

ETH Zurich – A Pioneer in Digital Sustainability!

Dear Colleagues and Students, Ladies and Gentlemen, Friends of ETH!

More than 16 centuries ago, Saint Aurelius Augustinus wrote in his book «De doctrina christiana»:

*«For if a thing is not diminished by being shared with others,
it is not rightly owned if it is only owned and not shared.»*

Knowledge is such a «thing» which is not diminished by being shared with others: I am not losing my knowledge, if I share it with you. I do not give it away, I just make a copy. In addition, it is very hard to prevent people from using knowledge once that it is spread out. It requires extra effort to exclude people from access. Economists call knowledge nonrivalrous and nonexcludable – and hence a *public good*.

Today, it seems only natural that a university as a public institution is treating knowledge as a public good to best fulfill its societal role: Contributing to humankind's development. Obvious to everybody in the audience today, it was not back then around the turn of the millennium. Two trends have been characteristic for Western societies at the end of the 20th Century:

- **Competition.** Western societies were marked by the dominance of the market. Property as the base of the market system was glorified and success was measured by the amount of money and objects someone owned. Companies were measured by their market capitalization and economies by their Gross Domestic Product. As societies gradually shifted from industrial to knowledge-based economies, a strong trend arose to also turn immaterial goods, like knowledge and information, into property with a price tag.
- **Information Technology.** Emerging digital technology dramatically affected all societies. Personal computers and the Internet had brought profound and rapid change as people could easily multiply and distribute information (be it text, images, audio or video) globally at zero marginal costs. The problem was that it took quite some time until people began to understand how different information is from physical objects.

These new possibilities presented a fundamental threat to those mighty corporations which based their business models on the exploitation of digital information. Ever more innovative new ways of collective creation of knowledge (and even culture) gradually rendered their businesses obsolete. Accordingly, their defense was determined. The problem was that knowledge was equated with property although it is different in essential ways. Let me give you three examples: software

producers, media corporations and scientific publishers.

Based on the notion of «knowledge is property», a whole new industry – *software* – accrued and built up a very successful business model based on the licensing of digital copies of software. The most successful company became the global monopolist on the operating systems market with a peak market share close to 100%! (It was broken up later because of market dominance, but I am sure you have heard of Microsoft). The consequences were reduced competition on the critical operating system market and limited choice for users. The innovation rate in software development slowed down and the dependency put a considerable financial burden on users around the world. At the UN World Summit on the Information Society held in 2003, Brazil claimed that it had to transfer an amount half the size of its poverty reduction program as license fees. It was legal in contractual terms but was it legitimate? Was it sustainable?

Another critical trend in software was the idea of making software patentable – An idea unthinkable today – and interestingly, unthinkable before the 1980s as well! So, it only lasted for some years in the US and was heavily debated in the EU but finally abandoned because it would have brought software development and innovation to a standstill.

Second example: Can you imagine that your children are a target group of an industry – and this very industry is regularly suing teenagers? Based on the notion of «knowledge is property», this is what happened in the years 2000-2005 as *media corporations* said they face financial losses because of so-called «piracy». Among the hippest teen gadgets at that time were portable music players and peer-to-peer software which allowed file-sharing over the Internet. The media corporations claimed that the artists would not create anymore if all their works are «stolen». (They hardly mentioned that the majority of them did not make their living from selling music but from playing at concerts.) Well, as you know we solved the problem of artist's remuneration with the «culture flat-rate tax» in 2010 which also allowed to collectively manage artists' online rights in an efficient way.

The elderly among you, like me, might remember the *scientific publishers* of the 20th century, the last example. The business model of the publishers was very interesting from today's perspective: The scientific community delivered articles gratis, peer-reviewed them gratis and handed over the copyright gratis as well. All in the name of science and glory – and citations. So, the publishers received gratis high-quality material and sold it by maximizing their profits like any company would. All that based on the notion of «knowledge is property». Constant demand led to a rigid market and ever increasing subscription prices. An increasing number of universities failed to acquire the funding needed to subscribe to all relevant journals. Even «well-off» institutions like ETH had problems – let alone the non-Western world: Scientists from Asia, Africa or South America hardly got into these journals nor were they able to subscribe to them. You might ask: How would we have been able to survive the last 30 years while ignoring three quarters of the globe's knowledge? A very good question indeed!

