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**Trading Facts: Arrow's Fundamental
Paradox and the Emergence of
Global News Networks, 1750-1900**

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Trading Facts: Arrow's Fundamental Paradox and the Emergence of Global News Networks, 1750-1900

Gerben Bakker¹

Abstract

The nineteenth century saw the advent of news agencies that became well-coordinated global organisations with large networks of correspondents, such as Reuters, Havas, Wolff-Continental and Associated Press. Essential features of these agencies were substantial fixed and sunk set-up costs, high fixed operating costs, a marginal cost of supplying news to an additional customer of virtually zero, and the quasi-public good character of information, which had implications for the organisational form, marketing and pricing. To solve Arrow's fundamental paradox of information, agencies adopted subscriptions, because this made the *marginal price* of news zero. The news networks were operated by unique organisations whose evolution interacted with new technologies. The paper investigates how the news agencies emerged, whether and how they co-evolved with infrastructure firms, what business models they pioneered, how they developed/discovered these models, and how they became encapsulated in an oligopolistic industry structure in the course of the nineteenth century.

1. Introduction

During the nineteenth century, the communications industry grew considerably. Before the middle of the century, visual telegraph systems, postal pigeons and messenger services were widely used, while later the

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electric telegraph would become the predominant mode of communication. Standardised and universal postal service also grew substantially during the century. This sharp growth in communication speed, capacity and quality had a pronounced effect on international news gathering, the evolution of news agencies and the information they sold. One of the first and major customers of the news agencies were people in business, the business section of newspapers and the business press.

This paper will investigate how the news agencies emerged, what kind of business models they developed and what they contributed to the productivity growth in this industry. It will analyse the increasing industrial concentration of news agencies and the specific organisational forms adopted as well as analyse what this paper calls the process of industrialisation of messaging and news services. It will also discuss whether Britain had a comparative advantage in communications and news.

This paper's perspective is that technological change was largely endogenous, that it was determined by increasing demand for news and communications, not primarily by a new technology that was invented out of the blue. To test this point, alternative transmission technologies that preceded the electric telegraph are investigated, as well as the development of news agencies before the rise of the electric telegraph.

The paper will investigate the value of information and how it could be determined, the difficulties of trading information and how they were overcome and the reasons why the business press and business persons were among the main users of the news services. This paper will not give a descriptive history of the infrastructure development or the news agencies, as these can be found readily elsewhere.

This research is worthwhile because of the unusual economic features of the communications industry, involving high fixed and sunk

costs and marginal costs approaching zero. Although this business model differs from several standard textbook models, more and more businesses throughout the nineteenth and twentieth century came to share some of these characteristics. One thinks, for example, of electricity, water, entertainment, railroads, highways, pharmaceuticals, software, etc. Second, because of measurement problems, productivity growth in some of these industries has not always been properly quantified or appreciated. Even when properly measured, price often decreased so much that the industry seemed not very significant even if output growth was enormous. Productivity and welfare gains in these industries were therefore often unnoticed and unappreciated.

This research is also worthwhile because it may give some insight into the nature of information in terms of its use in society, the historical evolution of information gathering, trade and retail and its relevance to the business press and business customers.

The paper is structured as follows: The next section will discuss the evolution of the news agencies and the transmission technology they used, and is followed by an analysis of their business models. A subsequent section evaluates whether the significant changes in information gathering and distribution can be characterised as an industrialisation process. It is followed by a discussion of the management and organisation of the news agencies. A final section estimates the productivity growth in the industry.

2. Evolution of the Industry

This section discusses the existing early news agencies, the growth of news agencies during the first half of the nineteenth century, and the effect of the electric telegraph on the news agency business.

The main customers of the early news services were businesses. Often businessmen informally exchanged letters with each other to share news. Messaging services existed that corresponded with agents in important trading cities, and then compiled newsletters which were sent to paying subscribers. Before the adoption of the printing press, this was a costly process. The bank and trading firm Fugger operated a messaging service that made use of correspondents in the firm's offices throughout Europe. Another news service run from the same city during the sixteenth century was that run by Jacob Philipp Hainhofer.² In the Netherlands during the seventeenth century, Abraham Casteleyn operated a regular messaging service from Haarlem.³ Many independent news services existed that often delivered newsletters on a weekly basis, the news being copied by a team of copyists. In the Italian city states during the sixteenth and seventeenth centuries, these newsletters, or *avvisi*, became increasingly important.⁴ In major trade cities—such as Venice, Augsburg, Neurenberg, Wittenberg, Frankfort, Cologne and Antwerp—correspondents existed that sold all kinds of business information. The postmasters in these cities also made money from the gathering and sale of news.⁵ Because of the high costs of running a news service and copying the news and the resulting high subscription fees, business and governments were probably the only customers willing to pay for the service, as they could make an assessment whether the financial benefits they had received from being better informed weight up against the cost of subscription.

During the sixteenth and seventeenth century the handwritten newsletters with mainly business and political news seem to have survived the adoption of the printing press. Initially, it seems that the

² Wilke 1998: 163.

³ Baggerman 1985: 16.

⁴ Baggerman 1985: 15.

⁵ Baggerman 1985: 17.

pamphlets turned out by the printing presses had a more popular and sensational content and little current news. The large costs of printing and the need to print a large run that could be sold over a large time span may have been a reason why news services still kept using copyists.⁶

During the early nineteenth century, news agencies expanded substantially. Initially, the growth was partially government-led. Governments invested in extremely costly information transmission systems, mainly using the visual telegraph technology. Pioneering here were the French revolutionary government, who began building a network of towers and hilltops using the technology of Charles Chappe. This was followed by similar investments by many other governments, and soon messages could travel rapidly across Europe. By the mid-1830s, the European visual telegraph network reached from Amsterdam to the Mediterranean, and from the French Atlantic coast to Venice in the east, with further networks in Germany, Britain, Russia, Finland, Sweden and Denmark. Telegraph towers numbered almost one thousand.⁷

The limited bandwidth of these networks meant that they were mainly used for the most essential political and military information, i.e. information with a very high potential value. As the government was the single customer that would receive the highest absolute value of telegraphed news, it is not surprising that the investments were mainly done by governments. As a group, business persons would collectively most likely derive more benefits, but only when bandwidth would be wider. With a bandwidth that only allowed the sending of a few messages

⁶ One could also argue that as part of the copyists were automated away by the printing press, the wages of copyists should come down, and thus the costs of hand-written newsletters.

