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# A property rights view on the impact of file sharing on music business models – why iTunes is a remedy and MusicNet is not

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## ABSTRACT

This article addresses the issue of file sharing from the music industry's specific point of view – and with a strong economic approach. Following the property rights theory we model the problem of file sharing systems for the music industry as a trade-off between negative external effects caused by uncompensated exchange of music files and transaction costs to internalize these effects. The aggregated curve of both effects shows the optimal degree of internalization of property rights at its minimum. We argue that with the appearance of file sharing systems it is more expensive now to enforce property rights on music files. In the model's context this leads to a rise in transaction costs which in turn lowers the optimal degree of internalization. Future music business models will have to pay attention to the fact that some property rights can not be allocated anymore and accept a new situation in which consumers have the possibility and intention to exchange and copy media files.

## Keywords

Music business, file sharing, peer-to-peer, property rights, intermediaries

## INTRODUCTION: MUSIC BUSINESS AND FILE SHARING

Media companies generate revenues to a great extent by supplying media products also referred to as content (Picard 1989). Media products can be divided into information and entertainment products and are generally characterized by high production costs for the first copy while reproduction costs are comparatively low. This effect is called first copy cost effect and its potential tends to increase by the emergence of digitized content and distribution via the Internet. While also production costs can be lower with digitized products, marginal reproduction costs as well as distribution costs deserve a significant reduction (Varian 1995). In addition to that, digitalization leads to the erosion of the classical connection of content and medium (Hass 2002), i.e. the content of a journalistic article can be used both for printed hard-copies and for online versions of a newspaper.

New opportunities arising for media businesses due to these evolutions together with the continuing diffusion of Internet technologies are widely discussed in literature (Bailey 1998, Hummel and Lechner 2001). Economic theory generally tends to assume a reduction in transaction costs (Picot, Reichwald and Wigand 1997, Shapiro and Varian 1998). Less attention is paid to the Internet's threats for existing media business models which may be caused by *higher* transaction costs for these players.

One evident menace is currently experienced by music companies. So-called file sharing systems based on peer-to-peer (P2P) technology (Fattah 2002, Oram 2001) allow a decentralized and free exchange of music files via the Internet. Leaving the music companies uncompensated, these systems, together with the possibility to write music to CD, currently threaten the entire music business. The Recording Industry Association of America (RIAA) reports a 7,2% slump in 2003 (RIAA 2004), from which a considerable amount is attributed to file sharing and (illegal) CD copying (Bender 2002).

While in the beginning this threat was not taken seriously, now belated reactions on different areas can be observed. Measures taken can be categorized as legal, technological or economic. Some users of file sharing systems are taken to court where they are charged high fines (Abbott and Brett 2003) with the aim to establish a sense of illegality and to deter other users from participating any longer in file sharing systems. While these measures succeeded to a certain degree (Stone 2004), two aspects have to be taken into consideration: First, users feel criminalized by these efforts which surely does not provide a

good basis for future business relations. Second, latest innovations allow completely anonymous file sharing, making it impossible to identify and punish file sharers (Eng 2004). A different starting point is the elimination of the file sharing systems themselves. But, although it is quite easy to declare them illegal, it is nearly impossible to eliminate these systems technologically if they are built on a completely decentralized P2P infrastructure. And this holds true for nearly all current file sharing systems. Accepting this fact, other technological measures have been taken by music companies. They range from a concerted “spamming” of file sharing systems with dysfunctional music files to the implementation of Digital Rights Management Systems (DRMS) (Picot and Fiedler 2003). The latter technologies substantially restrict the usability of the files sold, i.e. files are only valid for a certain period of time or cannot be copied (Jefferson 2003). Reactions on this strategy comprise users’ discontent with protected files which cannot be played on some of their music devices along with many DRMS so far being cracked within a short time. This raises the question whether technological measures are effective or counter-productive.

Economic efforts recently focus on the presentation of various legal music download services that mainly stand out from file sharing systems in that a price has to be paid for music files on a per-time, a per-song basis or a combination of both. These commercial online music services primarily differ from each other in the amount and type of music files offered and in DRMS included. However the first attempts of music companies to offer music download services, including those of MusicNet and Pressplay failed (BBC 2002). In conclusion, all legal, technical or economic measures have one thing in common: So far, they have not been able to reduce availability and success of file sharing systems substantially and thus revenues for the music industry continue to diminish.

But there has been one exception: computer company Apple Inc. started its own music online service iTunes Music Store (N.N. 2004e) in April 2003 and it has been the first player to sell a significant number of digital music files over the Internet. For the first time it was shown that the willingness to pay for music downloads is higher than zero, at least for some users (Walter and Hess 2003). While research on a lacking willingness to pay on the internet (Chyi 2002) will have to consider this fact in general, in our special case the interesting question is to analyze critical success factors for online music businesses. In the following, we approach this question applying the economic theory of property rights which will lead us to a rough taxonomy of today’s download services and some recommendations for music companies.

