Full text available at: http://dx.doi.org/10.1561/1800000015

The Web Economy: Goods, Users, Models, and Policies

The Web Economy: Goods, Users, Models, and Policies

Michalis Vafopoulos

Aristotle University of Thessaloniki
Greece
vaf@aegean.gr

the essence of knowledge

Boston – Delft

Foundations and Trends® in Web Science

Published, sold and distributed by:
now Publishers Inc.
PO Box 1024
Hanover, MA 02339
USA
Tel. +1-781-985-4510
www.nowpublishers.com
sales@nowpublishers.com

Outside North America:
now Publishers Inc.
PO Box 179
2600 AD Delft
The Netherlands
Tel. +31-6-51115274

The preferred citation for this publication is M. Vafopoulos, The Web Economy: Goods, Users, Models, and Policies, Foundation and Trends® in Web Science, vol 3, nos 1–2, pp 1–136, 2011

ISBN: 978-1-60198-564-4

Foundations and Trends® in Web Science
Volume 3 Issues 1–2, 2011

Editorial Board

Editorial Scope

Foundations and Trends® in Web Science will publish survey and tutorial articles in the following topics:

- Agents and the Semantic Web
- Content Management
- Databases on the Web
- Data Mining
- Dependability
- Emergent behaviour
- Human-Computer Interaction
- Hypertext/hypermedia
- Languages on the Web
- Mobile/pervasive
- Multimedia
- Network infrastructures
- Performance
- Scalability
- Security
- Semantic Web — metadata, ontologies
- Standards
- Trust and Provenance (Policy)
- Universal Usability
- User Interfaces
- Web Searching/Information Retrieval
- Web Services

Information for Librarians
Foundations and Trends® in Web Science, 2011, Volume 3, 4 issues. ISSN paper version 1555-077X. ISSN online version 1555-0788. Also available as a combined paper and online subscription.

Foundations and Trends® in
Web Science
Vol. 3, Nos. 1–2 (2011) 1–136

DOI: 10.1561/1800000015

now
the essence of knowledge

The Web Economy: Goods, Users, Models, and Policies

Michalis Vafopoulos

Aristotle University of Thessaloniki, Greece, vaf@aegean.gr

"It is the journey, not the destination."

Homer

Abstract

The web has evolved from a piece of software code into an interdependent techno-social system of multi-purpose functionalities. From an interlinked bulletin board with low levels of interaction, a system of multiple interlocking contexts has developed which is now responsible for a substantial share of our financial transactions. Users not only post and link digital content, but also communicate, work, advertise, and exchange information. Multi-fold social and economic interactions result in a dynamic compound of moral values and code. Web Science constitutes a systematic effort to investigate the salient features and implications of this compound by studying the web as a self-standing techno-social artifact. The economic aspects of the web are fundamental but still unexplored in this agenda. The scope of this survey article is twofold: (a) to analyze how the web economy differs from traditional

settings and what the implications of these differences are and (b) to formalize a minimal common understanding on the subject of incentives and mechanisms in the web economy. Accordingly, the concept of web goods, a classification of web users and the main functions of the web economy are introduced. This effort is not, by any means, a thorough review of the economic literature related to the web. The focus is on the web as a standalone economic artifact with its own functionality and processes. Our approach is to study goods, users, models, and policies within the web perspective, hopefully contributing to the initiation of Web Economics as a field which investigates the economic motives and implications of the web. In particular, we look at how we can achieve the right balance between open access to online information while also providing proper incentives, producing content, and developing network infrastructure. Moreover, we examine how we can accelerate development by facilitating life-critical functions, transparency, and participation.

WSSC* Classification:
"webscience.org/2010/E.1.1.1 Goods in the web"
"webscience.org/2010/E.1.1.2 The web economy"
"webscience.org/2010/E.1.1.4 Antitrust Issues and Policies on the web"
"webscience.org/2010/E.1.1.6 Web-based economic development"
"webscience.org/2010/E.1.2.3 Advertising on the web, sponsored search"

Keywords: web goods, Web Economics, net neutrality, web-based development, online self-determination.

JEL Classification: L86, O39, D85, E26

ACM Classification: J.4, K.6, K.4

* Web Science Subject Categorization System [171], `http://webscience.org/2010/wssc.html`

Contents

Glossary

Information Goods

In economics and law, *information good* is generally defined as a commodity that derives its main market value from the information it contains (e.g., books). First, telecommunication technologies (e.g., radio) and later digitization enabled the detachment of information goods from the medium of transfer. This change had tremendous effects on the production, exchange, and consumption of information that could not be fully captured by the traditional conceptualizations. In 1999, Shapiro and Varian [149] redefined information goods as anything that can be digitized (a book, a movie, a record). These potentially digital information goods may be copied, shared, resold, or rented in order to provide revenues.

Digital Goods

Quah [128] organized digital goods as sequences of 0s and 1s that have economic value. They are distinguished from traditional goods by five characteristics: nonrivalry, infinite expansibility, discreteness, aspatiality (weightlessness or spacelessness), and recombination.

Network Goods

Pure network goods are defined to be goods that derive their entire value from network externalities. Pure network goods have no value in a network of zero size (e.g., telephony, Internet, the web).

Externalities

Externalities in economic theory are defined as the indirect effects of consumption (i.e., demand side) or production (i.e., supply side) activity. These are effects on agents other than the originator of such activity, which do not work through the price system. If this indirect effect (or transaction spillover) is beneficial to the other agents it is called a *positive externality* and in the opposite case of a cost it is called a *negative externality*. For example, the addition and interconnection of new information on the web may result in positive externalities if it is educational or joyful, or may cause negative externalities if it is privacy threating or libelous.

Network Externalities

Network externalities in economic analysis are defined as the externalities involved in network goods.

Network Effects

Network effects are participants in the market that internalize network externalities. Usually, in the presence of network effects, a user takes into account only her own utility in her decision to join or not join the network. Consequently, the extra utility he provides to all other users is overlooked in his decision. Network effects can be elaborated in four main categories: direct, indirect, two-sided, and learning network effects.

URI — Uniform Resource Identifier

URI[2] is a short string that identifies resources on the web. These can be documents, images, downloadable files, services, electronic mailboxes,

[2] http://www.w3.org/Addressing and http://www.ietf.org/rfc/rfc2396.txt.

and other resources. It makes resources available under a variety of naming schemes and access methods such as HTTP, FTP, and Internet mail addresses in the same simple way. They reduce the tedium of "log on to this server, and then issue this magic command" down to a single click. Every URI is owned by a physical or a legal entity that has the right to sell it or to provide access for any other entity it wishes (refer to [63] for a detailed discussion of identity and references on the web). URI is the specific part of digital information contained in a web-being that identifies exclusively and enables direct linking and transfer to other web-beings. URI identifies strictly one web good. It is the most profound and stable technology to create communication channels on the web. It requires the minimal description of invariant elements in communication through the web and acts like a fingerprint of the web-being because it is directly connected to a person's existence (birth, access, navigate, edits, and death). Each web good has one generic URI, but can be identified through many other URIs. URI is the *borderline* and the *interlocutor* of web goods. It enables "teleportation" of navigators (i.e., direct access), as well as automatic exportation and importation of content from other web goods.

