6-26-2018

Innovating through standardization: How Google Leverages the Value of Open Digital Platforms

Yoshiaki Fukami
Rikkyo Business School, Keio Research Institute at SFC, yoshiaki@rikkyo.ac.jp

Takumi Shimizu
McGill University, takumi.shimizu@mail.mcgill.ca

Innovating through standardization: How Google Leverages the Value of Open Digital Platforms

Completed Research Paper

Yoshiaki Fukami
Rikkyo Business School,
Keio Research Institute at SFC
yoshiaki@rikkyo.ac.jp

Takumi Shimizu
Desautels Faculty of Management,
McGill University
takumi.shimizu@mail.mcgill.ca

Abstract

The purpose of this paper is to examine how an actor strategically develops and diffuses technology standards that align with innovation trajectories while maintaining a consensus with competitors. We conduct a field study of HTML5 standardization and examine how Google strategically influences the development and diffusion of HTML5 toward their favorable standard trajectories. We show that Google has adopted two strategic policies (integrating outside technologies and avoiding the monetization of technologies) and engaged in two relational practices (forming alliances with browser vendors and engaging developer communities) to realize an open Web application platform on the HTML5 while competing and coordinating with other actors. Google attracts application developers and browser vendors to collaboratively develop HTML5 specifications and HTML5-compatible products and services, which have enriched Google's open Web application strategy. These relational practices were enabled and amplified by non-commercial policies for corresponding web applications and the use of other parties' technologies.

Keywords: technology standard, standard development, standard diffusion, innovation

Introduction

Innovating in today's industry involves considerable interaction and coordination with multiple stakeholders including suppliers, complementors, and even customers in the industry ecosystem. A standard, which defines specifications and interfaces of how components of a system interact with one another to ensure interoperability among them, is an enabler and driver of such innovation activities (Wiegmann et al. 2017). Especially in the technology field, technology standards play a key role in developing new products and services and in shaping the evolution of an industry (Baldwin and Clark 2000; Garud and Kumaraswamy 1993). For example, any services related to the Internet of Things work only through the coordination of multiple components via the Internet, which requires industry-wide codified specifications. Since technology standards have consequential impacts on innovation and technological trajectories in the industry, technology standards inevitably affect firm strategies and performance (Aggarwal et al. 2011; Blind et al. 2017). How firms can shape and adopt technology standards is crucial to their innovation activities.

Information systems scholars made efforts to understand how technology standards are developed and diffused in industries. The standard development process can be classified into three categories based on which institution primarily drives standardization: committee-based, market-based, and government-based standardization (Wiegmann et al. 2017). In reality, these processes are not mutually exclusive but are intertwined; firms create a consortium to develop a consensus among industry members while they compete in the market. As a result, the standardization process involves not only technical but also political and strategic battles (Backhouse et al. 2006; Garud et al. 2002). Heterogeneous actors coordinate and negotiate their points of view based on their institutional contexts (Markus et al. 2006;

Nickerson and zur Muehlen 2006). Additionally, the diffusion of standards is heavily driven by network effects (Kauffman et al. 2000; Zhao and Xia 2014), costs associated with adoption (Chen and Forman 2006; Zhu et al. 2006), benefits from adopting standards (Bala and Venkatesh 2007; Hovav et al. 2004), and coordination among participants (Weitzel et al. 2006). However, these two streams of literature are rarely discussed together. Although there are few exceptions (e.g., Botzem and Dobusch (2012)), most previous studies treat standard development and diffusion as distinct phenomena and focus little on the mutual entanglement of development and diffusion processes. Even among those who study the interplay between standard development and diffusion, the primary focus is on the standardization process itself and not on strategic actors and their practices. Therefore, little is known about firm strategies used during standardization processes, which involve development and diffusion at the same time.

The purpose of this paper is to examine how an actor strategically develops and diffuses technology standards that align with innovation trajectories while maintaining a consensus with competitors in a given industry. To address this issue, we conducted a three-year longitudinal field study of Web technology standard development. We specifically investigate how Google strategically influences the development and diffusion of HTML5 (the fifth major version of Hyper Text Markup Language with APIs and other new functions), which is a key technology standard in the Web industry, toward their favorable trajectories at the World Wide Web Consortium (W3C). From our qualitative analysis, we show that Google has adopted two strategic policies (integrating outside technologies and avoiding the monetization of technologies) and engaged in two relational practices (forming alliances with browser vendors and engaging developer communities) to realize an open Web application platform on the HTML5 while competing and coordinating with other actors with different points of view such as Microsoft, IBM, and the W3C. As Google has integrated outside technologies regardless of who invented them and avoided monetizing Web applications based on HTML5 standards, Google can attract many content developers and browser vendors as (unofficial) collaborators to create products and services that align with Google's open Web application strategy. Google can drive the development of HTML5 specifications based on this content implemented by developer communities and diffuse specifications to other browser vendors, thus forming a consensus among industry members and, eventually, the official recommendation of HTML5. This study contributes to an understanding the intertwined nature of technology standard development and diffusion while providing insights into how actors can strategically shape technological trajectories in their fields and innovate through standardization.

This paper is organized as follows. The next section describes the theoretical background of this paper (the literature on standard development and diffusion) and shows a lack of research on the interplay between these two aspects of standardization. We then describe our research context, data collection methods, and analytical approach. In the findings section, we show our empirical findings based on our qualitative analysis. Finally, the paper addresses our theoretical contributions, practical implications, and avenues for future research.

Theoretical Background

In the information systems field, information technology (IT) standards can be defined as "sets of specifications for communicating or performing actions that ensure that various technologies or products that implement certain specifications are compatible (Uotila et al. 2017, p.1208)." Our study adopts the process view on IT standard making (IT standardization). The literature on IT standardization can be divided into two streams: standard diffusion and development.