#### **MODEL: PROPERTY RIGHTS THEORY**

Property rights are discussed in different research fields, ranging from jurisdiction (Ham and Atkinson 2000) to philosophical topics (Machan 2001). We now focus on the economic branch of property rights theory (Barzel 1997, Demsetz 2002, Furubotn and Pejovich 1974, Hart and Moore 1990), which is concerned with all enforceable relations among economic actors that result from the existence of goods and which belong to their use. Following Demsetz, “the main allocative function of property rights is the internalization of beneficial and harmful effects” (Demsetz 2002). In order to be able to decide which alternative property rights allocations are advantageous a combined criteria is deployed which can be traced back to the Coase Theorem (Coase 1937): On one side, external effects or externalities (Olson and Zeckhauser 1970) influence macroeconomic welfare, on the other side internalization of these effects generates so-called transaction costs. In the case of negative externalities, on which this paper is centered, general public social costs are higher than those occurring to the actor (Coase 1960). Within property rights theory, a correlation between the amount of external effects and the ability to allocate property rights on actors is supposed. A complete allocation of property rights on actors is assumed to be optimal (“concentrated property rights”), but is generally not feasible due to the existence of transaction costs which occur by generation, allocation, assignment and enforcement of property rights (Picot, Dietl and Franck 2002). As elementary as these assumptions are, as manifold are the theory’s applications: In the field of generation and allocation of property rights legislators can fall back to this theory, while the discussion of assignment and enforcement of property rights can help a company to choose its ideal legal form.

Trying to formalize the combined criteria of external effects and transaction costs we follow the work of Picot et al. (Picot et al. 2002). We further introduce a semi-formal approach<sup>1</sup> in order to be able to depict our assumptions on the impact of file sharing systems on the optimal degree of internalization mathematically and graphically. In spite of using linear functions we model both effects with e functions (  $x$  = degree of internalization) because their concave slope is more apt to depict what we want to show. In particular, we assume exponentially increasing marginal transaction costs as the level of internalization increases. On the other hand a major portion of external effects is internalized very easily while the internalization of the last

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<sup>1</sup> As we focus on general assumptions we particularly refrain from naming concrete numbers or scales in formulas and coordinate planes.

percent of external effects is increasingly harder to achieve. Picot et al. (Picot et al. 2002) suppose a very similar argumentation and this is why we follow them in figure 1:

- The function for external effects is modelled as an e function with a negative slope ( $e^a =$  no internalization) in order to show that a little degree of internalization is easily accomplished, while higher degrees are steadily harder to achieve (for examples see next bullet point):

$$f(x) = e^{a-x}$$

- The function for transaction costs is modelled as an e function with a positive slope. This is because we want to show that a moderate degree of internalization is achieved with a comparatively small amount of transaction costs (i.e. information about legislation makes people behave according to laws), while a very high degree is disproportionately expensive (i.e. constant control of all personal computers in use in order to monitor people who hide their illegal behavior)<sup>2</sup>:

$$g(x) = e^x$$

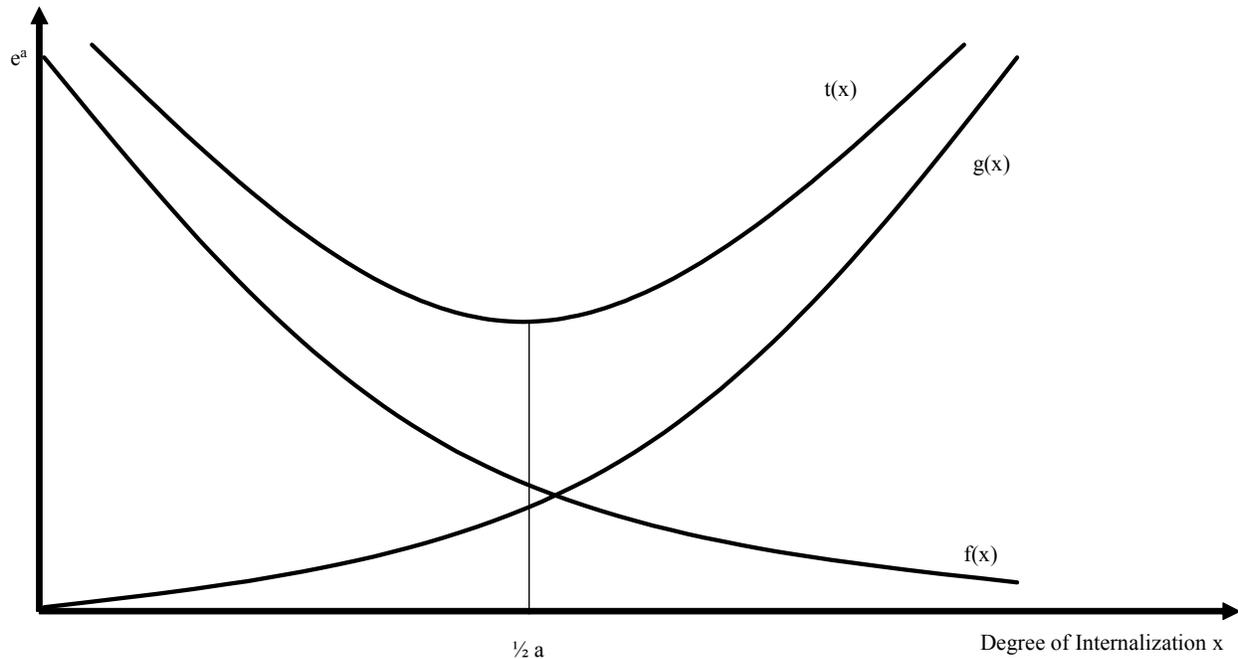
- The two functions are interdependent and almost diametrically opposed. In order to internalize all external effects, very high transaction costs are inevitable while a high degree of external effects does afford nearly no transaction costs. This is why it makes sense to aggregate the two curves to one total effect curve  $t(x)$  which depicts their interdependency:

$$t(x) = f(x) + g(x) = e^{a-x} + e^x$$

- This aggregated function shows the optimal degree of internalization at its minimum, which can be formalized by deploying the first order derivation (see appendix A1. for details):

$$x^* = \frac{1}{2} a$$

External effects  $f(x)$ , transaction costs  $g(x)$ , total effect  $t(x)$



**Figure 1. Optimal degree of internalization without file sharing**

On the basis of the model described here we now deploy it on a partial analysis of the music industry’s point-of-view, introduce the impact of file sharing systems and integrate three generic classes of music download services.

<sup>2</sup> At a certain high degree of internalization “prohibitive” transaction costs keep the actor from a further internalization, i.e. he cannot afford to pay the measures that would be necessary to achieve a higher degree.

**ANALYSIS: PROPERTY RIGHTS AND FILE SHARING**

Artists and music companies own property rights on music files. These rights are generated and allocated according to law and enforced by the legal sale of music files. Revenues generated are to be understood as the compensation for the work that has to be done to create music and deliver it to customers.

While the generation and allocation of property rights on music files might still be as costly as ever (provided that laws remain the same), file sharing causes new transaction costs in the field of assignment and enforcement of property rights. Users of peer-to-peer file sharing systems might not be authorized to offer, interchange and copy large numbers of music files, but to stop them from doing so affords prohibitively high transaction costs (i.e. constant monitoring of each personal computer in use). In the model's context higher economic efforts necessary to enforce property rights are to be interpreted as additional transaction costs (see figure 2).

- We introduce a new function which represents a new type of transaction costs due to the effect of file sharing systems. It is modelled the same way as the transaction costs mentioned above, weighted with a *file sharing factor*  $s$  ( $0 < s < 1$ ) which can be adapted according to the extent to which the effect is assumed to increase the level of total transaction costs. If  $s = 0$  then  $h(x) = 0$ :

$$h(x) = se^x$$

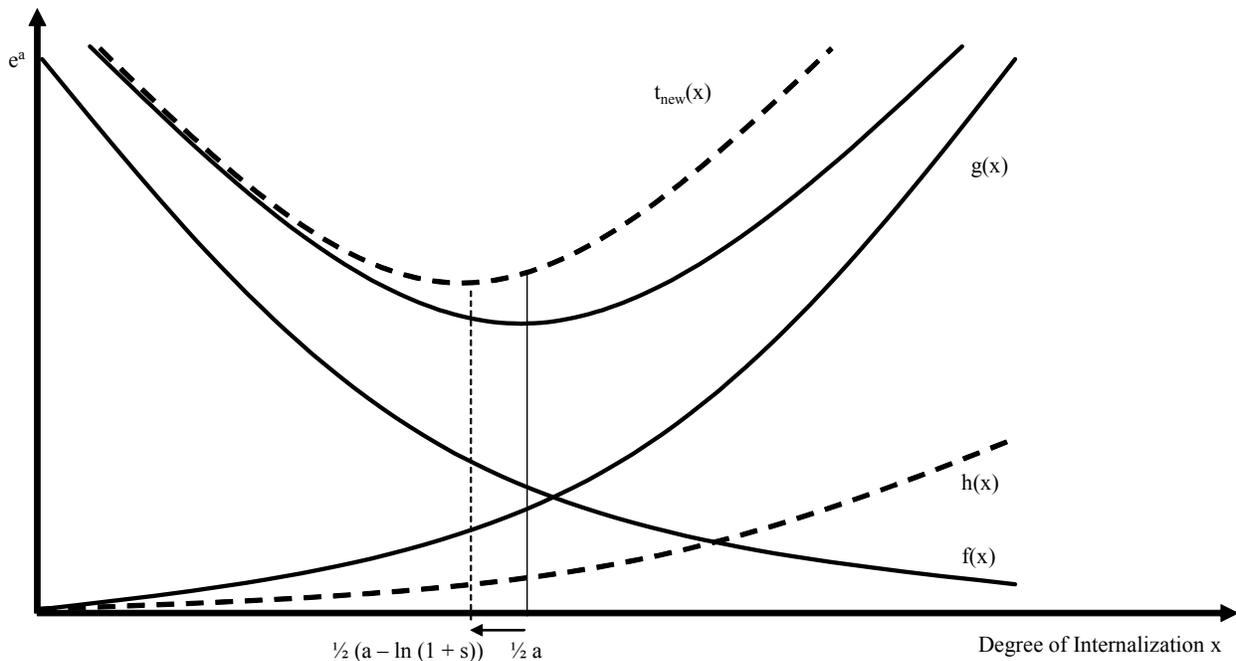
- We derive a modified total effect by adding the file sharing function  $h(x)$ :