⁷ Standage 1998: 18. On the German visual telegraph network see Beyrer 1998. The line Berlin-Koblenz, taken into use in 1833, counted 61 stations (and from 1842 63 because of the large distance between stations number 24 and 25; p. 23). To keep a clear line of sight, trees had to be cut, and sometimes whole lines had to be hacked through forests. Also, areas with a lot of mist had to be evaded. In 1852, the last visual line was taken out of service and replaced by the electric telegraph.

each day, the potential value of those messages needed to be higher than that of alternative messages that could have been sent. Napoleon, for example, ordered that winning national lottery numbers were transmitted weekly through the telegraph, which sharply reduced the fraud committed with it.⁸ This is an extreme example of a message with a large (social) value/return related to the size of its content. Another example illustrating the high returns governments got from the networks, happened half a century later, when the British government saved about £50,000 with a single message to Canada. The telegram cancelled a previous order to send a large regiment of Canadian troops to India, to quell an uprising that had been suppressed in the mean time. The next day, the transatlantic cable broke down.⁹

The visual telegraph networks were hardly used for business news, because of their limited capacity and their ownerships by government. For a short period, some stock market information was sent over the French network, but this experiment was soon stopped by the French government.¹⁰ In Britain, besides the military network built by the admiralty, some private networks operated for business purposes existed. A visual telegraph line was built between Liverpool and Merseyside, to relay information about incoming and departing ships.¹¹

Parallel with the expansion of government and military news services, private news services using different technologies flourished as well. From 1811, for example, the agency Correspondence Garnier ran a daily news service from Paris, charging fifty francs a month. Its major customers were German newspapers.¹² Also, many 'translation bureaus' existed, that translated news from many sources in different languages to

⁸ Standage 1998: 16.

⁹ Standage 1998: 144. See also Neutsch.

¹⁰ Neutsch.

¹¹ Standage 1998.

¹² Baggerman 1985: 15

one news overview in one target language.¹³ In 1832, Charles-Louis Havas founded Bureau Havas, which was to become a major international news agencies. Havas bought several existing news agencies, including Garnier. He made use of the French government's extensive visual telegraph network, and in 1840 he started a regular pigeon service between Paris, London and Brussels. In 1852, Havas started using the electric telegraph.

The Times of London was one of the very few newspapers that operated its own news service. Its subscribers were mainly business persons. It had a global network of correspondents, and in 1837 it started a pigeon service to deliver stock market information from the continent. Julius Reuter supplied *The Times*' competitors, the number of which had boomed after the abolition of the newspaper duty in the 1850s. These newspapers could not afford their own news service. Eventually *The Times* became a customer of Reuter. Reuter charged 2s6d for twenty words if Reuters name was acknowledged, and 5s if it was not. This underlines the importance of reputation in the news business, as customers often could not verify and check the news they received in a timely way.

In the US, during the 1830s news services emerged on the east coast that would approach incoming vessels in fast 'news boats', to get the news from Europe before the ships reached the harbour. The value of having the news first is clear from the premium newspapers were willing to pay for the news. The *New York Herald*, for example, offered to pay \$500 for every hour European news arrived at the *Herald* in advanced of its competitors.¹⁴ Over time, newspapers pooled their news gathering into agencies, to save costs, and in 1857 two existing organisation, Harbour

¹³ Julius Reuter worked for such a service before starting his own company. Standage 1998: 141.

¹⁴ Standage 1998.

News Association and Telegraphic and General News Association, merged to form Associated Press.

The news agencies used various kinds of technologies to gather and distribute news. Transport and messengers were used. In the US, for example, two New York business newspapers, the *Journal of Commerce* and the *Courier and Enquirer*, each ran a pony express between Washington and New York in order to get the political news first.¹⁵ Fast boats were used to get news from ships before they arrived in the harbour. Pigeons were also widely used. Julius Reuters, for example, started his business with a pigeon service between Aachen and Brussels, and added pigeon services from many other European cities. After market closure, stock market information was put on lightweight paper, rolled up in a small cylinder and attached to a pigeon. Three pigeons were sent off each time with identical information, to improve reliability. The route Aachen—Brussels was strategic as it connected two telegraph hubs. When the telegraph line Aachen—Brussels was completed, Reuters kept using his pigeons in addition to the telegraph line,¹⁶ suggesting that the limited capacity and high costs of the early telegraph kept other transmission technologies economically viable, as only the information of the highest value and time-sensitiveness was sent over the telegraph line. Reuter, for example, initially served mainly business customers, and only later served more and more newspapers and other businesses.¹⁷ For Reuters customers, the telegraph would change the way of doing business revolutionary. Beforehand, information could not arrive faster than carriages, ships and trains.¹⁸ When this changed, management changed. Inventory management, for example, became very different.¹⁹

¹⁵ Standage 1998: 138-139.

¹⁶ At least, this is what Standage 1998 writes.

¹⁷ Standage 1998: 142.

¹⁸ Standage 1998: 145.

¹⁹ See Field 1987, 1992, and DuBoff 1982.

The electric telegraph also changed the news agency business. News was now reported far more in instalments, as it was in progress, so the quantity of news messages increased. The low marginal costs of distribution also integrated previously more isolated markets for news more and more. It seems that many smaller news agencies were put out of business or taken over, and in most countries a few large organisations emerged, and at an international level just a few agencies dominated the news trade.

3. The Emerging Business Model of News Agencies

As news agencies were growing during the early nineteenth century, they needed to develop new business models for their activities, new ways of organising and transacting that would make the gathering and distribution of news profitable. The arrival of the electric telegraph during the 1840s further affected the development of a business model for the agencies.

News is similar to a quasi-public good. It is non-diminishable; one person getting acquainted with certain news does not prevent another person also getting acquainted with it. Only the medium on which the news is delivered is diminishable, but the news carried on the medium can spread in many other ways.²⁰ News is, however, not entirely non-excludable. By using the distribution technology one can differ the time at which various consumers/customers get access to news, and news gatherers may keep news secret. For example, news on a planned merger may exist, but may be confined to the persons involved in the

²⁰ Arrow (1962) also notes that information is indivisible: just a small piece of it often does not have a proportionate value, but has no value at all.

negotiations, while all other persons in a country are excluded from the news until a point in time when an announcement is made.²¹

This quasi-public good character was a major challenge for news agencies. In theory, a subscriber could resell or share the news with other organisations that did not subscribe. Solutions to this problem were contracts that prohibited such redistribution, as well as selling news in bulk to associations of newspapers and organisations. Moreover, after some time, news would become old and lose its value. Timeliness was thus an essential selling point of news agencies.