Web Goods (WGs)

Web goods are defined as sequences of binary digits that (a) are identified and communicated by an exclusively assigned URI and (b) affect the utility or the payoff of an individual in the economy. Their market value stems from the digital information they are composed of and a specific part of it, the hyperlinks, which connect resources and facilitate navigation and editing over a network of web goods with minimal costs. Pure WGs include goods that are basically exchanged and consumed on the web and are not tightly connected to an ordinary good or a service (pre-) existing in the physical world. For instance, a blog entry that comments on the market of used cars is a pure WG but a car sales advertisement is not. According to a production incentives-based categorization, WGs are categorized as *commercial* (e.g., sponsored search results) and *non-commercial* (e.g., Wikipedia entries). Based on their excludability, WGs could be divided into *public* (e.g., Open Data) and *private* (e.g., subscription to the online version of a magazine). A WG

is considered to be public if it is non-excludable. WGs can be made excludable, and in that case become *purely private goods* through the institutional setting of provision. Private WGs are excludable because of a financial fee (e.g., subscription paid for a web service), a *personal data fee* (e.g., submit email address), or a *social fee* (e.g., Facebook friendship).

Web Users

The distinction of users is based on the motivations and economic impact of their actions in the web ecosystem. First, users are partitioned to navigators and editors of WGs. Navigators consume information by navigating the web. Editors produce WGs by creating, updating or deleting online content and links on the web network. Editors are categorized as *amateur* and *professional* based on their production incentives. In contrast to amateur editors (e.g., Wikipedia editors), professional editors are profit maximizers and take into account direct financial compensations in producing WGs (e.g., a blog with paid advertisements). The service pluralism of Web 2.0 calls for a function-based distinction among editors that is economically relevant. Editors, on the basis of their aggregation capability, can be further divided into the categories *simple* and *aggregators*. Aggregators are characterized by their automated mechanisms for selecting and presenting WGs and are further divided into search engines, platforms, and reconstructors. Their function is more focused on creating content-based WGs than on filtering and linking existing WGs.

Net Neutrality

The provision of Internet services is considered to be *neutral* if Internet users pay ISP(s) only for the right to access the network at their end (one-sided pricing). In contrast, the access is characterized as *non-neutral* if editors and developers of Internet applications should also pay ISP(s) for the "right" to reach navigators and other Internet users (two-sided pricing). The question is which of the two pricing policies maximizes the social welfare.

1

Introduction

1.1 The Web in Short

The web initially emerged as an answer to the rapidly increasing quantity of accumulated knowledge in the 20th century, which has been caused mainly by scientific progress and digitization technology. Human memory and processing power are extended through the storage and interconnection of online content. The web limited the time for an innovation to become mainstream technology. It took 38 years for telephone technology to reach the threshold of 50 million users, while television needed 13 years, Internet 4 years, iPod 3 years, and Facebook just 2 years. The web became the new "promised land" for quick fortunes and unlimited business growth in the late 1990s because of browsers and search engines that enabled user-friendly navigation. Overwhelming expectations and excessive enthusiasm drove the economy of 2001 to a noisy burst of the 5 trillion dollars dot-com bubble.

In the mid-2000s, the web enabled mass participation and was reborn from the ashes of the dot-com bubble. After this lesson, the new business models were updated in order to include advertising revenue from web navigation and provision of value added services. At this moment, the web economy is bigger and more robust with new services

ranging from search to social networking, virtual entertainment, and giant multi-stores. On the side of demand, most of the population in the western world is involved on the web economy. While Silicon Valley is, at the time of writing, focused on the Initial Public Offerings of the leading social networks, President Sarkozy introduces the e-G8 summit and includes the web in the agenda of the traditional summit. The web strengthens its development by empowering people in life-critical functions and enabling participation and transparency. It has been transformed into a battlefield of winner-takes-all fights among titanic firms affecting not only business but also consumer choice globally. Public and personal info spheres and their interplay are reinvented under new privacy, trust, and security laws, ethics, and practices. In this new web ecosystem, researchers and governments are asked to create new policy mixtures that will balance market power with personal and social development.

1.2 Web and Economic Research

The emergence of the Internet, and later the web, has had an important influence on the research agenda of Economics and Business literature. The massive participation of users in a variety of social and economic functions created a new terrain of field experiments and analysis concerning consumer behavior, market structure, and policy implications. New forms of economic data (e.g., co-purchase networks, real time linked data from Eurostat, etc.) have given the researchers the ability to conduct new or existing investigations that are less expensive. For example, the estimation of demand for thousands of different products is now feasible with only a few weeks of time-series data from web mass merchants [33].

The available data for research are however just a tiny fraction of the collected data from search engines, mass merchants, social networks and others on the web. In contrast to physical and life sciences, where massive amounts of open data revolutionized fields like biology and physics, this does not happen for economic and social research [92]. The exclusive exploitation of behavioral data on the web is an issue of primary importance with scientific, economic and social

aspects. First, it limits academic research to the inside of companies and government agencies, excluding open scientific research and dialogue. Secondly, companies that hold data and afford to analyze them have built comparative advantages to (potential) competitors or they have simply been selling them with a high profit. Finally, privacy and security risks (e.g., personal data leaks, almost full profiling practices) create negative externalities, on both a personal and a social level, which are not compensated. It is possible that the exclusive and limited data exploitation will become, if it has not already happened, the major source of negative externalities in the online world.

The economic analysis of the Internet and the web economy follows, with a small time lag, technological improvements and mass phenomena. It also includes the study of new products, services, business processes, market structures and macroeconomic issues such as taxation theory, labor economics, regulatory economics, public goods, and development. The first important issue has been related to the optimal pricing of Internet traffic [102]. The lack of agreement on access pricing was leading in inefficient allocation of limited resources at that time (i.e., bandwidth) [105]. The web as a universal platform for representing and communicating information in digital form has initiated the microeconomic analysis of information, network, and digital goods including pricing, bundling, sharing, versioning, switching costs, network externalities and standards, economies of scale and scope, and antitrust regulations.

1.3 The Web Science Perspective

The enormous impact, scale and dynamism of the web in time and space exceed our abilities to observe and measure its evolution process. The complex interplay of social and technological entities occurring simultaneously in the micro and macro level calls for a huge and systematic research effort in order to understand it, model its stylized facts, and engineer its future uses in more prosperous ways. Apart from Economics, web-related studies can be found in many other disciplines such as Computer and Information Science, Mathematics, and Social and Law Studies.