$$t_{new}(x) = f(x) + g(x) + h(x) = e^{a-x} + e^x + se^x$$

- Again, the total effect curve shows the optimal degree of internalization at its minimum which can be calculated using the first degree derivation (see appendix A2. for details):

$$x_{new}^* = \frac{1}{2} (a - \ln(1+s))$$

External effects  $f(x)$ , transaction costs  $g(x)$ , file sharing effect  $h(x)$ , modified total effect  $t_{new}(x)$



**Figure 2. Reduced optimal degree of internalization in the presence of file sharing**

We see that if  $s$  equals 0 the effect of file sharing on the optimal degree of internalization is 0 ( $\ln(1) = 0$ ) whereas if  $s$  is bigger than 0 the optimal degree of internalization is less than without file sharing. We also see that independently of the value for  $s$  the effect on the degree of internalization is mitigated by an  $\ln$  function. In other words even a significant rise in transaction costs only means a relatively small shift in the optimal degree of internalization.

The extended model tells us that with the existence of file sharing systems it appears to be optimal to internalize less external effects. Music companies cannot enforce property rights the way they were used to before, which was already commented for the case of CD copying (Bender 2002). Consumers have to be given more freedom because control is now only possible at significantly higher transaction costs.<sup>3</sup>

### CONCLUSION: NEED FOR A NEW CLASS OF BUSINESS MODELS

Music companies should integrate the mentioned implications in their own business models. In the following, we discuss the conclusions of our analysis in detail by deriving different classes of music download services. On one side there are file sharing systems which allow a massive exchange of music files without compensation of artists and music companies. On the other side the big music companies stick to their usual principles although they realize that profits are getting smaller. In particular, although their download services possess sophisticated and restrictive DRM tools, they obviously cannot prevent consumers from interchanging and writing music files at a reasonable cost. A reduction in property rights internalization as proposed by our model could address to this fact: Why not give the consumers the right to copy and interchange music files to a certain degree? This means to establish a third intermediate class of download services which integrates the consumers' new needs with the music businesses' right for compensation. We believe that this class of service is not just an option but a must for those download services we call restrictive in order not to lose more and more customers to file sharing systems. As a conclusion we can categorize the following three classes of music download services which we integrate in our model (see figure 3)<sup>4</sup>.

#### a) *File sharing systems (FSS)*

File sharing systems exhibit a high degree of external effects by not compensating the owners of property rights on music files. In our model's context this equals huge external effects and leads us to position these services at the very left of our total effect function  $t(x)$ . For them, transaction costs barely increase with a further diffusion of other file sharing systems. At the time of writing, KaZaA (N.N. 2004d) is one prominent example of these file sharing services.

#### b) *Restrictive download services (RDS)*

We see music companies which present their own download services equipped with tough DRM Systems in order to push through all property rights they were used to. This proves to be unsuccessful. Talking in our model's logic they still assume the former optimal degree of internalization. As a result they neglect that enforcing all the property rights they were used to in pre-Internet times afforded much higher transaction costs now. To us, MusicNet (N.N. 2004b) is a typical example of this class of services.

#### c) *Liberal download services (LDS)*

This class comprises those online music business models which integrate both, certain features of FSS and some advantages of RDS. On one side, they may allow consumers to interchange and copy music files to a certain degree. On the other side they provide high quality music instead of faked or virus containing (Kotadia 2004) files. Besides, they give their customers the feeling of acting legal. Apple's iTunes Music Store (N.N. 2004e) has been the first and at the time of writing most popular example of this new class of liberal download services.