A second challenge that news agencies faced was the difficulty of trading in information. According to the ‘fundamental paradox in the determination of demand for information’, put forward by Kenneth J. Arrow, buyers cannot assess how much they would want to pay for information without knowing its content, but once they know its content, they do not need to pay anymore; ‘...its value for the purchasers is not known until he has the information, but then he has in effect acquired it without cost’.²² This made selling news piece by piece rather problematic. The emerging news agencies introduced two solutions to this problem. First, they used subscriptions, by which customers paid an advance fee for all the news. The price was based on the agency’s past reputation in delivering news and the guarantee that the subscriber would get all the news the agency would gather. When subscribers had to decide whether it was worth renewing, they only had to think of the value of the few news items that made a difference in their business or their organisation, and these items could differ from subscriber to subscriber. This subscription system made the marginal price of a news item to the customer equal to

²¹ A detailed historical case study examining how Associated Press of the US, a non-profit cooperative owned by newspapers, developed a business model solving the quasi-public good characteristics of news is Shmanske 1986. A future version of this paper aims to compare the specific AP model as identified and analysed by Shmanske with the more basic and general model presented here.

²² Arrow 1962: 615.

zero, and thus solved Arrow's paradox.²³ Second, besides making the marginal price zero, subscriptions bundled news in packages which contained boring and exciting, relevant and irrelevant news. Which was which could differ from customer to customer. A third way to solve the paradox was to establishing a monopoly on news provision: international news agencies often had exchange agreements, in which they would be the sole supplier of information to and from a certain area. An example was for example the contract between Reuters and the Australian newspapers. First of all, the Australian newspapers formed their own cooperative news gathering organisation, establishing a virtual Australian monopoly. Second, they made an exclusive agreement with Reuters, in which they would only sell their news to Reuters, and Reuters would only buy Australian news from them.²⁴

News agencies were characterised by considerable fixed costs, consisting of local offices and correspondents, lease of telegraph lines, head office costs etc. To limit duplication international news agencies sometimes agreed territorial monopolies. Especially between about 1870 and the First World War, the international news trade was run by a cartel of Reuters of Britain, Havas of France, Wolff-Continental from Germany, and Associated Press from the US. Together they had divided up the world.

The marginal costs of news distribution were quite low: there were hardly any costs in adding an additional subscriber. This meant that an increase in the subscriber base would reduce average costs indefinitely, as the fixed costs would be spread over more subscribers. This also

²³ It may however, not be optimal in efficiency terms, as the price signal can not be used to reach the most efficient allocation, and because of this absence of the price signal for individual news items users have to 'over-consume' information to find the information that is most valuable for them. The present-day 'information overload' may be illustrative of this suboptimal allocation mechanism. Another solution to Arrow's fundamental paradox is to make the marginal price zero by bundling it with sponsored messages, which is often used in end (consumer) markets (e.g. television advertising).

²⁴ For a detailed historical discussion of the situation see Rantanen 1998.

explained why, after the telegraph, relatively few news agencies dominated national and international markets. The costs of the incumbents, who already had a large subscriber base, would be very low.

The marginal cost of news production was also quite low, but not minimal. Correspondents, reporters and stringers were largely fixed costs, as often, depending on their contract, they needed to be paid whether there was much news or not. On the other hand, eventful years with large quantities of news could increase costs substantially, as more reporters and correspondents would be hired and sent away, and more telegraph line capacity needed to be rented. Reuters used to say that the boring years paid for the exciting years, because in exciting years costs would be higher while the subscriber base would not significantly change.

Increasing expenditure on news gathering would not necessarily lead to larger revenues. In the long-run it may have added a few subscribers, but once large agencies such as Reuters have subscribed nearly all potential customers, marginal expenditures on news gathering will hardly result in marginal revenues. First of all, the agencies did not own the papers, so profits from increased circulation because of better news will go largely to newspapers. Yet over time agencies could extract part of these increased rents by increasing subscription fees for newspapers. Second, increased expenditure on news gathering generally did not lead to more news happening. Mostly, increased expenditure was a result of more news happening. Increased expenditure could only increase quality by offering more human interest reports or by including additional news categories, such as sports, arts, or science.

4. The Industrialisation Process

The question remains whether the development of modern news agencies can be seen as a form of industrialisation of services. A

previous work has attempted to characterise industrialisation of services.²⁵ It argues that in certain service industries that experience rapid market growth, a shift of process to product innovations involving high sunk costs takes place. The service is automated, standardised and made tradable, resources are shifted from the traditional to the modern sector, productivity growth accelerates, many identical, typical, representative firms are replaced by just a few quasi-unique organisations, and the technology diffuses rapidly across the world.

It is possible to compare the evolution of news agencies with the industrialisation characteristics above in a qualitative way. While the emergence of modern infrastructure provision can be regarded as the industrialisation of messaging services, the development of modern news agencies could be regarded only partially as industrialisation; their evolution may be more a consequence of industrialisation than the industrialisation itself.

The large effect on total factor productivity from the industrialisation of messaging is apparent from the large fall in real prices, both because of the introduction of the telegraph and because of technical improvements to the telegraph. Between 1866 and 1882, when many international telegraph lines came online, the average price per message decreased 17.4 percent annually in real terms (Hugill 1999: 35). The real price of transatlantic telegrams also declined substantially, from \$217 dollars (of 2002) per word in 1858, to \$4.70 per word in 1888, which amounts to a 12.3 percent decrease per annum (figure 1). Figure 2 illustrate the decrease in real prices of telegraph messages and telephone calls in the US. Nowadays, email has made the price per written message about two orders of magnitude lower than in the early

²⁵ Bakker 2005.

1970s.²⁶ Interestingly, while telephone was growing rapidly, the absolute number of telegraphy messages did not decline initially; it only started to decline after 1950. This suggests that industrialisation involving high sunk costs was partially demand-led, and focused on applications that were differentiated from existing sunk investments, and that therefore they met less resistance than traditional industrialisation, as it did not always have a direct observable effect in the form of job losses on the older industry.