The literature on standard diffusion has identified key drivers of IT standard diffusion. Costs and benefits associated with adopting standards play critical roles in standard diffusion. When switching costs associated with shifting from one standard to another is high, firms do not typically adopt new standards (Chen and Forman 2006; Zhu et al. 2006). Firms also consider how much benefit they can gain from adopting a standard (Hovav et al. 2004; Zhu et al. 2006). As adopting standards leads to interoperability and collaboration opportunities among adopters of standards, firms carefully select a standard to achieve enough collaboration gains among them (Bala and Venkatesh 2007). Another salient

factor is network effects, which are closely related to the benefits of standards (Kauffman et al. 2000; Zhao and Xia 2014; Zhu et al. 2006). Network effects suggest a positive association between the size of a network (i.e., the number of adopters) and benefits of adopting a network technology (Katz and Shapiro 1986). The more adopters an IT standard attracts, the more adopters can benefit from the standard. As a result, this IT standard will attract more new adopters and continue to grow. In cases of committee- or government-based standardization (Wiegmann et al. 2017), deliberate coordination also plays a key role in processes of IT standard diffusion. The centralized coordination and mobilization of related actors through consortia or government bodies can ensure the adoption and convergence of a single standard (Lee and Oh 2006; Weitzel et al. 2006).

Previous studies have paid relatively little attention to the process of standard development compared to the diffusion process (Lyytinen and King 2006; Uotila et al. 2017). There is a key consensus in the literature that IT standardization is not just a technical matter but involves social and political aspects (Backhouse et al. 2006; Garud et al. 2002; Hanseth et al. 2006; Zhao et al. 2011). In many cases, firm participation in private consortia or alliances heavily shapes the process of standard development (Axelrod et al. 1995; Leiponen 2008). Institutional factors such as those of committee governance affect how participating actors coordinate their different points of view to develop standards (Nickerson and zur Muehlen 2006). As heterogeneous actors who compete in the market participate in standard development, power relations among these actors play an important role in the process (Backhouse et al. 2006). Actors in the standard development process need to cooperate with competitors (Garud et al. 2002).

A real challenge facing the standardization literature is that standardization often involves both standard development and diffusion simultaneously. The development and diffusion of standards are mutually constitutive and are linked as collective dilemmas (Markus et al. 2006; Zhao et al. 2007). Most previous studies, however, treat standard development and diffusion as distinct phenomena and focus little on the intertwined nature of standardization processes. Even those who study the interplay between standard development and diffusion (e.g., Botzem and Dobusch (2012)) primarily focus on the standardization process itself and do not explore actors' strategic practices. A rare exception is a work by Hanseth and Bygstad (2015), which identifies three standardization strategies (anticipatory standardization, integrated solutions, and flexible generification) and how they work in the context of healthcare-related standards mainly driven by governments and local initiatives. We still do not know much about firm strategies that involve both standard development and diffusion when a firm needs to collaborate and compete with heterogeneous actors in the field at the same time.

Methods

Research Context

To address our research question, we conducted a case study with field observations of a large-scale standardization process in the Web industry. We studied the standardization process of HTML5 at the W3C and particularly focused on how Google strategically shaped and drove the process in their favorable way. Since the phenomenon of interests is emerging and under-theorized, the inductive case study approach is suitable for our research (Langley 1999; Yin 2009).

Standard setting is a collaborative activity among diversified stakeholders. Most standardization processes are not conducted only on the official channels of standard setting organizations. Both engineers who belonged to member companies of the W3C and independents had discussed to develop and improve specifications. Development of HTML5 is a typical case of distributed collaboration (Lakhani and Panetta 2007). Development and diffusion processes of the standard are affected by stakeholders outside the standard setting organizations. Older versions of Hyper Text Markup Language (HTML) were developed as simple "markup" languages for composing stable documents in which hyperlinks to other documents could be embedded. Instead, HTML5 is not just a language for stable documents but features a platform for web applications with APIs and other new functions. HTML5, as a platform for applications, plays the role of the platform. Therefore, research design needs to be based on the premise of the multi-sided market (Rochet and Tirole 2003; Eisenmann et al. 2006), which

consists of not only standard setters but also engineers as technology users outside of W3C and end-users.

Unlike ordinary joint ventures, stakeholders of standardization occasionally have conflicting interests. The standardization of HTML5 also serves as a case of co-opetition (Brandenburger & Nalebuff 1996; Casadesus-Masanell & Yoffe 2007) between Google, Apple, and Microsoft. Google's success in the standardization has involved the consensus formation among the members of the W3C in securing widespread support from outside the W3C.

Data Collection and Analytical Approach

We collected the data of Google's activities and the responses of other stakeholders through an analysis of official documents, press releases and news articles related to Google, the W3C, and other relevant organizations and software developer communities during the HTML5 standardization process from December 1997 (when the previous major version of HTML was published) to October 2014 (when the W3C published the official recommendation of HTML5). Stakeholders are not limited to representatives of W3C member organizations. Interactions among Google employees and individual engineers of developer communities have affected discussions of standardization processes. Moreover, employees of the same firms sometimes state conflicting contentions on their personal social media accounts. Therefore, additionally collected social media posts and statements cited in Web news media.

Moreover, the first author conducted the field observation at the W3C office in Japan from April 2010 to March 2013 and observed the flow of the HTML5 standardization process. From this observation, we got access to the mailing list archives of the HTML5 working groups, the meeting minutes, technical documents, and public relations materials. W3C's policy of standardization process management determines stakeholders' strategies and decisions. We also conducted interviews with key individuals from the W3C staffs, member organizations, and independent software developers. Understanding rules and context of the standard-setting organization enables us to refine our analysis strategies and decisions of organizations.