Looking at the evolution of download services we can see that some things have happened in the last time which indicate that music industry is slowly accepting the need for this new LDS class of services. While in 2001 researchers were already recommending to pay attention to the principles of P2P file sharing systems (Shirky 2001) the first download services offered by the major music labels like PressPlay and MusicNet were quite restrictive in terms-of-use (i.e. no copying allowed, no file-sharing, time restrictions in the use of files). Nevertheless, in 2002 already first steps towards a more liberal attitude could be observed (BBC, 2002). In April 2003 Apple's own download service Music Store, which comes along with the iTunes software, started with quite liberal terms of use compared to all previous commercial services: With this service users are allowed to copy music to CD, they can share every file bought with two more users and there are no time restrictions on the use of music files (Rizzo and Viksnins 2003). On December 12<sup>th</sup> 2003, Apple reported its 25 millionth download (BBC 2003). It was the first successful commercial download service in history and we call it the pioneer of our new class of liberal download services. Since then, different new download services have emerged which tend to imitate Music Store's features

<sup>3</sup> One has to bear in mind that this is not a new effect with the emergence of Internet but true for several goods (Alchian 1967).

<sup>4</sup> For a first descriptive approach to characterize and differentiate the three classes see appendix B

and pricing policy (Jefferson 2003). Recently, competitors Napster 2.0 (N.N. 2004c) and Musicmatch (N.N. 2004c) received most attention. Big companies enter the scene like Wal-Mart (N.N. 2004a) which offers files at a lower price than Apple (Chmielewski 2003). Other players from totally different fields integrate the Music Store service itself as a marketing tool. For example Pepsi Cola is promoting altogether 100 Mio. songs by offering one song for free in 1 out of 3 bottles of Pepsi (Jefferson 2004).

On the other side of the spectrum, the possibilities for music business models on P2P basis are explored (Gehrke and Anding 2002, Ghosemajumder 2002). Shawn Fanning, creator of the first popular file sharing system Napster, is about to launch a commercial download service which will be based on P2P technology (Borland and Olsen 2004). As a conclusion, we notice tendencies towards the new class of liberal download services (LDS).