Interestingly, in the case of the US, as the networks increased, the number of messages per mile of wire decreased (figure 3). This may be because innovation made costs decrease, so it became increasingly possible to extend existing telegraph networks with more marginal lines, as the additional revenue would still make it profitable. Arrow's fundamental paradox can also explain why receivers of postal letters, telegrams and emails generally did not pay a price for receiving each individual item: they would only want to pay if they would know what or from whom the message was, and if they did know, they often would not need to pay anymore; thus the marginal price of receiving is generally set at zero.²⁷

²⁶ If one writes 90 messages of 50 words a month and pays \$20 for internet connection, and \$20.83 for equipment depreciation ($\$1500/3/2/12$), then the average price per 10 words message would be \$0.09, or 9.1 cents.

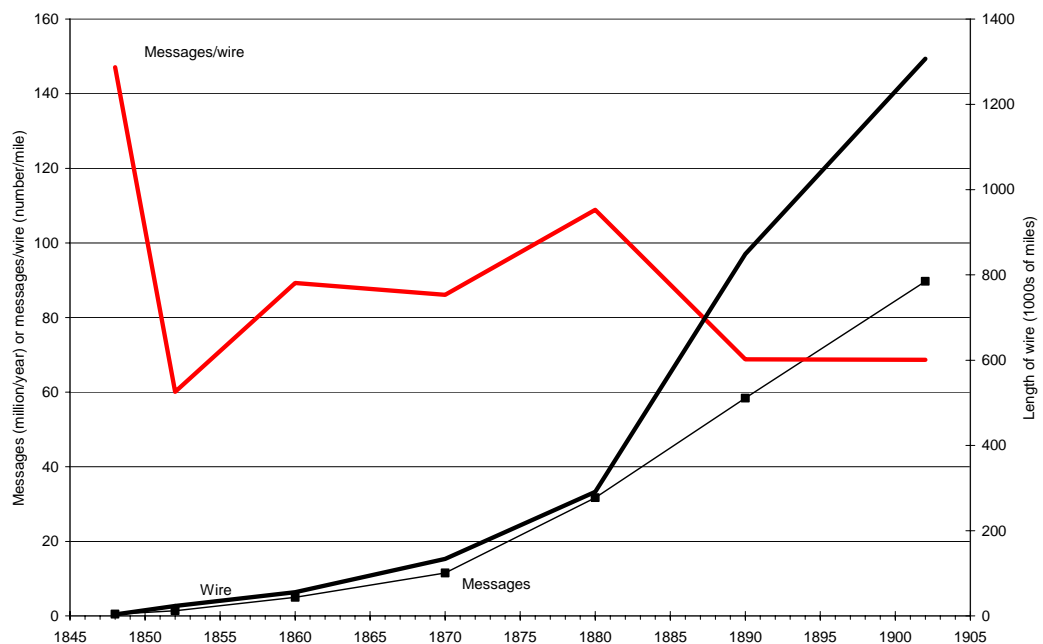
²⁷ Exceptions are 'collect calls' in which the receiver agrees to pay upon hearing who is calling.

Figure 1 The Real Cost of Telegrams Over the Transatlantic Cable, 1858-1888, in Cost-Per-Four-Letter Word (\$ Of 2002).



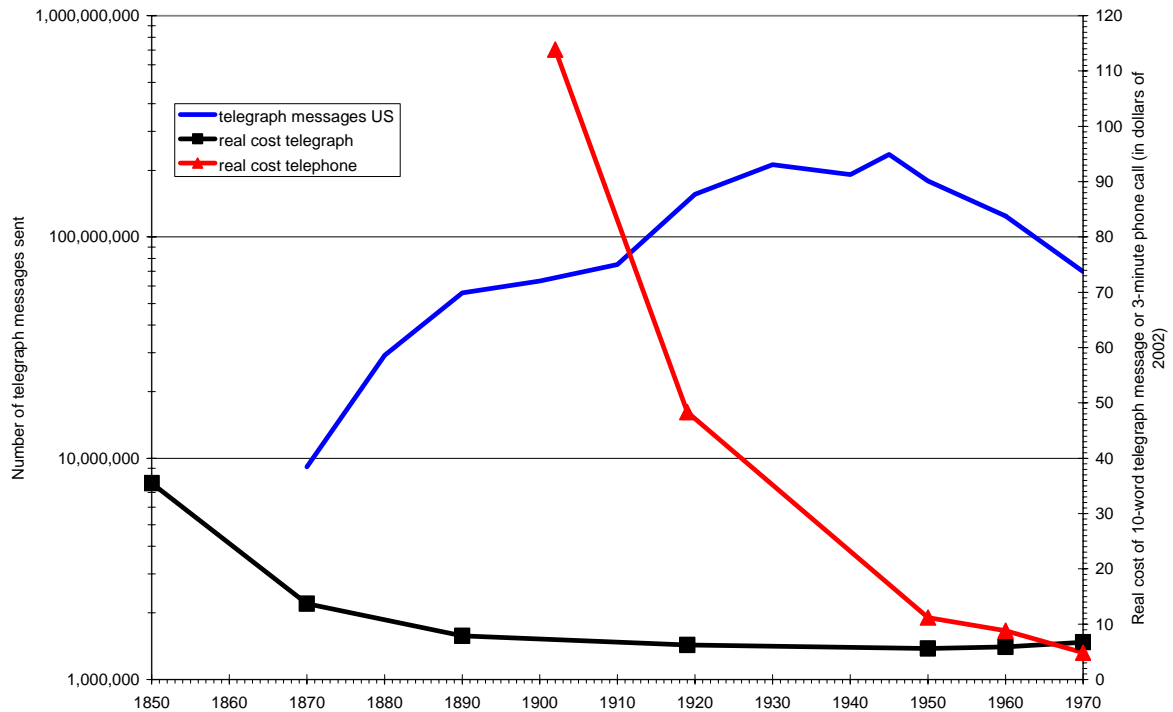
Source: Hugill 1999.

Figure 2 Number of Telegraph Messages Sent and Real Costs of Telegrams and 'Phone Calls, US, 1850-1970, in Number and Real Cost Per Ten Word Message or Three Minute 'Phone Call (in \$ of 2002).



Source: Nonnenmacher 2001.

Figure 3 Total Number of Messages, Total Length of Wire, and Average Number of Messages per Wire, United States, 1848-1903, in Number, Miles and Number/Mile.



Source: Fields 2004:65.