The three cases exemplify the challenge that the notion «knowledge is property» posed on the

market economy: To be able to fix a price, companies need scarce resources. But unlike any natural resource, knowledge is abundant and even gains value when it is spread. To protect the existing business model of multiple licensing of the same piece of digital information (be it software, music or a scientific article) the companies found two main ways to restrict access.

The *legal* way was to tighten the system of limited intellectual monopolies which were then called «intellectual property». (The term was used to convey the notion that immaterial goods behave like physical property – something we know better today.) Large media and software corporations led the legal battle by promoting the extension of copyright terms which prevented old works from entering the public domain and being available as prior art. Around 2006, the US regime of patents on software had turned into a non-reformable system – leaving companies occupied in legal battles about who owns what and who should pay royalties to whom instead of innovating – that it was abandoned completely by 2008.

The *technical* way was to restrict the usage of works through software. Concepts like «Digital Rights Management» (DRM) or «Trusted Computing» (TC) got developed to give more control to the right holders. These technical measures were reinforced by devising laws (USA 1998) which prohibited the development of circumvention technology which endangered the development of free software. In the first years after 2000, these chips were secretly integrated into the hardware because DRM or TC was obviously hard to sell to users. Only later people started to realize that this kind of absolute technical control was dangerous as it put the user's and the owner's rights out of balance (e.g. «fair use» for criticism, parody or quoting).

As a result of the actions of vested interests, the knowledge and cultural commons (music, literature and software) were rapidly eroding. This was fundamentally unsustainable because future generations of creators were deprived of the base for their works – the access to prior art. In the years towards 2010, more and more scientists realized that this was a real problem for innovation and societal development as a whole. Not directly existential like climate change and population growth but access to knowledge was definitely instrumental to their solving.

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Led by the Free Software Movement and the success of the GNU/Linux operating system an alternative movement emerged which forever changed the way we are handling intellectual and cultural resources ever since. In the movement of the «environmentalists», an established group of like-minded with a sound track record was found. The merging process resulted in what is known today as the *Commons Movement*.

The approach of the Commons Movement is based on cooperation and bears in mind the special nature of knowledge as a nonrivalrous and nonexcludable good. In other words, the movement stands for *sustainability in the natural as well as the intellectual realm*: Equity in the access to and the sharing of resources. The understanding that natural and intellectual resources – in science speak, the commons and the anticommons – behave differently has been crucial to the success of the movement.

An alert mind during that time might have seen the writings on the wall. Let me give you a handful of pioneering examples, many of which are well-known to you today – accompanied by short glimpses of the role ETH took in each of them.

It is widely accepted today that the *Free Software Movement* (famous for the GNU software and the General Public License) was the spiritus rector for many of the developments in the broader Commons Movement. Software licensed under the General Public License becomes a public good forever; with the additional effect of making software it touches free as well. This made the development, prosperity and survival of the GNU/Linux operating system possible despite legal and technological attacks by the software industry over the years.

For example, from the first semester, ETH's students learn to develop real-life software by engaging in international free software projects which are used by millions of people. This does not only improve programming skills but hones the skills needed to contribute to a real-life problem within an international team as well. Making a contribution is part of education and using the PC is considered an essential cultural technique just like reading and arithmetic are.

As a university, ETH encourages its staff to use and to participate in developing free software. The last contract for a proprietary software expired in 2020. Since then, the funds for the license fees are invested in education and research. *ETHnix*, our own science distribution of GNU/Linux is widely appreciated by scholars around the world for supporting academic work.

Today it is normal that learning to take responsibility is an integral part of education. Knowledge is applied in real-life projects: Be it in programming or any other mandatory practical field work (which takes place abroad). Changing reality already during the study years has become a clear distinction to the universities of the 20th century.