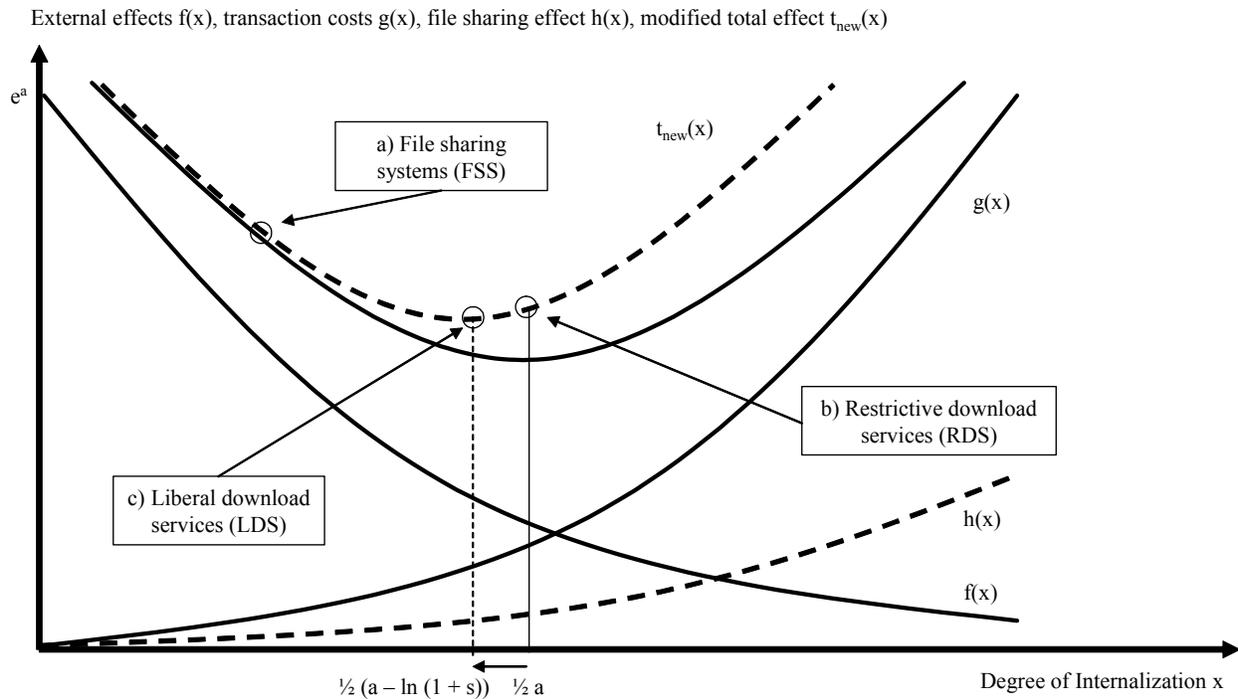


Figure 3. Three classes of download services from a property rights view

**LIMITATIONS AND FURTHER RESEARCH**

As already mentioned above, our analysis is to be understood as a partial view. In particular, from a macroeconomic point of view, the higher transaction costs for music companies assumed in this model might be disproportionate to far lower transaction costs occurring to consumers in the presence of file sharing systems. In any case, the direction of the total effect will have to be discussed. In addition to that, the proposed property rights view is to be supplemented with further models, for example in order to generate information on how to generate revenues with online music. One can estimate that a further rise in transaction costs will reduce the optimal degree of internalization to a level which does not allow music businesses to generate revenues from selling music downloads. Indeed, Apple officials already announce that by sheer music downloads no profits can be made (Salkever 2004).<sup>5</sup>

If this comes true for all download services while revenues from offline sales continue to diminish, one day terms like “music company” or “record industry” might not be appropriate anymore. Is Apple a music company? Steve Jobs said so, but in fact his company does not generate revenues from the sale of music files but from complementary hardware sales.<sup>6</sup> The Pepsi

<sup>5</sup> Surely, besides the degree of internalization there are more relevant criteria to classify classical and new music business models (i.e. the number of files offered or the price to be paid for music files).

<sup>6</sup> Apple sold 730.000 of its portable device iPod in the last quarter of 2003.

case also points in the same direction as the focus lies on complementary products. Anand and Galetovic believe that the supply of complementary goods is an appropriate strategy when property rights cannot be enforced (Anand and Galetovic 2003). Turning things round, the supply of music files seems to degenerate to a complementary service. This leads us to a quite fundamental question: Will there be a future for music companies as we know them?

As we doubt this, we propose to invent a new name for all actors in the media business, which are involved in delivering music or any other type of content to customers. We call all these players *content intermediaries* as they intermediate between the production and the reception of content. Current big media companies might be disintermediated (Chircu and Kauffmann 1999) by other players. These may be the artists themselves, new players like Apple (although until today close cooperations with big music companies exist) or the customers which interchange media files via file sharing systems. All these players serve as content intermediaries but do not fit into what we call “media companies”. Further research on a reallocation of functions on actors in this field will be necessary in order to be able to determine possibilities for future music business models.

## REFERENCES

1. Abbott, J. and Brett, W. (2003) *Legal Music Downloading Service: A Band-Aid for the Music-Industry*, FAMU-FSU College of Engineering, <http://www.eng.fsu.edu/~jabbott/hw/ein5322/paper1.pdf>, 2004-02-20.
2. Alchian, A. (1967) Property Rights, In *The Concise Encyclopedia of Economics* (Ed. Indianapolis, IN).
3. Anand, B. and Galetovic, A. (2003) *Strategies that work when property rights don't*, University of California, Los Angeles.
4. Bailey, J. P. (1998) *Intermediation and Electronic Markets: Aggregation and Pricing in Internet Commerce*, MIT, Cambridge, MA.
5. Barzel, Y. (1997) *Economic analysis of property rights*, Cambridge University Press, Cambridge, MA.
6. BBC (2002) *Music industry's digital plans 'fail'*, BBC, [http://news.bbc.co.uk/1/hi/entertainment/new\\_media/1809391.stm](http://news.bbc.co.uk/1/hi/entertainment/new_media/1809391.stm), 2004-02-17.
7. BBC (2003) *Apple store tops 25 million tunes*, BBC, <http://news.bbc.co.uk/1/hi/technology/3323583.stm>, 2004-02-20.
8. Bender, C. (2002) *IPR-Protection and information technology*, University of Münster, Münster.
9. Borland, J. and Olsen, S. (2004) *Napster's Fanning has Snocap-ped vision*, CNET, [http://news.com.com/2100-1025\\_3-5146858.html](http://news.com.com/2100-1025_3-5146858.html), 2004-02-20.
10. Chircu, A. M. and Kauffmann, R. J. (1999) *Analyzing Firm-Level Strategy for Internet-Focused Reintermediation*, *Proceedings of the 32nd Hawaii International Conference on System Sciences*, Maui, Hawaii.
11. Chmielewski, D. (2003) *Wal-Mart unveils online music store*, Mercury, <http://www.mercurynews.com/mlf/mercurynews/7524804.htm>, 2003-02-21.
12. Chyi, H. I. (2002) *No One Would Pay for it? Web Content as Inferior Goods*, *Proceedings of the Fifth World Media Economics Conference on: Media Firms: Structures, Operations, and Performance*, Turku, Finland.
13. Coase, R. H. (1937) *The Nature of the Firm*, *Economica*, 4, pp. 386-405.
14. Coase, R. H. (1960) *The problem of social cost*, *Journal of Law and Economics*, 3, pp. 1-44.
15. Demsetz, H. (2002) *Toward a theory of property rights*, *Journal of legal studies*, 31, 2, pp. 653-672.
16. Eng, P. (2004) *Of Ants and Online Pirates - Insects Inspire 'Untraceable' Online File-Sharing Network*, ABC news, [http://abcnews.go.com/sections/SciTech/FutureTech/mute\\_file\\_sharing\\_futuretech\\_040120.html](http://abcnews.go.com/sections/SciTech/FutureTech/mute_file_sharing_futuretech_040120.html), 2004-02-21.
17. Fattah, H. M. (2002) *P2P: How Peer-to-Peer Technology Is Revolutionizing the Way We Do Business*, Dearborn Trade Publishing, Chicago.
18. Furubotn, E. G. and Pejovich, S. (1974) *Introduction: The New Property Rights Literature*, In *The Economics of Property Rights* (Ed. Furubotn, E. G. and Pejovich, S.) Ballinger, Cambridge, pp. 1-9.
19. Gehrke, N. and Anding, M. (2002) *A Peer-to-Peer Business Model for the Music Industry*, In *Towards the knowledge society - eCommerce, eBusiness and eGovernment* (Ed. Monteiro, J. e. a.) Kluwer Academic Publishers, Boston, pp. 243-257.
20. Ghosemajumder, S. (2002) *Advanced Peer-Based Technology Business Models*, MIT, Cambridge, MA.
21. Ham, S. and Atkinson, R. (2000) *Napster and Online Piracy: The need to revisit the digital millennium copyright act*, *E-Business Law Bulletin*, 1.
22. Hart, O. and Moore, J. (1990) *Property Rights and the Nature of the Firm*, *Journal of Political Economy*, 98, 6, pp. 1119-1158.
23. Hass, B. (2002) *Geschäftsmodelle von Medienunternehmen, Ökonomische Grundlagen und Veränderungen durch neue Informations- und Kommunikationssysteme*, Gabler, Wiesbaden.
24. Hummel, J. and Lechner, U. (2001) *A Community Model of Content Management - A Case Study of the music industry*, *The International Journal on Media Management*, 3, 1, pp. 4 -14.