The analysis of this paper focuses on the process of HTML5 standardization and how Google acts during this process with the inductive approach (Langley 1999). First, we created a chronology of the HTML5 standardization and identified key events and activities of stakeholders during the standardization period. Second, we particularly focused on and analyzed how Google strategically acts and mobilize their resources and related actors to shape the trajectories of HTML5 standardization in their favorable way with all the related materials mentioned above. When we developed the chronology and identified Google's strategic actions, we triangulated them by analyzing multiple data sources including field observations, articles, press releases, and social media and blog entries by key actors in the standardization process. As a result, we reached two categories of findings (strategic policies and relational practices) from this inductive analysis, which is explained in the following section.

Findings

Google successfully developed a new business model with web applications by innovating through standardization. The standard that is used to realize web applications is open and collaboratively developed. Key factors of this success include collective supports for the proposed specifications from multiple stakeholders and the process of consensus building about the standard (HTML5). Google adopted two strategic policies (integrating outside technologies and avoiding the monetization of technologies) and engaged two relational practices (forming alliances with browser vendors and engaging developer communities) to achieve this success.

Integrating outside technologies

Google succeeded to develop an open platform for web applications by adopting the existing proposals developed by other firms. HTML 5 is a set of specification in which a plurality of technologies for executing a web application is integrated. "XHTML module," renamed to "Web Forms 2.0" later, and "Web Applications 1.0" would later be consolidated into HTML5. These proposals were developed by

Ian Hickson, an engineer at Opera Software, a Norwegian browser vendor. He had previously worked at Netscape. Google had refined these prototype specifications by employing and appointing him as a director of standard-setting activities and proposed the "XHTML Module: Extensions to Form Controls" for the W3C Forms WG in September 2003.

"Web Form" or "HTML form" is an element of web pages that enable users to input features such as text boxes, checkboxes, and submit buttons. Hickson's proposal was an attempt to add functions of applications to web standards. In contrast to Netscape and Sun's attempts to apply JavaScript to their products, the proposal to open standard setting organization marked an intention to have all web browser vendors apply the proposed functions.

There were two alternatives for Google to expand their business to web application-related services. One was to develop the specifications as proprietary and implement their browser exclusively. The other was to adopt the specifications proposed by Hickson and to contribute improvement at standardization process.

Both alternatives have pros and cons. The proprietary strategy involves fewer coordination costs and the appropriability of the profits. At the same time, Google was forced to face market competition with browser venders and OS venders. The merits of the open strategy are lower costs for development and diffusion. However, there tends to be more cost for coordination. Moreover, the W3C adopts a royalty-free policy. Therefore, no one can make a profit from intellectual properties proposed for the standards. If Google were to utilize technologies standardized at the W3C, it could not make a profit through platform development itself. Unlike Sun Microsystems, which used Java, there were two alternatives for Google to develop and diffuse advanced web applications. One was to develop their proprietary platform. The other was to contribute to the open standard and make them be implemented by all major web browsers. Google chose the latter one and succeeded to diffuse advanced web applications.

The "XHTML Module: Extensions to Form Controls" proposal of September 2003 was the first attempt to transform HTML into a platform for web applications. Ian Hickson composed the corresponding draft renamed "Web Forms 2.0" and proposed it at the W3C Workshop on Web Applications and Compound Documents held in June 2004 by Opera Software and The Mozilla foundation.

Google's first attempt to develop web applications started in 1999. Google employed Paul Buchheit, who had developed its webmail service. Google, which had focused on search engine-related services including advertisements, expanded its scope to web applications. Buchheit initiated the development of Gmail in August 2001 at Google, and Google launched its Gmail services on April 1, 2004. After launching Gmail, Google continued to develop other web services, such as Google Maps in 2005 and Google spreadsheet in 2006. The functions of web applications were limited by web browsers because web browsers provided an interface for the service. It was necessary to improve the capacities of web browsers for the advancement of web applications.

Larry Page and Sergey Brin, the founders of Google, proposed a plan for entering the browser market to Eric Schmidt, executive chairman, in March 2001 when Schmidt transferred to Google. Before Google released its Chrome browser, it decided to help the existing browser vendors develop and implement functions for platform for applications. Google's strategy did not involve the vertical integration of applications and web browser. Google intended to transfer all browsers to platform for rapid diffusion. Google finally released its own browser business with Chrome on September 2nd, 2008 after the launch of HTML5's development at the W3C. Google provided the key components of its web application as its product after ensuring that the proposed technology would be based on an open standard and that most browsers would be made compatible with such specifications.

Avoiding the monetization of technologies

Google had utilized the W3C's web standard. The W3C adopted a royalty-free policy. Therefore, one can receive revenue from patenting the specifications proposed as prospected standard to the W3C. In other words, Google had chosen an IP strategy by which they never make a profit from core components of web applications.

Google intended to diffuse its environment in the same way as HTML5-compatible browsers. First, Google employed Ben Goodger and Darin Fisher, who worked at Mozilla as developers of the Firefox browser in January 2005. They continued to work for Firefox development after Google hired them. Firefox is an open source software (OSS).

Google has developed the Gears browser extension program, which allows web applications to operate offline as an open source software. There is no need to be secretive about technologies intended for proposal to the W3C because any specifications are made public immediately after they are proposed to the W3C, and it is more effective to promote technologies than to keep them closed and proprietary. Google announced the release of Gears at the first Google Developer Day held in Sydney on May 31, 2007. Google promoted Gears and its functions not to end-users but instead to developers.