The common characteristic of these studies is the lack of focus on the web as a techno-social and standalone artifact. Usually, they refer to conventional questions and apply existing methodologies in their field. But the web changes some of the underlying assumptions of the human society. It is a powerful social machine [71] that partially depreciates cost and removes institutional barriers. As a result of this, the practical potential to exploit the inputs and outputs of the information economy is increased. The economic paradigm is enriched since peer production emerges as the third mode of production, governance, and property. Thus, it is important to select the fundamental issues, and to set new priorities, to organize and expand the efforts of web study.

The trans-disciplinary field in this area has been titled *Web Science*. Web Science considers the web as its primary object of study. It is focused on the significant reciprocal relationship among the social interactions enabled by the web's design, the scalable and open applications development mandated to support them, and the architectural and data requirements of these large-scale applications [71]. One of the major questions in Web Science is: what changes need to be incorporated in the web ecosystem to best serve humanity? Practically every discipline is focusing its research efforts on the most important issues during specific periods of time. Nowadays, economists put their efforts in discovering new ways for estimating systemic risk because of the severe financial crisis [172] while biologists try to find new personalized cures to diseases after encoding DNA and so forth. Concerning the web ecosystem, scholars are faced with two major research challenges:

(1) To obtain the right balance between open access and processing of online information, on the one hand, and, on the other hand, providing the proper incentives to produce content and to develop network infrastructure.
(2) To accelerate socio-economic development by facilitating life-critical functions in the developing world, and by enabling the publication, interlink and re-use of valuable datasets and services in the developed world.

Issue related to Web Economics and Business are indexed under the Web Society (E) category of the Web Science Subject Categorization

System [171]. The Web Society category includes the following perspectives: Economic and Business Analysis, Social Engagement and Social Science, Personal Engagement and Psychology, Philosophy, Law, Politics, and Governance.

1.4 Studying Goods, Users, Models and Policies on the Web Ecosystem

In the first 20 years of its existence, the web has had a fundamental and transformative impact on all facets of our society. While the Internet was introduced twenty years earlier, the web has been its most successful application with more than 2 billion users worldwide accessing some trillion web pages. Searching, social networking, video broadcasting, photo sharing, blogging and micro-blogging have become part of everyday life whilst the majority of software and business applications have migrated to the web. In this survey, the term *web ecosystem*, or simply *web*, is used to describe three interconnected parts: (1) Internet infrastructure, (2) web technologies and online content, and (3) users. Users navigate, create and edit existing content on the web, i.e., the web goods. Web goods are networked information goods in digital form built by web technologies.

The web has been initiated as a software program of interlinked hypertext documents that are accessible through the Internet. Using a browser, users access web pages that may contain text, images, videos, or other multimedia and navigate among them using hyperlinks. The web constitutes an *information space* in which the items of interest, referred to as *resources*, are marked up by a set of *rules* (i.e., HTML[1]), identified by global identifiers (URI[2]), and transferred by communication protocol (HTTP[3]). The web has become the most successful and popular piece of software in history because it is based on a technical architecture, which is simple, free or inexpensive, networked, based on open standards, extendable, tolerant to errors, universal (regardless of the hardware and software platform, application software, network

[1] HyperText Markup Language.
[2] Uniform Resource Identifier.
[3] HyperText Transfer Protocol.

access, public, group, or personal scope, language and culture operating system and ability), powerful, and enjoyable.

This survey analyzes the economic aspect of the web ecosystem. The goal is to understand how the web economy differs from the traditional setting and what implications these differences have. Secondly, we establish a minimal common understanding about the incentives and properties of users and goods on the web. This survey is not, by any means, a thorough review of the economic literature related to the web. The primary focus is on its relevant part that models the web as a standalone economic artifact with native functionality and processes. This study is composed of nine parts. After the current introduction, the second part is devoted to understand the properties of goods on the web. Analysis is established upon the tradition of economic analysis of information, knowledge, and digital and network goods to introduce a new type of goods, the web goods. Web goods are defined as sequences of binary digits, identified by their exclusively assigned URI. They affect the utility of or the payoff to at least one individual. Their market value stems from the digital information they are composed of and a specific part of it, the hyperlinks, which link resources and facilitate navigation across a network of web goods. Our analysis includes the consideration of web goods as commodities, and search and experience goods.

The third part refers to the users of the web network. In the Web 2.0 Era, users are the protagonists of the cyberspace because they can easily edit, interconnect, aggregate, and comment on online content as never before. In this part, a simple and comprehensive categorization of web users is provided in order to facilitate the comparative analysis of existing literature in economics of the web. The distinction of users is based on the motivations and also on the economic impact of their actions on the web ecosystem. Web users are discriminated to navigators and editors of web goods. Navigators consume information by navigating the web. Editors produce web goods by updating online content and are classified as amateur and professional based on their motivation. In the last section of the third part, we identify the core function of the web economy. In short, navigators explore the web to acquire utility by consuming web goods. This navigation creates traffic streams for editors. Amateur editors are concerned to attract traffic

for their content, even if they do not actually own it (e.g., personal profile page on Facebook). In contrast, professional editors, who own or/and administer web goods, can transform some parts of this traffic into income through selling it to third parties, advertising, or directing sales of both physical and web goods. The resulting income acts as an incentive for editors to update the already existing web goods and create new ones, producing the new web network with novel possibilities for navigators so as to maximize their utility. Finally, the aforementioned functions are integrated into a more general framework of four interconnected networks, namely: users, topics, queries, and the web.

The fourth part analyzes the characteristics of production and consumption on the web. What the web primarily contributes to the economy is a new source of increasing returns which arise from the provision of more choices with less transaction costs in production and consumption. More choices in consumption range from a larger variety in available goods to online consumer reviews and ratings. Despite the fact that more energetic and connected consumption on the web helps consumers to make better decisions, they are often forced to consume both information and contextual advertisements. Attention, as approximated by the logged traffic, is the currency of the web that gives both amateur and professional editors the incentive to update and develop the web network. Moreover, attention has become a primary part of the value chain in the web economy because it can be more efficiently contextualized. The emergence of energetic and connected consumption blurs the borders between production–consumption and reintroduces the concept of prosumption. The fifth part is devoted to the production side. In the Web Era, many business operations have been virtualized, gone online, and became less hierarchical. Also, niche online markets and services have emerged, and traditional industries have been revolutionized. Peer production communities are based on information sharing mechanisms concerning inputs and outputs, which create public knowledge repositories to store the community's aggregated preferences and expectations. Peer production as a new form of decentralized intercreativity outside the traditional market redefines two economic orthodoxies: diminishing marginal productivity and increasing returns to scale. We also discuss how digital and web technologies

drive the demassification of the media by lowering the access barriers to the production, distribution, and consumption of online information. Moreover, apart from private and public, peer production arrives as the third mechanism in production, governance, and property.