Traditionally, services have been seen as different from manufacturing and several specific characteristics have been proposed, such as the inseparability of production and consumption, perishability, intangibility, variability and verifiability.²⁸ Traditional messaging seems to conform more fully to them than telegraph technology. This also suggests that new technology industrialised the service and decreased several of its service characteristics. One characteristic appears to stand out: the telegraph sharply reduced variability of delivery times. First, news consumption was closer in time to the news production, and the difference became more uniform and standardised: generally, it depended on the telegraph transmission time. Second, the moment when

²⁸ See, for example, Kotler, *Principles of Marketing*.

most consumers would consume the news became more synchronised. Before the telegraph, news production was unified in time, while news consumption was highly dispersed over time, depending on customers' geographic position and transmission times. The telegraph made news consumption more equal in time: consumers in a country would consume important news at approximately the same moment, and—most important for business news—they would be aware that most other consumers would consume the news when they would consume it, i.e. they would know that other business would be aware of the news at the same time (or earlier), while before the telegraph, they could roughly calculate and conjecture whether other businesses would already have the news or not.

This increase in uniformity can actually be quantified. In the US, for example, in 1830, we can take travel times as a good approximation of how fast messages could reach other areas. At that time, twelve different zones existed which all would receive news at significantly different times. The average time to receive news from New York was as much as fourteen days, while variation was enormous, with the coefficient of variation approaching one (table 3). We can then compare this situation to two future 'real' scenarios: first of all, the decrease in communication times brought about by traditional technologies (i.e. improving transport networks), and second, the decrease brought about by the telegraph. This also underlines that in the absence of the telegraph, messaging and message transmission times would not have remained static.

Table 3. *Transport and telegraph transmission time from New York to US regions, 1830 and 1857.*

Reception zone	Transport		Telegraph	Net contrib
	1830	1857	1857	Telegraph
	days	days	days	days
A	1	1	0.25	-0.75
B	2	2		-2.00
C	3	3		-3.00
D	4	4		-4.00
E	5	5		-5.00
F or F-L	6	6		-6.00
G	7			-6.00
H	14			-6.00
I	21			-6.00
J	28			-6.00
K	35			-6.00
L	42			-6.00
Time zones (no.)	12	6	1	-5
Standard deviation	13.5	1.7	0.0	-1.7
Mean	14	3.5	0.25	-3.3
Coeff of variation	0.97	0.49	0.0	-0.5
Median	6.5	3.5	0.25	-3.3
Index 1830=100				
Time zones (no.)	100	50	8	-42
Standard deviation	100	13	0	-13
Mean	100	25	2	-23
Coeff of variation	100	50	0	-50
Median	100	54	4	-50
Annual percentage decrease, 1830-1857				
Time zones (no.)		2.5	11.7	9.1
Standard deviation		7.4		
Mean		5.0	18.2	13.2
Coeff of variation		2.5		
Median		2.3	15.0	12.8

Source : calculated from Fields 2004: 78-79.

The first scenario shows that, because of improving transport, by 1857, the number of reception zones had halved, average reception time was with 3.5 days only a quarter of what it had been before, and the coefficient of variation had halved as well. The second scenario shows an even sharper increase in uniformity, with the reception zones all merging into one zone, the coefficient of variation approaching zero, and the mean

only being 0.25 day (and this is a liberal overestimate which tends to underestimate the contribution of the telegraph). It may be misleading to compare the telegraph directly to 1830 messaging times, but subtracting the reductions in transmission times achieved by transport improvements, it is possible to estimate the net contribution of the telegraph in the increase in uniformity of news reception and consumption.

This contribution amounted to a decrease in the number of time zones with nine percent per year, on average, a decrease in average transmission times with thirteen percent per year, and a decrease in variability of reception times with thirteen percent per year as well.²⁹

With the new technologies of the twentieth century, such as radio and television, the uniformity in time would become even higher, as the last leg of the news distribution process (from telegraph line into newspaper into newsstand/seller), which still resulted in variable times at which consumers consumed the news, was also made uniform.

²⁹ Telegraph growth rates calculated over 20 years (1837 year of first introduction), transport growth rates over 27 years.

5. Management and Organisational Structure of the International News Agencies

The international news agencies that emerged in the second half of the nineteenth century had extensive international organisations (figure 4). They had a head office that coordinated the international gathering and selling of news. National offices would transmit news to the head office, who would retransmit it to all national offices or external buyers. National offices generally had a two-way function: they gathered local news that was internationally relevant and they sold international news that was locally relevant.