After Gears achieved popularity, its development was suddenly discontinued, and diverted the Gears technology to the proposed HTML5. Google succeeded in gathering programmers' interest in web applications and in the functions of HTML5 by promoting Gears. Programmers who had recognized the benefits of HTML5 began to accuse Microsoft of not implementing HTML5 in its web browser, Internet Explorer. Finally, Microsoft was forced to adopt HTML5 and it launched a campaign encouraging users to upgrade Internet Explorer to the latest version, which implemented HTML5.

Google introduced functions of the Gears in HTML5 specifications for the first time in March 2008. Only three months later, Google announced its tactics to developers at Google I/O 2008. Aaron Boodman, technical lead of Gears at Google, gave a presentation entitled "HTML5, Brought to You by Gears." He said

> *HTML5 is a new set of proposed extensions to HTML that radically improve the capabilities of web applications. However, without implementations in a majority of browsers, these proposals remain just that, and out of reach for developers. The Gears mission is to begin implementing these APIs today, across as many browsers as possible, as quickly as possible. In this talk, I'll explain why we are doing this, what our motives are, and show how implementing web standards is good for Google and good for the web*[1].

These achievements made Google determine the development of Gears. Linus Upson, the engineering director at Google, said the following at an interview with PC Magazine on December 2009.

> *"Yes, we are not driving forward in any meaningful way [on Gears]. We're very focused on moving HTML 5 forward, and that's where we're putting all of our energy."*[2]

He announced the end of Gears development and planned to divert resources to HTML5 development. Then, Google officially announced the development Gears in March 2011. Gears development staffs at Google stated as below.

> *"We are excited that much of the technology in Gears, including offline support and geolocation APIs, are being incorporated into the HTML5 spec as an open standard supported across browsers, and see that as the logical next step for developers looking to include these features in their websites," [Anonymus Google Spokesman in e-mail]*[3]
>
> *With all (application caches, IndexedDB API, File API, geolocation, notifications, and web worker APIs) this now available in HTML5, it's finally time to say goodbye to Gears. Now that these*

[1] Boodman. A. (2008). *HTML 5, Brought to You by Gears*. (https://sites.google.com/site/io/html5-brought-to-you-by-gears)
[2] Hachman, M. (2009). Google Gears Is Dead; Long Live HTML 5.0. *PCMag.com*. (http://www.pcmag.com/article2/0,2817,2356492,00.asp)
[3] Milian, M. (2009). What's powering Web apps: Google waving goodbye to Gears, hello to HTML5 (http://latimesblogs.latimes.com/technology/2009/11/google-gears.html)

> *features have all been adopted by browsers and have official W3C specs, they are available to more developers than we could have reached with Gears alone [Aaron Boodman, Gears Team].*[4]

Google summarized that they successfully created demand for advanced web applications, made engineers recognize that they needed specifications and caused the features of Gears be adopted as web standard. Providing HTML5-compatible browsers for free encouraged end-users to recognize benefits of the specification early on.

Google had succeeded to implement HTML5-compatible technologies to most of web browsers for free, and built broadly based support for concept of HTML5 among end-users and engineers early on with avoiding the monetization of the technologies.

Forming alliances with browser vendors

Google had developed and promoted HTML5 with alliances with browser vendors such as Opera, Mozilla and Apple in and around of the W3C. Specifically, Google adopted the proposals of Opera and Mozilla, employed the engineer who developed the proposal of these vendors and engaged in concerted promotion of the specification.

Development and promotion of HTML5 begun as Ian Hickson's solo activity at Opera. Then, Mozilla and Apple came to support his activities. Opera and Mozilla jointly submitted a position paper that promoted HTML5 to "Workshop on Web Applications and Compound Documents" held in July 2004. The points of the paper were as follows: 1) backwards compatibility with a clear migration path, 2) well-defined error handling, 3) users should not be exposed to authoring errors, and 4) open process.[5]

However, the W3C rejected the proposal to develop specifications based on the position paper because they had already begun the standardization process of XHTML as the next version of HTML. XHTML is an upgraded HTML with XML technology, and lacks compatibility with HTML4.01, the latest version of HTML in 2004. These do not meet the needs of website developers or end users. XHTML was supported by W3C team staff including Tim Berners-Lee, the inventor of the Web, and by IBM, the firm that developed GML, the ancestral specification of HTML.

The W3C is not a public-sector agency and cannot force compliance with standards. Whether most major browser vendors adopt or not determines diffusion of specifications. Therefore, to diffuse platform for web applications, Google had to form alliances with browser vendors.

As noted above, Google supported the development activities of Firefox at Mozilla by hiring engineers to contribute to the project. Then, Google employed Ian Hickson, the author of the position paper. Google formed an alliance with Opera, Mozilla, and Apple.

Opera and Mozilla submitted a proposal for Web Forms 2.0 to the W3C again on February 7, 2005, and the W3C accepted it. Competition between the proposals began in the W3C. There were ultimately two standard candidates for the next version of HTML.

These browser vendors implemented HTML5 to their browsers before the specifications were standardized. Opera 9, released in July 2006, was partly compatible with Web Forms 2.0 and Web Application 1.0. Apple had at the time already implemented CANVAS, a part of Web Application 1.0 to Safari version 1. Mozilla had also implemented CANVAS and client-storage to Firefox 1.5.

Google also developed Gears while cooperating with Opera and Mozilla. These alliances had accelerated the diffusion of the environment to recognize the benefits of HTML5 with the existing web browsers.

---

[4] Boodman, A. (2011). Stopping the Gears. *Gears API Blog.* (http://gearsblog.blogspot.jp/2011/03/stopping-gears.html)

[5] https://www.w3.org/2004/04/webapps-cdf-ws/papers/opera.html retrieved on 2018/01/31

Engaging developer communities.