The sixth part presents four representative models of the web economy. Despite the fact that there are many research efforts that address web-related issues, these models analyze the web as a standalone economic artifact. The primary object of study focuses on the basic economic functions of the web and the implications for consumer preferences, firms' choices on the web, and social welfare. Since these studies originate from diverse research communities and use different systems of symbols and definitions, we analyze them based on the common understanding for web goods, users and core functions of the web economy that will be discussed in the second and third parts.

First, the Stegeman model provides an initial step of understanding the transition from mass to network media. It concludes that firms could widen total surplus by increasing quality, supplying less advertising and reducing access fees. The welfare results are mostly robust in the presence of small to moderate negative externalities from advertising. Second, the Kouroupas–Koutsoupias–Papadimitriou–Sideri model (KKPS) is the next attempt to account for the basic economic functions on the web by specifying the interplay of three out of four main factors (user-queries, topics, and web) of the web function. The KKPS model focuses on understanding how the interaction of users with search engines leads to a hierarchical power structure of law of the web. Third, the Katona–Sarvary model extends Stegeman's analysis of content exchange between producers and consumers, to hyperlinks exchange among different producers. It focuses on the commercial web, where advertising is used to increase traffic and revenues. The goal is not to inform or signal quality but to increase brand loyalty. The analysis of hyperlink incentives provides guidance to marketing managers on how to specialize their business models on the web. In particular, competition in the commercial web creates motivation for content producers in order to specialize in specific topics. The pattern of outlinks is different for both advertising and reference links. Fourth, the Dellarocas–Katona–Rand model is the first to account for the economic

implications of free reference hyperlinks placement to content nodes. They have found that (a) linking can sustain market entry of inefficient players, (b) the main benefit of aggregators to content producers comes from traffic expansion, and (c) the presence of aggregators incurs social costs that must not be overlooked.

The seventh part describes market regulation and antitrust issues in the web economy. In particular, we examine the basic antitrust issues raised by the "information gatekeepers" of the web (i.e., search engines) and the "infrastructure gatekeepers" of the Internet (i.e., ISPs). With respect to the first issue, Pollock argues that the search engine market is characterized by two stylized facts: (a) a cost structure, which involves high fixed costs and low marginal costs and (b) pure quality competition for users that is likely to feature very high levels of concentration and underprovision of quality by a single dominant firm. He demonstrates that since the market mechanism cannot provide socially optimal quality levels, there is space for regulatory engagement. Regulatory policies on the other hand, may involve the funding of basic R&D in web search, or even more drastic measures like the division of SEs into two separate parts: software and service. With regard to the second concern about *infrastructure gatekeepers*, the net neutrality debate is briefly presented. Economic arguments from both sides of the opposition are paired with the engineering perspective of providing neutral access under effective QoS.[4]

The eighth part raises the issue of web-based development. The role of ICTs is discussed in relation to social inequality, and major development drivers are highlighted in the context of networked economy. It is argued that the one-dimensional direct connection of ICTs with social inequalities should be now replaced by the more relevant question "what changes are required to be incorporated in the web ecosystem so as to serve humanity in the best way?" The first step in answering related questions should be the identification of connections among the web functions and economic development. Existing theories about the role of ICTs in social inequality are reviewed. The second step in understanding the web's developmental potential is to consider a

[4] Quality of service.

minimal framework of relevant policies. The third step is to identify some representative initiatives. In this direction, we describe two different types of projects concerning web-based development with different tasks. The Web in Society program was initiated by the Web Foundation to enable content sharing about life-critical functions through mobile phones in developing countries. In developed countries, however, the primary focus in content sharing is to unleash the economic potential of Open Government Data. In conclusion, the final part discusses issues for further research in the web economy.

References

[1] M. Alavi, "Review: Knowledge management and knowledge management systems: Conceptual foundations and research issues," *MIS Quarterly*, 2001.

[2] E. Altman et al., *Net Neutrality and Quality of Service*. Arxiv preprint arXiv:1105.0283, 2011.

[3] S. Anand and A. Sen, "Human development index: methodology and measurement," *Open Access Publications from University of Oxford*, 1994.

[4] R. Anderson and T. Moore, "The economics of information security," *Science*, vol. 314, no. 5799, p. 610, October 2006.

[5] S. P. Anderson and S. Coate, "Market provision of public goods: the case of broadcasting," NBER Working Papers, MA, USA: National Bureau of Economic Research Cambridge, 2000.

[6] Antitrust: Commission probes allegations of antitrust violations by Google, *http://europa.eu/rapid/pressReleasesAction.do?reference=IP/10/1624&format=HTML&aged=0&language=EN&guiLanguage=en*. 2010.

[7] K. Arrow, "The economic implications of learning by doing," *The review of economic studies*, vol. 29, no. 3, pp. 155–173, 1962.

[8] Y. Bakos and E. Brynjolfsson, "Bundling information goods: Pricing, profits, and efficiency," *Management Science*, vol. 45, no. 12, pp. 1613–1630, 1999.

[9] Y. Bakos and E. Brynjolfsson, "Bundling and competition on the internet," *Marketing science*, vol. 19, pp. 63–82, 2000.

[10] V. Bala and S. Goyal, "A noncooperative model of network formation," *Econometrica*, vol. 68, no. 5, pp. 1181–1229, 2000.

[11] A. Barabási and R. Albert, "Emergence of scaling in random networks," *Science*, vol. 286, no. 5439, p. 509, 1999.