25. Jefferson, G. (2003) *Comparison shopping at the online music sites*, USAtoday, [http://www.usatoday.com/life/music/news/2003-07-21-download-site\\_x.htm](http://www.usatoday.com/life/music/news/2003-07-21-download-site_x.htm), 2004-02-20.
26. Jefferson, G. (2004) *Pepsi, Apple team to tout music downloads*, [http://www.usatoday.com/tech/news/2004-01-28-sb-apple\\_x.htm](http://www.usatoday.com/tech/news/2004-01-28-sb-apple_x.htm), 2004-02-21.
27. Kotadia, M. (2004) *Almost half of Kazaa downloads 'threaten security'*, <http://www.zdnet.com.au/news/security/0.2000061744.20282469.00.htm>, 2004-01-21.
28. Machan, T. (2001) *The right to private property*, The Internet Encyclopedia of Philosophy, <http://www.iep.utm.edu/p/property.htm>, 2004-02-17.
29. N.N. (2004a) *Music Downloads*, Wal-Mart, <http://musicdownloads.walmart.com/>, 2004-02-20.
30. N.N. (2004b) *MusicNet*, MusicNet, <http://www.musicnet.com>, 2004-02-20.
31. N.N. (2004c) *N.T.*, Musicmatch, <http://www.musicmatch.com/>, 2004-02-21.
32. N.N. (2004d) *N.T.*, KaZaA, <http://www.kazaa.com/us/index.htm>, 2004-02-20.
33. N.N. (2004e) *The second generation of the iTunes Music Store now for Mac and Windows*, Apple Computer, Inc., <http://www.apple.com/itunes/store/>, 2004-02-20.
34. Olson, M. and Zeckhauser, R. (1970) *The Efficient Production of External Economics*, *American Economic Review*, 60, 3, pp. 512-517.
35. Oram, A. (Ed.) (2001) *Peer-to-Peer: Harnessing the Power of a Disruptive Technology*, O'Reilly & Associates, Inc., Beijing u.a.
36. Picard, R. G. (1989) *Media economics: concepts and issues*, Sage Publications, Newbury Park, CA.
37. Picot, A., Dietl, H. and Franck, E. (2002) *Organisation - Eine ökonomische Perspektive*, Schäffer-Poeschel, Stuttgart.
38. Picot, A. and Fiedler, M. (2003) *Impacts of DRM on internet based innovation*, In *Digital Rights Management: Technological, Economic, Legal and Political Aspects* (Ed. Becker, E., Buhse, W., Günnewig, D. and Rump, N.) Springer, Berlin, pp. 288-300.
39. Picot, A., Reichwald, R. and Wigand, R. T. (1997) *Information, Organization and Management - Expanding Markets and Corporate Boundaries*, Wiley, Chichester, New York u.a.
40. RIAA (2004) *2003 Yearend statistics*, RIAA, <http://www.riaa.com/news/newsletter/pdf/2003yearEnd.pdf>, 2004-4-16.
41. Rizzo, J. and Viksnins, R. (2003) *Apple iTunes Music Store*, ZDNet, [http://reviews-zdnet.com.com/Apple\\_iTunes\\_Music\\_Store/4505-3513\\_16-21220230-3.html?tag=subnav](http://reviews-zdnet.com.com/Apple_iTunes_Music_Store/4505-3513_16-21220230-3.html?tag=subnav), 2004-02-20.
42. Salkever, A. (2004) *Apple's Overlooked Upside*, BusinessWeek, [http://yahoo.businessweek.com/technology/content/jan2004/tc20040126\\_7356\\_PG2\\_tc055.htm](http://yahoo.businessweek.com/technology/content/jan2004/tc20040126_7356_PG2_tc055.htm), 2004-02-20.
43. Shapiro, C. and Varian, H. R. (1998) *Information Rules - A Strategic Guide to the Network Economy*, Harvard Business School Press, Boston, MA.
44. Shirky, C. (2001) *Listening to Napster*, In *Peer-to-Peer: Harnessing the Power of Disruptive Technologies* (Ed. Oram, A.) O'Reilly, Sebastopol, CA, USA.
45. Stone, B. (2004) *O.K. with pay for play*, Newsweek, <http://msnbc.msn.com/id/3868109/>, 2004-02-20.
46. Varian, H. R. (1995) *Pricing Information Goods*, Proceedings of the Symposium on Scholarship in the New Information Environment, Cambridge, MA.
47. Walter, B. v. and Hess, T. (2003) *iTunes Music Store: eine innovative Dienstleistung zur Durchsetzung von Property-Rights im Internet*, *Wirtschaftsinformatik*, 45, 5, pp. 541-546.