Formation of majority in the number of web browser venders was not sufficient for achieve extensive support at standardization process at the W3C and encouraging web contents creators to implement the proposed specifications. Google had succeeded to form a common policy among all major web browser vendors to support HTML5 and incentive for developers to implement HTML5 by growing popularity among developers by fostering two types of communities, standard development community and implementing community.

HTML5 was promoted through corporation among Google and major web browser vendors, except for Microsoft. It thus stands to reason that they took the lead in implementing HTML5 in their products. However, these actors lacked a competitive advantage in the web browser market. Microsoft dominated the web browser market with of Internet Explorer in the early 2000s, after it won its battle with Netscape Navigator in the 1990s. It needed Google to build competence with web browsers compatible to HTML5.

Microsoft was not unwilling to implement HTML5 to Internet Explorer at the time, partly because the concept of HTML5 competed with that of Windows OS. Microsoft adopted a *software "plus" services* strategy, and Steve Ballmer, CEO of the firm, promoted the approach enthusiastically as shown below.

> *"(Microsoft) grew up as what people like to call a desktop company. To this day, I'm not sure I know what a desktop company is, but I know we were a desktop company[6]."*

Another reason was that it is difficult to implement HTML5 to Internet Explorer because of the high costs of realizing backward compatibility with earlier versions of the browser, in which many proprietary specifications had been implemented. It needed to form the perception that an HTML5 "incompatible" browser was outdated, so Microsoft would change their attitude and adopt HTML5. Making HTML5 standard is an effective way to create such a perception among web content developers and end-users.

Market structure platform for applications is a typical multi-sided market. Any platform owner must attract complements suppliers (web content developers) and end-users. Attracting not only end-users but also web content developers is important. Moreover, the standardization process management policy used by the W3C is an implementation-oriented policy. This W3C policy is based on a clause of the W3C's process document introduced in 1999 and is excerpted below:

> *Shown that each feature of the technical report has been implemented. Preferably, the Working Group should be able to demonstrate two interoperable implementations of each feature[7].*

No proposed specification is ever certified as a standard without more than two implementation cases. The W3C and proposers call on working group members for implementation during middle stages of the standardization process. HTML working group has adopted a policy that opens every stage of the standardization process to the public. Therefore, specifications can be improved based on feedback received from implementations developed by non-WG members.

Supporters of HTML5 had to increase implementation cases by engineers outside the standard setting organization to gain an advantage for competing with XHTML. To do so, Google started supporting two types of developer communities: specification development communities and implementing communities.

Fostering Standard Development Community

The above strategy was applied to support the Web Hypertext Application Technology Working Group (WHATWG). Ian Hickson established the WHATWG with support from Mozilla, Opera, and Apple

---

[6] Forster, K. (2007). Microsoft's Software Plus Services Strategy, *Windows IT Pro.* (http://windowsitpro.com/windows-client/microsofts-software-plus-services-strategy)

[7] Jacobs, I. (ed.). (2005). 7.4.4 Call for Review of a Proposed Recommendation. World Wide Web Consortium Process Document 14 October 2005. (http://www.w3.org/2005/10/Process-20051014/tr.html#cfr)

just two days after his proposal was rejected at the workshop. The main purpose of the WHATWG is to develop specifications for web applications outside the W3C. He began to develop a draft entitled "Web Applications Markup Language 1.0." The draft was renamed "Web Application 1.0," and it integrated Web Forms 2.0 with HTML5. HTML5 includes a set of specifications for HTML with advanced form functions, multiple APIs and backward compatibility with existing HTML. HTML5 became a deliverable of open collaboration in the innovation community (Lynn et al. 1996).

Hickson announced the establishment of the WHATWG 2 days after the workshop was held. The WHATWG defines itself as "a growing community of people" and not as a joint venture of firms. WHATWG activities are open to the public, and anyone can take part in and contribute to the development of HTML5. The specification development process at the WHATWG was opened to the public. Anyone can easily register, post mailing lists, and measure differences between versions. The WHATWG is managed as open source software.

The organizations supporting XHTML failed to increase their implementation cases. However, browser vendors supporting the WHATWG took measures to encourage developers outside of their organizations to learn HTML5 and to generate implementation cases. Such activities are referred to as developer relations activities. Google honored excellent programmers as experts of HTML5 and encouraged grass-roots developers to organize communities to increase the implementation cases and to acquire proficiency in the specification. Their voluntary measures are derived from the implementation-oriented policy, which encourages proposers to increase number of implementation cases and the number of programmers using the proposed specifications. HTML5 was chosen as the next generation of HTML, as it was more broadly used at the time. The W3C HTML WG's process was left open to the public, similar to development activities of WHATWG.

Fostering Implementing Community

Google also encouraged independent engineers to establish implementing communities. In some cases, platform owners establish communities to share information on their products. For example, most programming languages (e.g., Java of Sun Microsystems and .net of Microsoft) were initially designed to promote firms' proprietary products or services. Instead, Google launched activities to support developers of open standard technologies.

"HTML5" became popular among web application/web content developers when the specifications were featured in the keynote speech of the Google I/O conference held in May 2009. Google I/O is a conference held in San Francisco every March. Google promotes its technologies, APIs, and products for developers through face to face events, websites and other channels. Other information technology companies engage in similar promotional events such as Microsoft's Microsoft Developers Network (MSDN). Some firms that provide APIs hold programming contests and hackathons to generate use-cases of their APIs and to attract engineers and foster their loyalty to firm technologies. One engineer who participated in the Google Desktop API contest stated the following.