[12] J. Barlow and S. Birkerts, "What are we doing on-line," *Harper's Magazine*, vol. 291, no. 1743, pp. 35–47, 1995.
[13] B. Bates, "Information as an economic good: A re-evaluation of theoretical approaches," *International Communication Association Conference, Honolulu*, 1985.
[14] M. Bauwens, "The political economy of peer production," *Post-autistic economics review*, vol. 37, 2006.
[15] M. Baye and J. Morgan, "Information gatekeepers on the internet and the competitiveness of homogeneous product markets," *The American Economic Review*, vol. 91, no. 3, pp. 454–474, 2001.
[16] M. Baye et al., "Information, search, and price dispersion," *Economics and Information systems*, vol. 1, pp. 323–373, 2006.
[17] R. Beckstrom, "A new model for network valuation," *National Cyber Security Center Research Paper*, 2009.
[18] Y. Benkler, *The Wealth of Networks: How Social Production Transforms Markets and Freedom*. New Haven, USA: Yale University Press, 2007.
[19] T. Berners-Lee, "Welcome to the semantic Web," *The Economist — The World in 2007*, 2006.
[20] T. Berners-Lee et al., "A framework for web science," *Foundations and Trends®in Web Science*, vol. 1, no. 1, pp. 1–130, 2006.
[21] D. Biswas, "Economics of information in the Web economy towards a new theory?," *Journal of Business Research*, vol. 57, no. 7, pp. 724–733, July 2004.
[22] C. Bizer et al., "Linked data — The story so far," *International Journal on Semantic Web and Information Systems*, vol. 5, no. 3, p. 1, 2009.
[23] S. Boccaletti et al., "Complex networks: Structure and dynamics," *Physics reports*, vol. 424, no. 4,5, pp. 175–308, 2006.
[24] A. Bonato, "A survey of models of the web graph," *Combinatorial and algorithmic aspects of networking*, pp. 159–172, 2005.
[25] S. Brin and L. Page, "The anatomy of a large-scale hypertextual Web search engine," *Computer networks and ISDN systems*, vol. 30, no. 1–7, pp. 107–117, 1998.
[26] B. Briscoe et al., "Metcalfe's law is wrong," *IEEE Spectrum*, vol. 43, pp. 34–39, 2006.
[27] A. Broder, "A taxonomy of web search," *ACM Sigir Forum*, pp. 3–10, 2002.
[28] A. Bruns, "The future is user-led: The path towards widespread produsage," *Fibreculture Journal*, vol. 11, 2008.
[29] E. Brynjolfsson and M. D. Smith, "Frictionless commerce? A comparison of Internet and conventional retailers," *Management Science*, pp. 563–585, 2000.
[30] E. Bucy, "Social access to the Internet," *The Harvard International Journal of Press/Politics*, vol. 5, no. 1, p. 50, 2000.
[31] M. Castells, *The Internet Galaxy*. United Kingdom: Oxford University Press, 2001.
[32] W. Chen and B. Wellman, "Minding the Cyber-Gap: The Internet and Social Inequality," *Social Sciences*, pp. 1–28, 2005.
[33] J. Chevalier and A. Goolsbee, "Measuring prices and price competition online: Amazon.com and BarnesandNoble.com," *Quantitative Marketing and Economics*, vol. 1, no. 2, pp. 203–222, 2003.

[34] E. K. Clemons and N. Madhani, "Regulation of digital businesses with natural monopolies or third-party payment business models: Antitrust lessons from the analysis of Google," *Journal of Management Information Systems*, vol. 27, no. 3, pp. 43–80, 2010.
[35] R. Coase, "The problem of social cost," *Journal of Law and Economics*, 1960.
[36] P. Cooke, "Regional development in the knowledge-based economy: The construction of advantage," *The Journal of Technology Transfer*, 2006.
[37] J. Crowcroft, "Net neutrality: The technical side of the debate: A white paper," *ACM SIGCOMM Computer Communication Review*, 2007.
[38] T. Davenport and L. Prusak, *Working Knowledge: How Organizations Manage What They Know*. Boston, MA: Harvard Business Press, 2000.
[39] P. David, "Clio and the economics of QWERTY," *The American economic review*, vol. 75, no. 2, pp. 332–337, 1985.
[40] P. David, "Knowledge, property, and the system dynamics of technological change," *World Bank Research Observer*, vol. 7, p. 215, 1992.
[41] G. Debreu, *Theory of Value*. New Haven, CT: Yale University Press, 1959.
[42] C. Dellarocas et al., "Media, aggregators and the link economy: Strategic hyperlink formation in content networks," Working Papers, 2010.
[43] V. Dhar et al., *The Gestalt in Graphs: Prediction using Economic Networks*. 2009.
[44] P. DiMaggio and E. Hargittai, "From the digital divide to digital inequality: Studying Internet use as penetration increases," *Princeton: Center for Arts and Cultural Policy Studies, Woodrow Wilson School, Princeton University*, 2001.
[45] J. Donner, "Research approaches to mobile use in the developing world: A review of the literature," *The Information Society*, vol. 24, no. 3, pp. 140–159, 2008.
[46] R. Dorfman and P. Steiner, "Optimal advertising and optimal quality," *The American Economic Review*, vol. 44, no. 5, pp. 826–836, January 1954.
[47] P. Drucker, *The New Realities: In Government and Politics, in Economics and Business, in Society and World View*. New York, NY: Harper & Row, 1989.
[48] S. N. Durlauf and L. Blume, *The New Palgrave Dictionary of Economics*. London: Palgrave Macmillan, 2008.
[49] N. Economides and F. Flyer, *Compatibility and Market Structure for Network Goods*. New York, NY: New York University, Leonard N. Stern School of Business, 1998.
[50] N. Economides and B. Hermalin, "The economics of net neutrality," *The RAND Journal of Economics*, 2012.
[51] N. Economides and J. Tag, "Net neutrality on the Internet: A two-sided market analysis," *Information Economics and Policy*, vol. 24, pp. 91–104, 2012.
[52] G. Ellison and S. F. Ellison, "Lessons about markets from the internet," *The Journal of Economic Perspectives*, vol. 19, no. 2, pp. 139–158, 2005.
[53] D. Evans, "Some empirical aspects of multi-sided platform industries," *Review of Network Economics*, vol. 2, no. 3, p. 1, September 2003.

[54] D. Evans and R. Schmalensee, "Two-sided platforms the industrial organization of markets with two-sided platforms," *Competition Policy International*, vol. 3, no. 1, 2007.

[55] D. C. Fain and J. O. Pedersen, "Sponsored search: A brief history," *Bulletin of the American Society for Information Science and Technology*, vol. 32, no. 2, pp. 12–13, 2006.

[56] J. Farrell and G. Saloner, "Standardization, compatibility, and innovation," *The RAND Journal of Economics*, vol. 16, no. 1, pp. 70–83, 1985.

[57] W. E. Forum, *Personal Data: The Emergence of a New Asset Class*. World Economic Forums, 2012.

[58] X. Gabaix and D. Laibson, "Shrouded attributes, consumer myopia, and information suppression in competitive markets," *Quarterly Journal of Economics*, vol. 121, no. 2, pp. 505–540, 2006.

[59] E. Gal-Or and A. Dukes, "Minimum differentiation in commercial media markets," *Journal of Economics and Management Strategy*, vol. 12, no. 3, pp. 291–325, 2003.

[60] L. Galambos, "Theodore N. Vail and the role of innovation in the modern Bell System," *The Business History Review*, vol. 66, no. 1, pp. 95–126, 1992.

[61] T. Girard et al., "Relationship of type of product, shopping orientations, and demographics with preference for shopping on the Internet," *Journal of Business and Psychology*, vol. 18, no. 1, pp. 101–120, 2003.