Who of you today is not using *Wikipedia* as the encyclopedia of choice? The project started in January 2001 with the goal «to encourage the growth and development of free content» . In less than four years, one million articles had been written by volunteers, gradually ending the 250 years tradition of *Encyclopedia Britannica* (1st ed. 1768), *Brockhaus Encyclopedia* (1st ed. 1809) and others. Wikipedia is one example of an intellectual resource made by the community for the community and outside the market system.

Around 2008, Wikipedia reached a level of quality which convinced ETH to integrate it in the curriculum. From then on, the encyclopedia was not only used in the classroom but professors and assistants were actively encouraged to contribute to it. Besides saving money for our library, the scholars could easily create new peer networks as experts from all parts of the world meet around topics on Wikipedia. This interaction has been fruitful for ETH research and in 2013 we decided to contribute by hosting a local mirror of Wikipedia.

Closer to academics was the *Open Access Initiative* and the *Public Library of Science*, started in 2004. With the aim of sticking to the high-quality system of peer-review, it started off with two journals on biology and medicine. The first years were not easy as the long-standing reputation of a

scientific journal needs time to be established. But other disciplines followed step by step and since 2019 all relevant scientific literature is freely accessible world-wide.

Of course, all publications by ETH faculty, students and staff are available in the Public Library of Science. The money saved for subscription fees is invested in faculty, particularly in interdisciplinary fields. Every graduate of ETH goes through an extensive training of ethics and responsibility – as a scientist and as a practitioner.

On a side note: One of the first big success stories in collective media production was the *Creative Commons* (CC) initiative started in 2001. CC applied the principles of the free software licenses to other artistic works like music, movies and literature. In its first year, more than 1 million works were placed under CC licenses. The works of the Public Library of Science are using CC licenses ever since. In 2009 ETH issued a policy of licensing all works with a CC license. This way, we are ensuring that the means invested in ETH to create and disseminate knowledge are going back to society.

Last example: Our partners and competitors at MIT in Boston caught us on the left foot in 2001 when they started their *OpenCourseWare* program: A 10-year initiative to make available the entire lecture notes and related material online for free – using a CC license. In the words of Mr. Vest, then president of MIT: «We hope that in sharing MIT's course materials, and our experience thus far with MIT OCW, we will inspire other institutions to openly share their course materials, creating a worldwide web of knowledge that will benefit mankind.»

At the same time ETH was using proprietary, password-protected software called WebCT which turned out to be too closed and expensive and was abandoned when Mr. Vest's inspiration finally hit ETH: Since 2012 ETH is actively contributing to the *Open Academy* which it co-founded. The Open Academy provides course materials made by scholars of all disciplines in all languages used today. Traditionally ETH is strong in technology-related fields – and I am glad to say that we are building a growing reputation in technology assessment as well.

The president of the ETH Council put «sustainable development as guiding principle» high on the agenda in 2004, anticipating the *United Nations Decade of Education for Sustainable Development* declared in 2005. It was realized that to solve the enormous problems we were facing at that time, a boost in collaborative innovation in research and education was needed. Free exchange of humankind's knowledge in all its forms was an absolute prerequisite to achieve this.

I am proud, that ETH pioneered in extending the concept of sustainability to the realm of knowledge and information. By 2008, ETH recruited a group of young scientists for the new *Center for Technology and Society* and subsequently built a reputation beyond its technological competence. Today, the Center is a regular adviser to the *Federal Department for the Intellectual Commons* which got created five years after the Federal Department for the Natural Commons was set up in 2013.

One single mind cannot innovate in isolation of others. The last 50 years have been an impressive show case for that. Nearly 100 years into the digital era, the world has become more than a global

village. The current plan of the United Nations to transform itself into a government and parliament shows that the understanding of belonging together is strengthening. Together with other leading universities around the globe, ETH will continue to provide this village with top-level education and excellent research and educational material freely accessible for each inhabitant of the village!

Thank you for your attention!

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