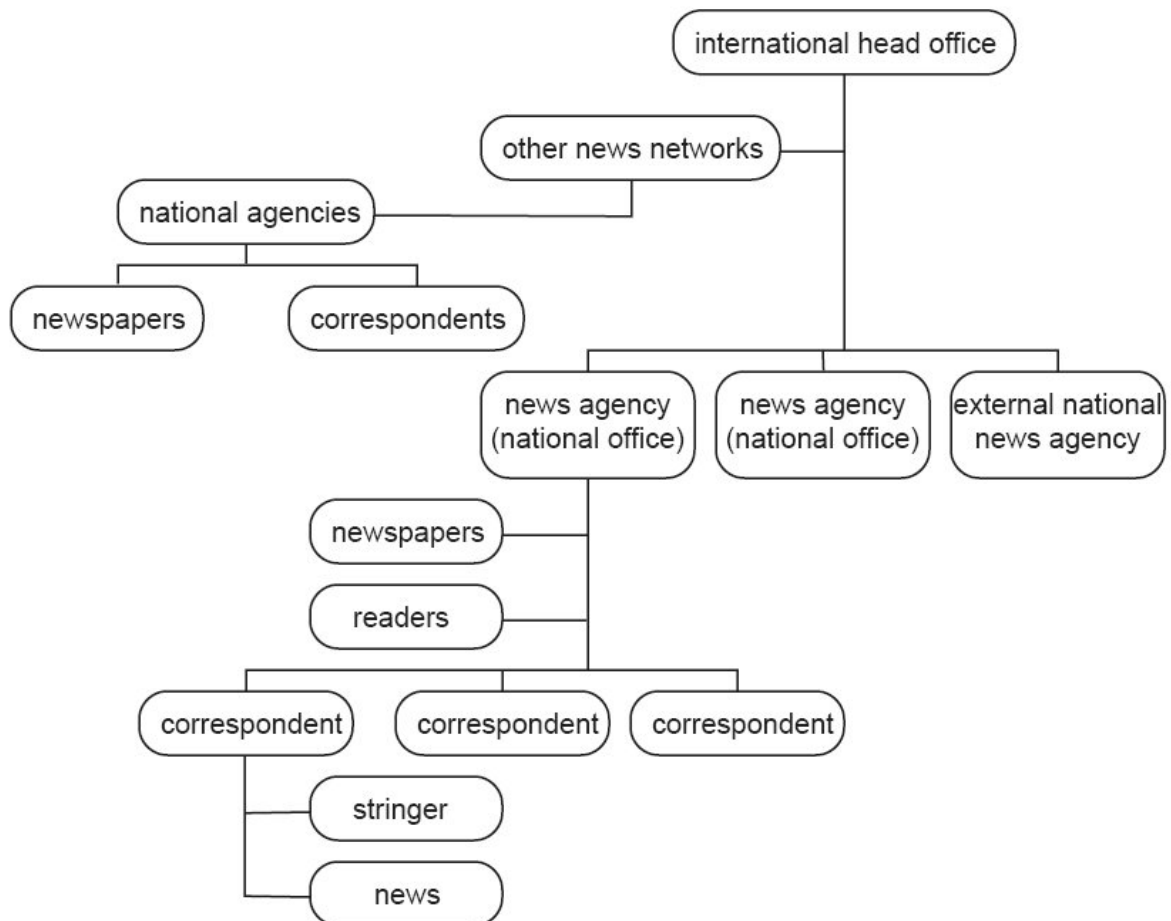


Figure 4 Stylised Diagram of the Organisational Structure of an International News Agency.

Sometimes they had also agreements with national news organisations, in which the national news organisations paid for the international news and were paid (far less) for national news they provided to the international agency. Reuters, for example, had an exclusive long-standing agreement with a cooperative formed by all Australian newspapers. Reuters would only sell to this cooperative, the cooperative would only buy international news from Reuters.³⁰ Such agreements limited the minimum efficient size of the agencies' national offices.

Within the organisational form, effective coordination was essential, as all news was time-sensitive per definition. The news gathering had a somewhat project-oriented nature, in that it was idiosyncratic and only partially predictable. Each news event constituted a project of its own. Nevertheless, many aspects of news gathering were institutionalised to deal with this. Separate tasks existed for reporters, copy editors, editors, etc., news bulletins got a specific structure and format in which the idiosyncratic news was to be reported. Synchronised deadlines structured and made uniform the time frame of news gathering and affected the creation of the news itself (organisations more and more took these deadlines into account when announcing news).

Given the large fixed costs of the international news networks and the small marginal costs, average costs would come down even as an agency's sales would encompass the entire market. This resulted in pronounced first-mover effects: after the first few companies had stepped in, further entrants would be deterred by the large fixed costs, and the knowledge that incumbents could price at marginal costs to keep them out. It may be no coincidence that the four main international agencies—Reuters, Havas, Wolff-Continental, and Associated Press—all had their headquarters in a different, large country, and that they probably benefit

³⁰ Rantanen 1998.

from considerable informal protection and country-specific advantages that helped them enter and stay in the international news business.

Many national news agencies were cooperative structures in order to solve the quasi-public good problem (see section 3 above). In the Australian example, the fact that nearly all newspapers were member of the cooperative sharply decreased the chance that an organisation would free-ride on Reuters news, and for the cooperative it made sure that any price at all could be obtained from the local news from Reuters.³¹

From about 1859 to the 1930s, Reuters, Havas and Wolff-Continental, with the acquiescence from Associated Press and several smaller players, operated an international cartel, in which they divided the world into areas where each had exclusivity for news gathering. The first agreement dated from 1856 and concerned the exchange of stock market and other business data between Havas and Reuter.³² These areas generally coincides with colonial and cultural spheres of influence, with competition sometimes maintained in areas that did not fall clearly in such a sphere. The agencies saved substantial costs by obtaining the news from each other in these areas rather than build a duplicate organisation. The cost properties associated with the first-mover advantages above may explain why a cartel in this case may not have been economically inefficient, given the market size and conditions at the time.

Reuters seems to have fared well under the cartel. Revenues reached about £200,000 at the turn of the century, and over half a million pounds on the eve of the Second World War (figures 5 to 7). The profit margin fluctuated between two and seven percent, and exceptionally reached over twenty percent in 1938.³³ The geographical distribution of revenues changed substantially during the start of the twentieth century.

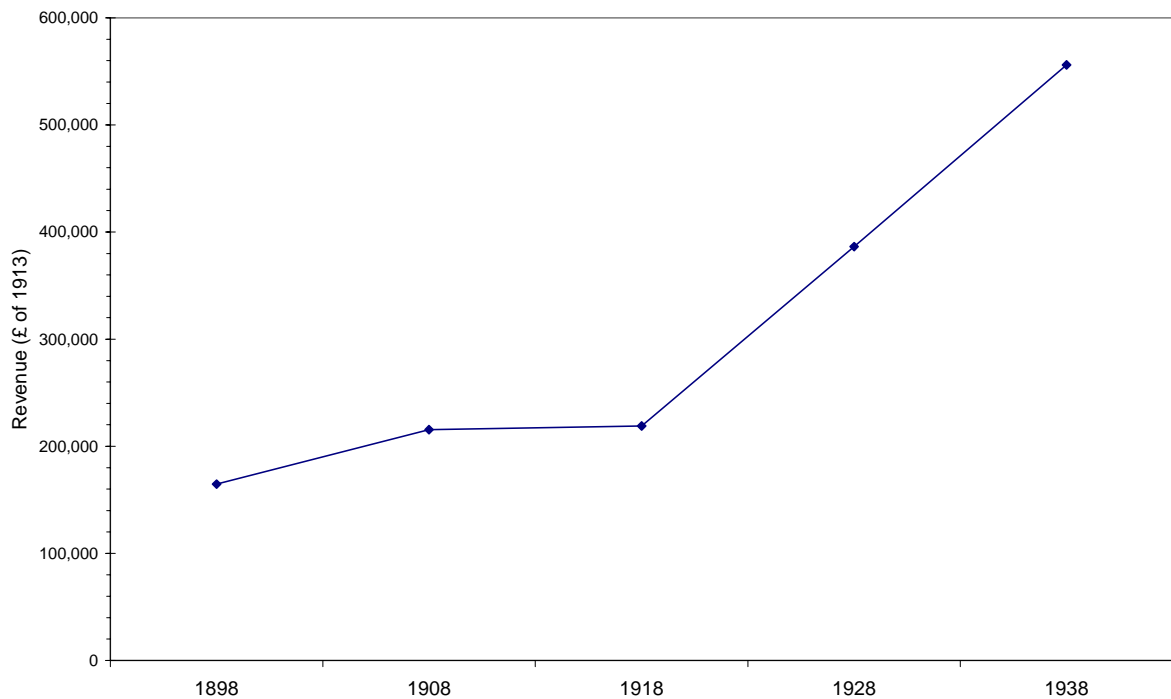
³¹ In the case of competition, Reuters probably would have had to pay far less to nearly nothing.