> *I am an advocate of Google. I was interested in Google Desktop Search because I could develop customized desktop gadgets. I developed an application for currency trading with data from Yahoo! Finance. After I registered this application on Google's website, I received an e-mail from Google with a thank-you message and gifts (a T-shirt and a "Desktop Search" cap). They were cool [Masakazu Muraoka Organizer of HTML5west.jp].*

A few employees had to communicate with engineers outside firms and promote APIs and other technologies. In contrast, some firms began to delegate such kinds of promotion to engineers. As an early case, Sun Microsystems Japan supported Java user groups and Sun's other products in Japan. One officer of the firm commissioned promote to engineers by Sun stated

> *Sun helped user communities by sending engineers who recognized Sun's technologies, by promoting events through websites and mailing lists, and by inviting speakers from employees of Sun worldwide. Sun sometimes sponsored events and provided financial support, venues and sent staff [Kazuhiko Nishimura, CTO of Voice Research, Inc.].*

Naoki Ishihara, an engineer of Google Japan and a previous Sun Japan employee, launched the "API Expert Program" with Kazuhiko Nishimura and Masahiko Yokota of a marketing outsourcing contractor. Google prizes engineers working outside of the firm as API Experts and provides technical information as needed. At the same time, API Experts are expected to establish and manage unofficial users' communities to share technical information on Google. Moreover, Google began to hold meetings with API Experts at the Google Japan headquarters once a month. Nishimura explained the end of the API Expert program as creating ecosystems of Google's technologies and fostering key persons who utilize technologies for developing various kinds of applications.

Masahiko Yokota, a marketer who worked with Nishimura, said the following.

> *We tried to make as many engineers use Google's technologies as possible and encouraged them to post blog entries about their technologies [Masahiko Yokota of Abidarma Inc.].*

Engineers working outside the company developed technical information for sustainable diffusion and achieved loyalty to the specifications and the company. API Experts are expected to act as advisories and specialists in specific technological fields, to disseminate technological information and to manage engineering communities for free. On the other hand, appointees could achieve merit by creating good publicity and building a network of connections. A few appointees had even published books.

Google extended its program from the use of proprietary technologies to the use of open standards. One HTML5 API Expert stated

> *I have obtained know-how on managing grass-roots engineering communities at meetings of API Experts. I think that Google and I obtain a mutual benefit, and this is why my employer allows me to participate in this program. I feel that I have contributed to my employer through this program [Kensaku Komatsu of NTT Communications].*

There was a barrier for Google to extend its program for proprietary technologies to an open one. If this program increased the perception of HTML5 technology and thus strengthened Google's strategy, there would be more counter opinions to the proposal of HTML5 during the standardization process.

The Google API Expert program was established by staff in Japan and was later adopted globally. Such activities were referred to as "developer relation programs," and more programs and events that featured HTML5 were held. The W3C launched its program in 2012. Such activities increased the supporters of HTML5. Google thus not only promoted HTML5 by themselves but also encouraged outside developers to promote HTML5 and develop implementation cases.

The W3C had already accepted the proposal of HTML5, and the standardizing process there had been integrated with the activity of WHATWG. Ian Hickson was the editor of HTML5 specification in the W3C HTML5 working group.

Google and colleagues' promotion of HTML5 made the specification popular among website developers. Eric Schmidt, then CEO, mentioned the following in his keynote of Google I/O 2009.

> *We have spent 20 years trying to build a programming model that is the right one. Then the Internet arrived. "It's time." This is the beginning of the real win of cloud computing, of applications (on the web)* [8].

He insisted that the time when an architecture compliant with enhanced web application was approaching. Then, Vic Gundotra, then vice president of engineering, who had moved from Microsoft stated the following.

> *"Never underestimate the web." At Microsoft (where he used to work) we thought web apps could never rival desktop apps. "The web has won." A more powerful web made easier. New HTML5*

[8] Siegler, M. G. (2009). Live From Google I/O 2009. *TechCrunch*. (http://techcrunch.com/2009/05/27/live-from-google-io-2009/)

> *standards. A chance to do things differently. Almost half a billion people are now using modern open source browsers.*

He claimed that HTML5 was a key technology to realize advanced web applications and that compatible browsers had already diffused. "Modern open source browsers" refer to Apple Safari and Google Chrome, both of which were developed with WebKit, an open source rendering engine, and Mozilla Firefox. This presentation attracted HTML5 engineers other than stakeholders of the standardization process. Market shares of HTML5-using browsers accounted for more than 30%[9].

Meanwhile, Microsoft, a major web browser vendor that had never taken part in WHATWG activity, joined HTML working group at the W3C in April 2007. Most major browser vendors and a web application provider were engaged in HTML5 standardization. However, Microsoft had not implemented HTML5 for Internet Explorer. Moreover, Microsoft had developed and promoted a proprietary technology of platform for multimedia content called Silverlight which works only with Windows OS.

Website developers were irritated by Microsoft not implementing HTML5 in their products but instead promoting their proprietary technology with vertical integrated architecture because the developers had to create two types of websites: those for HTML5-compatible browsers and those for Internet Explorer. It costed much more to create websites only with Internet Explorer-compatible specifications than with HTML5.

Therefore, website developers launched a negative campaign against Internet Explorer: "IE6 Must Die". They displayed pictorial figures signifying protests to using Internet Explorer 6 on the icon of their Twitter account[10]. Microsoft was forced to adopt and implement HTML5.

Finally, Microsoft changed its strategy. Steve Ballmer, CEO of Microsoft, announced a way to treat HTML5 as one of Microsoft's core cross-platform technologies at "Professional Developers Conference 2010."