[62] D. Godes and D. Mayzlin, "Using online conversations to study word-of-mouth communication," *Marketing Science*, vol. 23, no. 4, pp. 545–560, 2004.

[63] H. Halpin and V. Presutti, "An ontology of resources: Solving the identity crisis," *The Semantic Web: Research and Applications*, pp. 521–534, 2009.

[64] Y. Hao, "How does the valence of online consumer reviews matter in consumer decision making? Differences between search goods and experience goods," *Sciences (New York)*, pp. 1–10, 2010.

[65] R. Harris, "The knowledge-based economy: intellectual origins and new economic perspectives," *International Journal of Management Reviews*, 2001.

[66] F. Hayek, "Spontaneous ('grown') order and organized ('made') order," *Markets, Hierarchies and Networks: The Coordination of Social Life*, p. 293, 1991.

[67] R. Heeks, "ICT4D 2.0: The next phase of applying ICT for International Development," *Computer*, vol. 41, no. 6, pp. 26–33, June 2008.

[68] R. Heeks, *The ICT4D 2.0 Manifesto: Where Next for ICTs and International Development?* University of Manchester. Institute for development policy and management (IDPM). Development informatics group, 2009.

[69] J. Hendler, "Web 3.0 emerging," *Computer*, vol. 42, no. 1, pp. 111–113, April 2009.

[70] J. Hendler and J. Golbeck, "Metcalfe's law, Web 2.0, and the semantic Web," *Web Semantics: Science, Services and Agents on the World Wide Web*, vol. 6, no. 1, pp. 14–20, February 2008.

[71] J. Hendler et al., "Web science: An interdisciplinary approach to understanding the World Wide Web," *Communications of the ACM*, vol. 51, no. 7, pp. 60–69, 2008.

[72] B. Hermalin and M. L. Katz, "The economics of product-line restrictions with an application to the network neutrality debate," *Information Economics and Policy*, 2007.
[73] D. L. Hoffman and T. P. Novak, "How to acquire customers on the Web," *Harvard business review*, vol. 78, no. 3, pp. 179–188, 218, 2000.
[74] G. Homer, in *The Odyssey of Homer, Book Ix*, (G. M. Edwards, ed.), 1952.
[75] J. Howe, "The rise of crowdsourcing," *Wired Magazine*, vol. 14, no. 6, 2006.
[76] P. Huang et al., "Searching for experience on the Web?: An empirical examination of consumer behavior for search and," *Journal of Marketing*, vol. 73, pp. 55–69, March 2009.
[77] B. Huberman and A. Adamic, "Growth dynamics of the World-Wide Web," *Nature*, vol. 401, no. 6749, 1999.
[78] B. Huberman et al., "Strong regularities in world wide web surfing," *Science*, 1998.
[79] M. Jackson, *Social and Economic Networks*. Princeton, NJ: Princeton Univ Press, 2008.
[80] Z. Katona and M. Sarvary, "Network formation and the structure of the commercial World Wide Web," *Marketing Science*, vol. 27, no. 5, pp. 764–778, 2008.
[81] M. L. Katz and C. Shapiro, "Systems competition and network effects," *The Journal of Economic Perspectives*, vol. 8, no. 2, pp. 93–115, 1994.
[82] M. Kellar et al., "A goal-based classification of Web information tasks," *Proceedings of the American Society for Information Science and Technology*, vol. 43, no. 1, pp. 1–22, October 2007.
[83] L. R. Klein, "Evaluating the potential of interactive versus experience goods," *Journal of Business Research*, vol. 2963, no. 97, pp. 195–203, 1998.
[84] E. Koksal, "Network neutrality and quality of service: A two-sided market analysis," *International Journal of Management and Network Economics*, vol. 2, no. 1, pp. 39–57, 2011.
[85] S. Kominers, "Sticky content and the structure of the commercial web," *2009 Workshop on the Economics of Networks*, 2009.
[86] A. Kortebi et al., "Cross-protect: Implicit service differentiation and admission control," *High Performance Switching and Routing, 2004. 2004 Workshop on HPSR*, pp. 56–60, 2004.
[87] G. Kouroupas et al., "An economic model of the Worldwide Web," *Special Interest Tracks and Posters of the International Conference on World Wide Web — WWW '05*, p. 934, 2005.
[88] G. Kouroupas et al., "Experiments with an economic model of the worldwide Web," *Internet and Network Economics, 015964*, pp. 46–54, 2005.
[89] V. Kumar, "Why do consumers contribute to connected goods? A dynamic game of competition and cooperation in social networks," *Social Networks*, pp. 1–53, 2009.
[90] S. Lahaie, "An analysis of alternative slot auction designs for sponsored search," *Proceedings of the ACM Conference on Electronic Commerce*, pp. 218–227, 2006.
[91] A. Langville and C. Meyer, "Deeper inside pagerank," *Internet Mathematics*, vol. 1, no. 3, pp. 335–380, 2004.

[92] D. Lazer et al., "Social science. Computational social science," *Science (New York, NY)*, vol. 323, no. 5915, pp. 721–723, February 2009.
[93] J. O. Ledyard, "Public goods: A survey of experimental research," *Public Economics*, 1994.
[94] H. Leibenstein, "Bandwagon, snob, and Veblen effects in the theory of consumers' demand," *The Quarterly Journal of Economics*, vol. 64, no. 2, p. 183, 1950.
[95] K. Levitan, "Information resources as "goods" in the life cycle of information production," *Journal of the American Society for Information Science*, vol. 33, no. 1, pp. 44–54, 1982.
[96] P. Lévy in *Becoming Virtual: Reality in the Digital Age.* (Translated by R. Bononno), New York, NY: Plenum Trade, 1998.
[97] S. J. Liebowitz and S. E. Margolis, "Network externality: An uncommon tragedy," *The Journal of Economic Perspectives*, vol. 8, no. 2, pp. 133–150, 1994.
[98] Logging, Control In W3C., *http://www.w3.org/Daemon/User/Config/Logging.html#LogTime*. 1995.
[99] R. Lucas, "On the mechanics of economic development," *Journal of Monetary Economics*, 1988.
[100] B. Lundvall and B. Johnson, "The learning economy," *Industry and Innovation*, vol. 1, no. 2, pp. 23–42, November 1994.
[101] D. Lyon, *Information Society: Issues and Illusions.* Oxford: Polity, 1988.
[102] J. K. MacKie-Mason and H. Varian, "Pricing the internet," *Public access to the Internet* Cambridge, MA: MIT Press, pp. 269–314, 1995.
[103] K. Marx, "Capital: A critique of political economy (I): The process of capitalist production," *History of Economic Thought Books*, 1867.
[104] D. Mayzlin and H. Yoganarasimhan, *Link to Success: How Blogs Build an Audience by Promoting Rivals.* Yale University, September 2008.
[105] L. McKnight and J. Bailey, "Internet economics," *Information Society*, vol. 15, no. 1, pp. 65–66, 1997.
[106] A. Mehta et al., "Adwords and generalized on-line matching," *Foundations of Computer Science, 2005. Annual IEEE Symposium on FOCS 2005*, pp. 264–273, October 2005.
[107] B. Metcalfe, "Metcalfe's law: A network becomes more valuable as it reaches more users," *Infoworld*, vol. 17, no. 40, pp. 53–54, 1995.
[108] J. Moon et al., "Culture, product type, and price influences on consumer purchase intention to buy personalized products online?," *Journal of Business Research*, vol. 61, no. 1, pp. 31–39, January 2008.
[109] J. Musacchio and G. Schwartz, "A two-sided market analysis of provider investment incentives with an application to the net-neutrality issue," *Review of Network Economics*, 2009.
[110] N. Negroponte, *Being Digital.* New York, NY: Alfred A. Knopf, 1995.
[111] P. Nelson, "Information and consumer behavior," *The Journal of Political Economy*, vol. 78, no. 2, pp. 311–329, 1970.
[112] P. Nelson, "Advertising as information," *The Journal of Political Economy*, vol. 82, no. 4, p. 729, January 1974.