³² Read 1992.

³³ All data based on Read 1992.

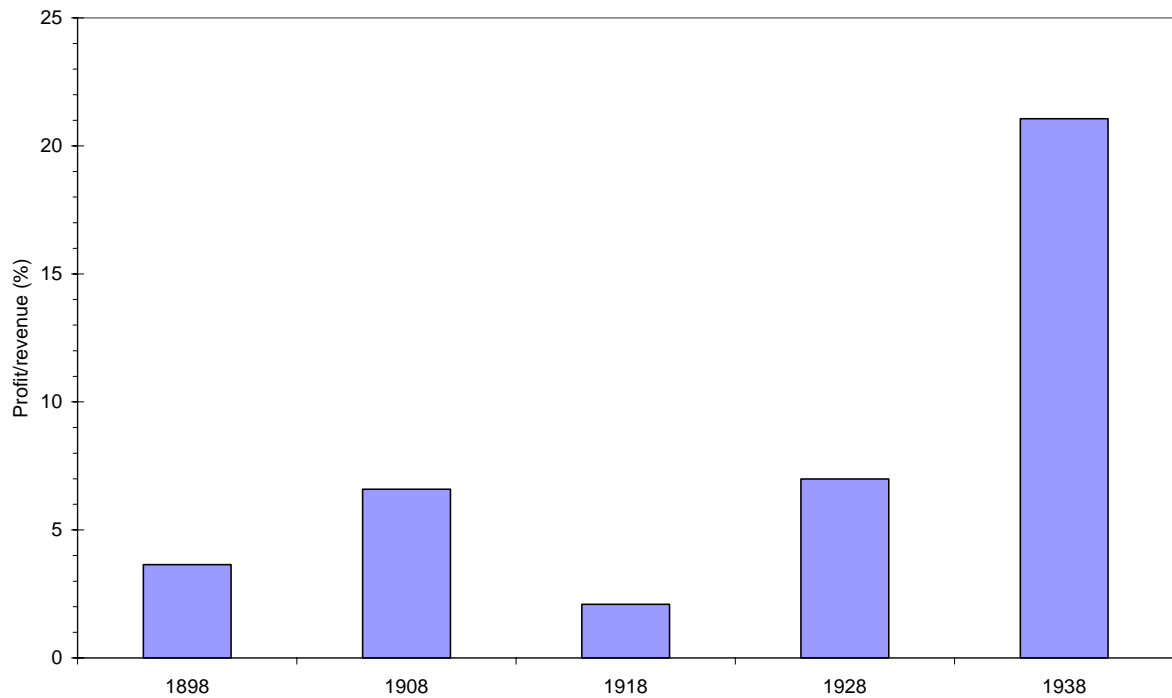
The UK and Europe declined in importance, while more and more revenues came from India, the far east and the rest of the world. Revenues from the US were extremely limited, possibly because here Reuters was competing with its cartel partners Havas and Wolff-Continental as well as Associated Press. US anti-trust regulation introduced at the time (the Sherman and Clayton acts) may further have affected the revenue possibilities in the US.

Figure 5 Reuters Total Real Revenue, 1898-1938, in Pounds of 1913.



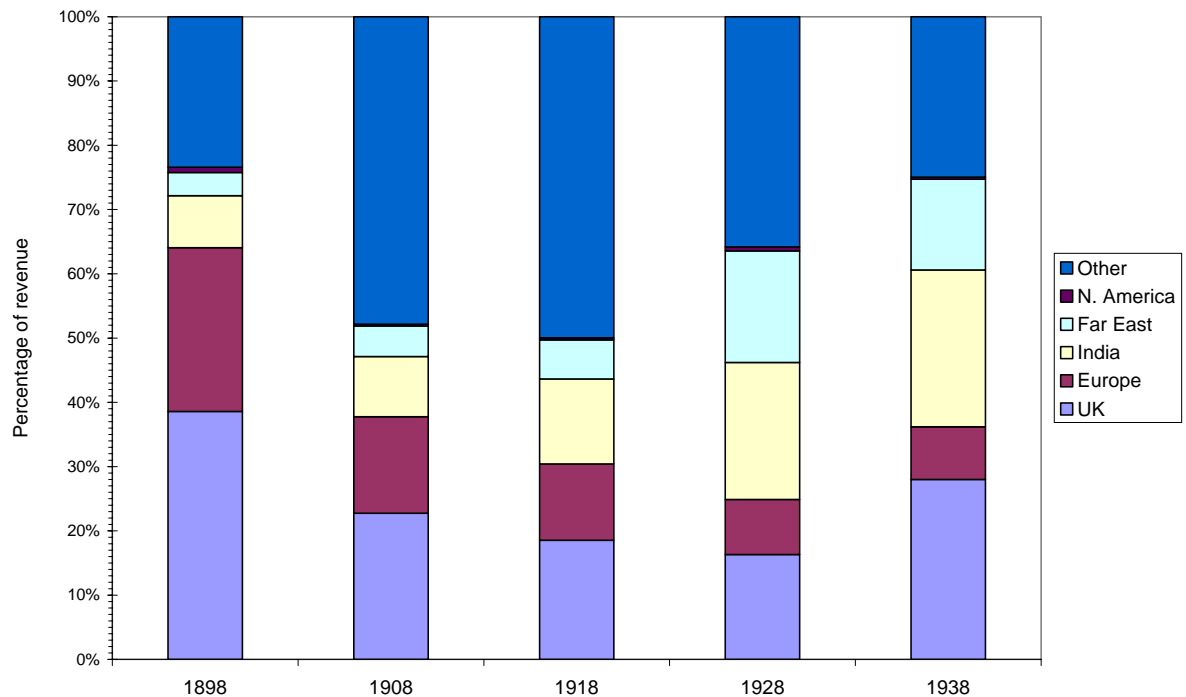
Source: Read 1992.