> *With the work that we're doing with Internet Explorer, we're trying to make that a whole lot simpler for you. With Internet Explorer 9, we made our focus on a couple of things: No. 1, doing HTML5 — standards-based HTML5 — really, really, really well. And No. 2, asking the question: How do we improve on the user experience for HTML5 applications based upon the fact that we know Internet Explorer runs on Windows? How do we integrate, if you will, applications and websites from a user experience perspective? How do we take advantage of the power of Windows and the Windows PC to improve the performance of HTML5-based applications?* [11]

Microsoft released Internet Explorer 9 immediately prior to Ballmer's keynote speech and promoted it as a highly HTML5-compatible product. HTML5 was in turn implemented by all major web browsers.

Discussion and Conclusion

This study investigates how Google strategically acts and mobilizes their resources and related actors to shape the standardization process in a favorable way in the context of developing and diffusing the HTML5 standard. We identify two strategic policies (integrating outside technologies and avoiding the monetization of technologies) and two relational practices (forming alliances with browser vendors and engaging developer communities) applied by Google during the periods of HTML5 development and diffusion. Google attracts application developers and browser vendors to collaboratively develop HTML5 specifications and HTML5-compatible products and services, which have enriched Google's open Web application strategy. These relational practices were enabled and amplified by non-commercial policies for corresponding web applications and the use of other parties' technologies.

---

[9] StatCounter *(*https://statcounter.com/)
[10] IE6 Must Die - Support Campaign. *Twibbon*. (http://twibbon.com/support/IE6-Must-Die/)
[11] Ballmer, S. (2010) *Steve Ballmer: PDC10 (record of keynote at Professional Developers Conference 2010).* (http://news.microsoft.com/2010/10/28/steve-ballmer-pdc10/)

Our findings contribute to the IT standardization literature in two ways. First, this study identifies key strategic policies and relational practices used to shape the standardization process, which involves standard development and diffusion. Although the literature addresses the importance of mutual relationships between standard development and diffusion, previous studies have focused on the standardization process itself and lacked attention to firms' strategic actions (Botzem and Dobusch 2012; Markus et al. 2006). The present paper unpacks firms' strategic activities that shape IT standards in a favorable way while firms compete with other actors in the industry in the case of hybrid (committee- and market-based) standardization (Wiegmann et al. 2017). Second, the paper sheds light on the importance of community development to the standardization process. The existing literature argues for the role of formal coordination by consortia or governments in facilitating standard development and diffusion (Lee and Oh 2006; Weitzel et al. 2006). On the other hand, this study reveals the critical role of informal collaboration (community development) in hybrid standardization. Online communities and collaboration are increasingly becoming important for innovation (Faraj and Shimizu 2018). Nurturing standard development and learning communities can help firms collectively develop and diffuse favorable industry standards.

This study also has practical implications for managers. First, it is helpful for (non-dominant) firms to form an alliance with competitors to challenge a dominant player in the industry. In the case of HTML5 standards, Google worked closely with Mozilla, Apple, and Opera to compete with Microsoft, the dominant player in the Web browser industry at the time. This alliance enabled Google to collaboratively develop HTML5 standards in its favor and to diffuse them among other key vendors without difficulty. Second, the paper articulates the important role of community development when firms develop and diffuse IT standards. Since industry-wide standards require a consensus among heterogeneous actors in the field, a firm needs to form a coalition with those with similar interests and who can share the same vision and technological trajectories to shape standards in a favorable manner. To form a coalition, it is necessary to develop and nurture developer communities that include standard and application developers. How well a firm can manage and sustain such communities can shape the standardization process. Third, a firm should adopt strategic policies to support these relational practices. Google adopted a non-monetization policy and technologies invented outside their organization. This openness has facilitated and supported its relational practices and has led to successful standard development and diffusion.

Although this study has the theoretical contributions and practical implications mentioned above, it also has some limitations that should be addressed in future research. This paper particularly focuses on the case of HTML5 (IT standard) and Google's strategic practices (a challenger in the Web browser industry). We should be careful about the boundary conditions (analytical transferability) of our findings. The more artifacts are connected to the Internet, the more services work through the interaction and coordination of multiple components based on technology standards. For example, all services of Internet of Things (IoT), not only the HTML5 related services, never work without the interoperability of connected components. Nowadays, we see that many products and services in the traditional industries such as the automobile and energy industry are connected to the Internet and work based on the industry standards. Future studies need to investigate how our findings may change when we face other contexts (e.g., non-IT standard) and focus on other players in the industry (e.g., a dominant player). Additionally, it might be fruitful to shed more light on the competition aspect of this standardization process. While this paper partially addresses this point, future research can evaluate Microsoft's practices and responses to Google's strategies in a more salient way and articulate the dynamics of such competitive acts. We believe that innovating with standardization is becoming increasingly important in today's business ecosystem and can serve as a promising research agenda for the IS field.

Acknowledgement

This study was funded by The Telecommunications Advancement Foundation. The data collection of this study became possible through the internship program at the W3C/Keio office, a stay at W3C/MIT, and many interviews with informants. The authors would like to note special thanks to the staff of the W3C, member organizations, and the developer community related to the HTML5.

References

Aggarwal, N., Dai, Q., and Walden, E. A. 2011. "The More, the Merrier? How the Number of Partners in a Standard-Setting Initiative Affects Shareholder's Risk and Return," *MIS Quarterly* (35:2), pp. 445–462.

Axelrod, R., Mitchell, W., Thomas, R. E., Bennett, D. S., and Bruderer, E. 1995. "Coalition Formation in Standard-Setting Alliances," *Management Science* (41:9), pp. 1493–1508.

Backhouse, J., Hsu, C. W., and Silva, L. 2006. "Circuits of power in creating de jure standards: shaping an international information systems security standard," *MIS Quarterly* (30:Special Issue), pp. 413–438.

Bala, H., and Venkatesh, V. 2007. "Assimilation of interorganizational business process standards," *Information Systems Research* (18:3), pp. 340–362.