[113] E. Ngai and F. Wat, "A literature review and classification of electronic commerce research," *Information and Management*, vol. 39, no. 5, pp. 415–429, 2002.
[114] N. Nisan, *Algorithmic Game Theory*. New York, NY: Cambridge Univ Press, 2007.
[115] P. Norris, *Digital Divide: Civic Engagement, Information Poverty, and the Internet Worldwide*. New York, NY: Cambridge Univ Press, 2001.
[116] F. Oberholzer-Gee and K. Strumpf, "The effect of file sharing on record sales: An empirical analysis," *Journal of Political Economy*, vol. 115, no. 1, pp. 1–42, Feburary 2007.
[117] G. Oestreicher-Singer, "The visible hand of peer networks in electronic markets," Social Sciences Research Network Working Paper, *Available at SSRN: http://ssrn.com/abstract*, 2010.
[118] K. O'Hara, "The web as an ethical space," in *Proceedings of the British Library Workshop on Ethics and the World Wide Web, 16th November 2010*, British Library, London, 2010.
[119] C. Park and T. Lee, "Information direction, website reputation and eWOM effect: A moderating role of product type," *Journal of Business Research*, vol. 62, no. 1, pp. 61–67, January 2009.
[120] R. Pollock, *The Economics of Public Sector Information*. University of Cambridge, Faculty of Economics, 2009.
[121] R. Pollock, "The economics of public sector information," *Search*, pp. 1–51, 2009.
[122] R. Pollock, "Is google the next microsoft: Competition, welfare and regulation in online search," *Review of Network Economics*, vol. 9, no. 4, p. 4, 2010.
[123] R. A. Posner, "An economic theory of privacy," *Georgia Law Review*, pp. 19–26, May 1978.
[124] C. K. Prahalad and V. Ramaswamy, "Co-creation experiences: The next practice in value creation," *Journal of interactive marketing*, vol. 18, no. 3, pp. 5–14, 2004.
[125] K. Purcell et al., "Understanding the participatory news consumer," *Pew Internet and American Life Project*, vol. 1, 2010.
[126] D. Quah, "Internet cluster emergence," *European Economic Review*, 2000.
[127] D. Quah, "Spatial agglomeration dynamics," *The American Economic Review*, 2002.
[128] D. Quah, *Digital Goods and the New Economy*. Centre for Economic Policy Research, 2003.
[129] D. P. Reed, "That sneaky exponential — Beyond Metcalfe's law to the power of community building," *Context magazine*, vol. 3, 1999.
[130] J. Reichardt and S. Bornholdt, "Statistical mechanics of community detection," *Physical Review E*, vol. 74, no. 1, p. 016110, 2006.
[131] G. Ritzer and N. Jurgenson, "Production, consumption, prosumption: The nature of capitalism in the age of the digital prosumer," *Journal of Consumer Culture*, vol. 10, no. 1, pp. 13–36, March 2010.
[132] L. A. Rivera-Batiz and P. Romer, "Economic integration and endogenous growth," *The Quarterly Journal of Economics*. National Bureau of Economic Research Cambridge, Mass., USA, 1990.

[133] J. W. Roberts and S. Oueslati, "Quality of service by flow aware networking," *Philosophical Transactions of the Royal Society London*, vol. 358, p. 2000, 2000.

[134] J. Rochet and J. Tirole, "Platform competition in two-sided markets," *Journal of the European Economic Association*, vol. 1, no. 4, pp. 990–1029, June 2003.

[135] J. Rohlfs, "A theory of interdependent demand for a communications service," *The Bell Journal of Economics and Management Science*, vol. 5, no. 1, pp. 16–37, 1974.

[136] P. Romer, "Increasing returns and long-run growth," *The Journal of Political Economy*, 1986.

[137] P. Romer, "The origins of endogenous growth," *The Journal of Economic Perspectives*, vol. 8, no. 1, pp. 3–22, 1994.

[138] W. Ross, *Plato's Theory of Ideas*. Oxford: Clarendon press, 1953.

[139] J. Rowley, "What is information?," *Information Services and Use*, vol. 18, no. 4, pp. 243–254, December 1998.

[140] J. Rowley, "The wisdom hierarchy: Representations of the DIKW hierarchy," *Journal of Information Science*, vol. 33, no. 2, pp. 163–180, February 2007.

[141] J. Sachs, *Investing in Development: A Practical Plan to Achieve the Millennium Development Goals*. Australia: Earthscan, 2005.

[142] B. Sarwar et al., "Item-based collaborative filtering recommendation algorithms," in *Proceedings of the 10th international conference on World Wide Web*, pp. 285–295, 2001.

[143] B. V. Schewick, "Towards an economic framework for network neutrality regulation," *Journal on Telecommunications and High Technology Law*, 2006.

[144] R. Schmalensee, "Output and welfare implications of monopolistic third-degree price discrimination," *The American Economic Review*, 1981.

[145] J. Schumpeter, *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest and the Business Cycle*. 1934 translation, 1911.

[146] G. Schwartz and N. Shetty, "Net neutrality and ISPs property rights: Why Internet lacks differentiated services," *Submitted for Publication*, 2009.

[147] A. Sen, "The possibility of social choice," *The American Economic Review*, vol. 89, no. 3, pp. 349–378, 1999.

[148] A. Shaked and J. Sutton, "Natural oligopolies," *Econometrica*, pp. 1469–1483, 1983.

