform precise, repetitive movements, and tackle more complicated tasks, such as building computers and aircraft from stores of parts.

Edward Johns, a roboticist at Imperial College London, said: "We will soon see manufacturing robots moving beyond car assembly lines, but the key long-term challenge is generalisation to everyday environments, outside of factories and laboratories. In particular, fine-grained object manipulation, such as hammering a nail into a hole, is extremely challenging for robots to adapt to new environments, and yet these are the skills which really showcase human dexterity above all other animals".

Plenty of challenges remain for robots, said Manuel Giuliani at the Bristol Robotics Laboratory at the University of the West of England. Machines struggle to recognise parts that are lying on top of each other; are bad at handling slippery objects; and have yet to master picking up soft items, such

as fruit, without squishing them, he said.

In the meantime, Pham is keen to see if robots can learn to build the chair using only an image of the assembled product as a guide. Will the technology ever help humans who struggle with the task? "I don't think it is in Ikea's business model to have robots assemble their chairs," he said. "In the next 10 to 20 years, people will still be sweating over flat-pack furniture."

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