Figure 6 Reuters' Profit Margin, 1889-1938.



Source: Read 1992.

Figure 7 Reuters Revenue by Territory, in Percentage of Revenue, 1898-1938.



Source: Read 1992.

6. Conclusion

This paper has argued that the development of the communications industry during the nineteenth century does fit the industrialisation of services framework. Rapid market expansion first triggered process innovations of existing transmission technologies and when these reached decreasing returns, product innovations of new transmission technologies, such as the electrical telegraph. Information transmission was automated, standardised into specific formats, and partially made tradable. A process of structural change was set in motion in that in increasingly higher proportion of workers would work in the modern part of the industry (electromagnetic transmission) rather than in the traditional part (messenger/courier services and universal postal service). This process was relatively painless as it was hidden by the sharp growth of the industry as a whole. The emergence of the modern part also brought about a shift from low to high fixed and sunk costs, and the shift from many identical firms to a few quasi-unique organisations. The industrialisation process was also characterised by a rapid international diffusion of the new transmission technology.

This process of industrialisation was largely demand-led and endogenous. This is supported by the circumstance that first more traditional technologies – such as a universal postal service, the visual telegraph, and carrier pigeons – were further developed. Only when additional improvements to these technologies reached decreasing returns were new technologies pioneered. Likewise, the news agencies that came to dominate the national and international trade in news, did not emerge as a consequence to technological improvements, but because of the general rise in demand for information that also drove the development of the infrastructure.

This leaves the question of what drove the surge in demand for information. First of all, increased transport speeds – the result of better

roads (e.g., turnpikes), canals, railways, and oceanic shipping – required more precise coordination, and faster information transmission combined with increased transport speed would allow for better inventory management. Second, increasing urbanisation concentrated demand spatially, resulting in larger markets for a given infrastructure investment. Growing labour mobility and integration of the world economy under Britannic rule also increased the demand for information. Third, the general growth of human capital (for example literacy) increased the demand for information products (such as newspapers) that used timely information as an input. Fourth, it is possible that information transmission endogenously further increased the demand for information: by integrating markets and delivering more information about markets far away, it could actually trigger demand for further information on those markets. For example, once the transatlantic cable made US grain prices available in London in real time, London business people probably now wanted access to a wider range of time-sensitive information on the US, as well to be able to make their own assessment on future price movements.

The new technology had high fixed and sunk costs, and relatively small marginal costs. The most extreme case of this was telegraph lines, which involved huge fixed and sunk set-up costs, large fixed operating costs, but hardly any marginal costs for an additional telegram transmitted. This meant average costs kept ever-falling as output on a line expanded. The news agencies incurred large fixed costs to keep their network of correspondents running and to pay their subscriptions and leases to telegraph companies. Higher costs in years with lots of headline news did not result in concomitantly larger revenues, as most information was sold by subscription. Quiet years therefore paid for busy years. When the first movers had global networks in place, their average costs were also continuously decreasing in their output volume: a news message

needed to be produced only once, but could be sold/distributed infinitely many times, especially with the new transmission technology. This made new entry difficult and probably explains how the news industry became heavily concentrated during the nineteenth century, with a handful of agencies dominating the international news trade, and national cooperatives monopolising the national intermediate news gathering.

On the revenue side, news agencies faced Arrow's fundamental paradox of information, that made trading information so difficult: at the moment the news happened customers did not know how much they want to pay for it, because they had to know the news first, but when they knew the news, they did not need to pay for it, as they already knew it. News agencies solved this paradox in three parallel ways:

First, they sold the news into subscriptions. In that way, the marginal price of news for the customers became zero, and Arrow's paradox was solved. In deciding whether or not to renew subscriptions, customers would not systematically value the whole stream of information they had received, but those few instances in which the information had proved essential to them.³⁴

Second, they bundled news in packages that contained both hard news and soft news, boring and exciting news, relevant and irrelevant news, and which was which could depend on customers' preferences. Likewise, news from different geographical areas and topics was bundled together. Customers could only chose to subscribe to broad packages (e.g. add on 'sports' or 'arts and entertainment' to their subscription), but could not buy narrower news streams.

³⁴ This is still the way subscription systems work today. Subscription channels on cable TV, for example, do not aim to maximise audience size by focusing on the lowest common denominator (the usual technique to maximise advertising revenue), but by having a variety of programmes, each of which may be highly valued by a small group of customers. When those customers renew, they will remember the few programmes that they intensively like, not mainstream programmes that they occasionally watch.

Third, news agencies tried to establish monopolies. A problem on the marketing side was that news had strong public good characteristics: it was non-diminishable and not fully excludable. Customers could easily distribute news they received to other potential customers. This problem was solved internationally by a cartel structure, in which each agency exclusively supplied the news from and distributed the news to a certain area in the world, and nationally by that the international agencies generally supplied a local monopoly or near-monopoly on intermediate news gathering (often in the form of a cooperative). It appears that the news industry devised a private solution to a public good problem.

The business press and business customers played a leading role in the development of news agencies and infrastructure. For businesses the information was often the most valuable, and they therefore were among the first customers of the new companies, as their willingness to pay was high. Moreover, their demand would generally sharply increase with a price decrease, as a lower price would result in additional demand for other information with a slightly lower business benefit. One could therefore argue that it generally was the demand for business news that kept the news industry growing and kept driving market growth as prices declined. As the price of information fell, businesses learned to make money from ever lower level forms of information.

Productivity growth is a more complicated issue in the news industry. Concerning the infrastructure, the price per standard message decreased substantially, while prices for labour and capital did not, suggesting a sharp growth in productivity, and/or a fall in industry price/cost margins. If the standard message is corrected for transmission time, productivity appears to have grown even faster. Concerning news gathering, productivity estimates are more difficult, as the news agencies started to offer many new products in the form of news from new locations and on more segmented topics. A business newspaper of the

late nineteenth century therefore was a product of far higher quality than a newspaper a century earlier, although its price was far lower. This low price and the everyday character of a product containing information from virtually everywhere in the world in a sense hid the enormous productivity increase and technological advance that had made this product possible. The productivity effect, both qualitatively and quantitatively, on virtually every other industry that existed is even harder to quantify. It suffices to say that the development seen in the twentieth century would not have been possible without the emergence of global news networks. They formed the nervous system of the emerging world economy.

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