[149] C. Shapiro and H. Varian, *Information Rules: A Strategic Guide to the Network Economy*. Harvard Business School Press, 1999.

[150] N. Shetty et al., "Internet QoS and regulations," *Networking, IEEE/ACM*, vol. 18, no. 6, pp. 1725–1737, 2010.

[151] O. Shy, *The Economics of Network Industries*. Cambridge Univ Press, 2001.

[152] J. Sidak, "A consumer-welfare approach to network neutrality regulation of the Internet," *Journal of Competition Law and Economics*, vol. 2, no. 3, pp. 349–474, 2006.

[153] R. Solow, "A contribution to the theory of economic growth," *The Quarterly Journal of Economics*, 1956.

[154] M. Spence and B. Owen, "Television programming, monopolistic competition, and welfare," *The Quarterly Journal of Economics*, vol. 91, no. 1, p. 103, February 1977.
[155] D. Spulber, "Consumer coordination in the small and in the large: Implications for antitrust in markets with network effects," *Journal of Competition Law and Economics*, vol. 4, no. 2, p. 207, 2008.
[156] M. Stegeman, *Information Goods and Advertising: An Economic Model of the Internet*. 2003.
[157] P. Steiner, "Program patterns and preferences, and the workability of competition in radio broadcasting," *The Quarterly Journal of Economics*, vol. 66, no. 2, p. 194, 1952.
[158] A. T. Stephen and O. Toubia, "Deriving value from social commerce networks," *Journal of Marketing Research*, vol. 47, no. 2, pp. 215–228, 2010.
[159] G. Stigler, "The economics of information," *The Journal of Political Economy*, 1961.
[160] J. Sutton, *Sunk Costs and Market Structure: Price Competition, Advertising, and the Evolution of Concentration*. The MIT press, 1991.
[161] T. Swan, "Economic growth and capital accumulation," *Economic Record*, 1956.
[162] D. Tapscott and A. D. Williams, *Wikinomics: How Mass Collaboration Changes Everything*. Portfolio Trade, 2008.
[163] The imperatives of the link economy:, "*http://www.buzzmachine.com/2008/07/28/the-imperatives-of-the-link-economy*. Accessed: 2011-05-20," 2008.
[164] The "New" Innovation Theory: Boldrin and Levine and Quah: 2005, *http://www.rufuspollock.org/economics/papers/boldrin_levine_quah.html*.
[165] The Social Life of Books: Visualizing Communities of Interest via Purchase Patterns on the WWW: 1999, *http://www.orgnet.com/booknet.html*. Accessed: 2011-06-01.
[166] The World of Data We're Creating on the Internet: 2010, *http://www.good.is/post/the-world-of-data-we-re-creating-on-the-internet/*. Accessed: 2011.
[167] A. Toffler, *The Third Wave*. London: Pan Books Ltd, 1980.
[168] U.S. Senate Committee on Commerce, Science, and Transportation Hearing on "Network Neutrality:" 2006, *http://commerce.senate.gov/pdf/cerf-020706.pdf*.
[169] M. Vafopoulos, "A framework for linked data business models," *Panhellenic Conference on Informatics (PCI)*, pp. 95–99, 2011.
[170] M. Vafopoulos, "Modeling the Web economy?: Web users and goods," *WebSci '11, June 14–17, 2011, Koblenz, Germany*, 2011.
[171] M. Vafopoulos, "Web science subject categorization (WSSC)," *Proceedings of the ACM WebSci'11*, pp. 1–3, 2011.
[172] M. Vafopoulos, "Looking for grassroots sources of systemic risk," *Journal of Payments Strategy & Systems*, vol. 6, no. 2, 2012. Henry Stewart Publications.
[173] M. Vafopoulos and M. Oikonomou, "Recommendation systems: Bridging technical aspects with marketing implications," in *Studies in Computational Intelligence (forthcoming)*, (I. Anagnostopoulos et al., ed.), Springer, 2012.
[174] M. Vafopoulos et al., *The Personal Grid e-workspace (g-work)*. WIT Press, 2006.

[175] M. Vafopoulos et al., "Inter-viewing the amazon web salespersons: Trends, complementarities and competition," *Panhellenic Conference on Informatics (PCI)*, pp. 299–303, 2011.
[176] M. Vafopoulos et al., "Modeling Web evolution," *SSRN eLibrary*. SSRN, 2011.
[177] M. Vafopoulos et al., "A methodology for internal Web ethics," *WWW2012, PhiloWeb 2012*, 2012.
[178] J. Van Dijk and K. Hacker, "The digital divide as a complex and dynamic phenomenon," *The Information Society*, vol. 19, no. 4, pp. 315–326, 2003.
[179] H. Varian, "Position auctions," *International Journal of Industrial Organization*, vol. 25, no. 6, pp. 1163–1178, December 2007.
[180] H. Varian and J. Farrell, "The economics of information technology: An introduction," *Cambridge Books*, 2004.
[181] L. Von Bertalanffy, *General Systems Theory*. New York, NY: Braziller, 1968.
[182] C. C. Wang and C. C. Chen, "Electronic commerce research in latest decade: A literature review," *International Journal of Electronic Commerce*, vol. 1, no. 1, pp. 1–14, 2010.
[183] D. Weitzner et al., "Information accountability," *Communications of the ACM*, vol. 51, no. 6, pp. 82–87, 2008.
[184] What is the difference between a network externality and a network effect?: 2011, *http://www.quora.com/Network-Effects/What-is-the-difference-between-a-network-externality-and-a-network-effect*.
[185] What Is Web 2.0: 2005, *http://oreilly.com/pub/a/web2/archive/what-is-web-20.html?page=1*. Accessed: 2011-06-01.
[186] Where is the business value in linked data?: 2008, *http://tomheath.com/blog/2008/09/where-is-the-business-value-in-linked-data/*.
[187] J. Yang and E. Mai, "Experiential goods with network externalities effects: An empirical study of online rating system," *Journal of Business Research*, vol. 63, no. 9–10, pp. 1050–1057, September 2010.
[188] C. A. Yeung et al., "Decentralization: The future of online social networking," *W3C Workshop on the Future of Social Networking Position Papers*, 2009.
[189] W. Yih and J. Goodman, "Finding advertising keywords on web pages," *conference on World Wide Web*, p. 213, 2006.
[190] C. Yoo, "Network neutrality and the economics of congestion," *Georgetown Law Journal*, vol. 94, 2006.
[191] C. Yoo, "Keeping the internet neutral?: Tim Wu and Christopher Yoo Debate," *Federal Communications Law Journal*, 2007.
[192] G. R. Zodrow, "Network externalities and indirect tax preferences for electronic commerce," *State Tax Notes*, vol. 28, no. 11, 2003.