**APPENDIX A: OPTIMAL DEGREE OF INTERNALIZATION**

A1. Optimal degree of internalization without file sharing

$$t(x) = e^x + e^{a-x}$$

$$t'(x) = e^x - e^{a-x}$$

$$t'(x) = 0$$

$$\Leftrightarrow e^x = e^{a-x}$$

$$\Leftrightarrow (e^x)^2 = e^a$$

$$\Leftrightarrow e^{2x} = e^a$$

$$\Leftrightarrow x = \frac{a}{2}$$

## A2. Reduced optimal degree of internalization in the presence of file sharing

$$t_{new}(x) = e^x + e^{a-x} + se^x$$

$$t_{new}'(x) = e^x - e^{a-x} + se^x$$

$$t_{new}'(x) = 0$$

$$\Leftrightarrow e^x + se^x = e^{a-x}$$

$$\Leftrightarrow e^x = \frac{1}{1+s} e^{a-x}$$

$$\Leftrightarrow (e^x)^2 = \frac{1}{1+s} e^a$$

$$\Leftrightarrow e^x = \sqrt{\frac{1}{1+s} e^a}$$

$$\Leftrightarrow \ln e^x = \ln \sqrt{\frac{e^a}{1+s}}$$

$$\Leftrightarrow x \ln e = \ln \sqrt{\frac{e^a}{1+s}}$$

$$\Leftrightarrow x = \ln \sqrt{\frac{e^a}{1+s}}$$

$$= \ln \left( \frac{e^a}{1+s} \right)^{\frac{1}{2}}$$

$$= \frac{1}{2} \ln \left( \frac{e^a}{1+s} \right)$$

$$= \frac{1}{2} (\ln e^a - \ln(1+s))$$

$$= \frac{1}{2} (a - \ln(1+s))$$

$$x_{new} = \frac{1}{2} (a - \ln(1+s))$$

**APPENDIX B: CHARACTERISTICS OF DIFFERENT CLASSES OF DOWNLOAD SERVICES**

Characteristics	a) File sharing systems (FSS), Example: KaZaA	b) Restrictive download services (RDS), Example: MusicNet	c) Liberal download services (LDS), Example: iTunes Music Store
Economic aspects			
External effects	High	None	Low
Transaction costs	None	High	Medium
Compensation	None	High	Medium
Recent success	Yes	Little	Increasing
Legal aspects			
Legality	Problematic	Yes	Yes
User owns files	Questionable	Depends	Yes
Technological aspects			
DRM	None	Restrictive	Liberal
File exchange	Yes	None	Partly
Write-to-CD	Yes	Newly	Partly
Quality of files	Depends	High	High
Ease-of-use	Yes	Yes	Yes

**Table 1. Characteristics of three different classes of download services**