Baldwin, C. Y., and Clark, K. B. 2000. *Design Rules: The Power of Modularity* (Vol. 1), Cambridge, MA: MIT Press.

Blind, K., Petersen, S. S., and Riillo, C. A. F. 2017. "The impact of standards and regulation on innovation in uncertain markets," *Research Policy* (46:1), pp. 249–264.

Botzem, S., and Dobusch, L. 2012. "Standardization cycles: A process perspective on the formation and diffusion of transnational standards," *Organization Studies* (33:5–6), pp. 737–762.

Chen, P., and Forman, C. 2006. "Can Vendors Influence Switching Costs and Compatibility in an Environment With Open Standards?," *MIS Quarterly* (30:Special Issue), pp. 541–562.

Faraj, S., and Shimizu, T. 2018. "Online Communities and Knowledge Collaborations," in *Oxford Research Encyclopedia of Business and Management*, R. J. Aldag (ed.), Oxford University Press, pp. 1–20.

Garud, R., Jain, S., and Kumaraswamy, A. 2002. "Institutional entrepreneurship in the sponsorship of common technological standards: The case of Sun Microsystems and Java," *Academy of Management Journal* (45:1), pp. 196–214.

Garud, R., and Kumaraswamy, A. 1993. "Changing competitive dynamics in network industries: An exploration of Sun Microsystems' open systems strategy," *Strategic Management Journal* (14:5), pp. 351–369.

Hanseth, O., and Bygstad, B. 2015. "Flexible generification: ICT standardization strategies and service innovation in health care," *European Journal of Information Systems* (24:6), pp. 645–663.

Hanseth, O., Jacucci, E., Grisot, M., and Aanestad, M. 2006. "Reflexive Standardization: Side Effects and Complexity in Standard Making," *MIS Quarterly* (30:Special Issue), pp. 563–581.

Hovav, A., Patnayakuni, R., and Schuff, D. 2004. "A model of Internet standards adoption: The case of IPv6," *Information Systems Journal* (14:3), pp. 265–294.

Katz, M. L., and Shapiro, C. 1986. "Technology Adoption in the Presence of Network Externalities," *Journal of Political Economy* (94:4), pp. 822–841.

Kauffman, R. J., McAndrews, J., and Wang, Y. M. 2000. "Opening the 'Black Box' of Network Externalities in Network Adoption," *Information Systems Research* (11:1), pp. 61–82.

Lakhani, K. R., and Panetta, J. A. 2007. "The Principles of Distributed Innovation," *Innovations: Technology, Governance, Globalization* (2:3), pp. 97–112.

Langley, A. 1999. "Strategies for theorizing from process data," *Academy of Management Review* (24:4), pp. 691–710.

Lee, H., and Oh, S. 2006. "A standards war waged by a developing country: Understanding international standard setting from the actor-network perspective," *Journal of Strategic Information Systems* (15:3), pp. 177–195.

Leiponen, A. E. 2008. "Competing Through Cooperation: The Organization of Standard Setting in Wireless Telecommunications," *Management Science* (54:11), pp. 1904–1919.

Lynn, L. H., Reddy, N. M., and Aram, J. D. 1996. "Linking technology and institutions: The innovation community framework," *Research Policy* (25:1), pp. 91–106.

Lyytinen, K., and King, J. L. 2006. "Standard Making: A Critical Research Frontier for Information Systems Research," *MIS Quarterly* (30:Special Issue), pp. 405–411.

Markus, M. L., Steinfield, C. W., and Wigand, R. T. 2006. "Industry-Wide Information Systems Standardization as Collective Action: The Case of the U.S. Residential Mortgage Industry," *MIS Quarterly* (30:Special Issue), pp. 439–465.

Nickerson, J. V, and zur Muehlen, M. 2006. "The Ecology of Standards Processes: Insights from Internet Standard Making," *MIS Quarterly* (30:Special Issue), pp. 467–488.

Uotila, J., Keil, T., and Maula, M. 2017. "Supply-Side Network Effects and the Development of Information Technology Standards," *MIS Quarterly* (41:4), pp. 1207–1226.

Weitzel, T., Beimborn, D., and Koenig, W. 2006. "A unified economic model of standard diffusion: The impact of standardization cost, network effects, and network topology," *MIS Quarterly* (30:Special Issue), pp. 489–514.

Wiegmann, P. M., de Vries, H. J., and Blind, K. 2017. "Multi-mode standardisation: A critical review and a research agenda," *Research Policy* (46:8), pp. 1370–1386.

Yin, R. K. 2009. *Case Study Research: Design and Methods Essential guide to qualitative methods in organizational research*Applied social research methods series ; 5, (L. Bickman and D. J. Rog, eds.) (Vol. 5), Sage Publications.

Zhao, K., and Xia, M. 2014. "Forming Interoperability Through Interorganizational Systems Standards," *Journal of Management Information Systems* (30:4), pp. 269–298.

Zhao, K., Xia, M., and Shaw, M. 2007. "An Integrated Model of Consortium-Based E-Business Standardization: Collaborative Development and Adoption with Network Externalities," *Journal of Management Information Systems* (23:4), pp. 247–271.

Zhao, K., Xia, M., and Shaw, M. J. 2011. "What Motivates Firms to Contribute to Consortium-Based E-Business Standardization?," *Journal of Management Information Systems* (28:2), pp. 305–334.

Zhu, K., Kraemer, K. L., Gurbaxani, V., and Xu, S. X. 2006. "Migration To Open-Standard Interorganizational Systems: Network Effects, Switching Costs, and Path Dependency.," *MIS Quarterly* (30:Special Issue), pp. 515–539.