

Ahveninen, Harri; Suni, Paavo; Zhao, Yanyun; Wu, Yilin

**Working Paper**

## Cost competitiveness of Chinese and Finnish paper and paper product manufacturing

ETLA Discussion Papers, No. 1173

**Provided in Cooperation with:**

The Research Institute of the Finnish Economy (ETLA), Helsinki

*Suggested Citation:* Ahveninen, Harri; Suni, Paavo; Zhao, Yanyun; Wu, Yilin (2008) : Cost competitiveness of Chinese and Finnish paper and paper product manufacturing, ETLA Discussion Papers, No. 1173, The Research Institute of the Finnish Economy (ETLA), Helsinki

This Version is available at:

<https://hdl.handle.net/10419/44542>

**Standard-Nutzungsbedingungen:**

Die Dokumente auf EconStor dürfen zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden.

Sie dürfen die Dokumente nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, öffentlich zugänglich machen, vertreiben oder anderweitig nutzen.

Sofern die Verfasser die Dokumente unter Open-Content-Lizenzen (insbesondere CC-Lizenzen) zur Verfügung gestellt haben sollten, gelten abweichend von diesen Nutzungsbedingungen die in der dort genannten Lizenz gewährten Nutzungsrechte.

**Terms of use:**

*Documents in EconStor may be saved and copied for your personal and scholarly purposes.*

*You are not to copy documents for public or commercial purposes, to exhibit the documents publicly, to make them publicly available on the internet, or to distribute or otherwise use the documents in public.*

*If the documents have been made available under an Open Content Licence (especially Creative Commons Licences), you may exercise further usage rights as specified in the indicated licence.*

## Keskusteluaiheita – Discussion papers

No. 1173

Harri Ahveninen – Paavo Suni – Yanyun Zhao  
– Yilin Wu \*

### **COST COMPETITIVENESS OF CHINESE AND FINNISH PAPER AND PAPER PRODUCT MANUFACTURING**

We would like to thank Esa-Jukka Käär from the Forest Industry Federation for useful comments.

However, any possible errors or misinterpretations are the sole responsibility of the authors.

\* Harri Ahveninen is a Forest Industry Consultant, Creapo OY, Yanyun Zhao is a Professor and Director on the Centre for Research on the Assessment & Competitiveness of Renmin University of China, Ms. Yilin Wu is a Research Fellow in the Centre and Paavo Suni is a Senior International Economist in ETLA, Helsinki.

**AHVENINEN, Harri – SUNI, Paavo – ZHAO, Yanyun – WU, Yilin, COST COMPETITIVENESS OF CHINESE AND FINNISH PAPER AND PAPER PRODUCT MANUFACTURING.** Helsinki: ETLA, Elinkeinoelämän Tutkimuslaitos, The Research Institute of the Finnish Economy, 2008, 50 p. (Keskusteluaiheita, Discussion papers, ISSN 0781-6847; No. 1173).

**ABSTRACT:** This study focuses on the labour cost competitiveness of the paper and pulp industry in China and Finland in particular, using the corresponding German, the US and Estonian industries as a point of comparison in the early 2000s. This study deepens the analysis of the earlier study of the cost competitiveness of the manufacturing industries in the same group of countries. Separate studies focusing on the labour cost competitiveness are carried out in a parallel manner on the chemical industries and metal industries. The results of these three sector studies deepen the knowledge about the change of competitiveness and its level.

Large unit labour cost differences in a common currency were obviously a key factor behind exceptionally rapidly changing international production and trade structures in the late 1990s and early 2000s. The Chinese paper and pulp industry grew by about a quarter per year in 2000-2007 as the average annual growth of the value added of world manufacturing volume was only 3 per cent in 2000-2006. Nominal wages as such do not imply good international competitiveness. Chinese wages are, however, low even if their low labour productivity is taken into account and costs per unit of production are compared in a common currency. The relative levels of the Chinese unit labour costs vis-à-vis Germany, using the unit value ratios (UVR) to make the production volumes comparable, were estimated to be about 9 per cent in the paper and pulp industry. The ratio has even declined in the early 2000s and has stayed relatively stable after that until 2007. Improving labour productivity in China had compensated for the effects of rapidly rising wages and an appreciating Renminbi. The outlook of the paper and pulp industry, like the economy in general, is clouded by the difficult global financial crisis, which strongly restricts export possibilities and dampens also the domestic markets of industry. On the other hand, the stimulus packages of the government support the demand for paper and pulp products.

**Keywords:** competitiveness, unit value ratio, UVR, paper&pulp industry, NACE 21

**AHVENINEN, Harri – SUNI, Paavo – ZHAO, Yanyun – WU, Yilin, COST COMPETITIVENESS OF CHINESE AND FINNISH PAPER AND PAPER PRODUCT MANUFACTURING.** Helsinki: ETLA, Elinkeinoelämän Tutkimuslaitos, The Research Institute of the Finnish Economy, 2008, 50 s. (Keskusteluaiheita, Discussion papers, ISSN 0781-6847; No. 1173).

**TIIVISTELMÄ:** Tutkimuksessa selvitetään Kiinan ja Suomen sellu- ja paperiteollisuuden kustannuskilpailukykyä ja sen kehitystä 2000-luvun alkuvuosina. Laajemman kuvan saamiseksi Suomen ja Kiinan kustannuskilpailukykyä ja sen osatekijöitä verrataan Viron, Yhdysvaltojen ja Saksan vastaavien toimialojen kilpailukykyyn. Tutkimus syventää vastaavien kemianteollisuuden ja metallituoteteollisuuden kustannuskilpailukykytutkimusten ohella aiemmin tehtyä tutkimusta tehdasteollisuuden kilpailuvyvystä ja kilpailuvyvyn tasosta. Tarkoituksena on selvittää globalisaatioon liittyvien etenkin kustannusperäisten muutosvoimien vahvuutta ja tulevaa vaikutuspotentiaalia.

Suuret yksikkökustannuserot yhteisessä valuutassa laskettuina olivat epäilemättä keskeinen tekijä poikkeuksellisen nopeassa maailmantalouden tuotannon ja kaupan rakennemuutoksessa 1990-luvun lopulla ja 2000-luvun alussa. Kiinan sellu- ja paperiteollisuuden tuotanto (NACE 21) lisääntyi vuosina 1999–2007 lähes viidenneksen vuodessa. Maailman tehdasteollisuuden kiinteähintainen jalostusarvo lisääntyi vuosina 2000–2006 vain 3 prosenttia vuodessa. Tosin nimellispalkat tai työvoimakustannukset eivät sinällään kuvasta kansainvälistä kilpailukykyä. Halvat kustannukset merkitsevät usein myös heikkoa tuottavuutta. Kiinan kustannukset ovat kuitenkin hyvin edulliset myös tuottavuuskorjattuina eli laskettuna yhtä tuoteyksikköä kohden yhteisessä valuutassa kilpailijoiden kanssa, kun tuotantojen tasot tehtiin vertailukelpoisiksi yksikköarvosuhteiden (UVR) avulla. Kiinan yksikkötyökustannukset

Saksan kustannuksiin verrattuina ovat noin yhdeksän prosenttia paperi- ja selluteollisuudessa, kun yksikkötyökustannukset tehdään vertailukelpoiseksi yksikköarvosuhteita hyväksi käyttäen. Suhde aleni 2000-luvun alkuvuosina ja on pysynyt sen jälkeen melko vakaana vuoteen 2007 saakka. Työn tuottavuuden ripeä kasvu kompensoi työvoimakustannusten nopean nousun ja renminbin vahvistumisen vaikutuksen. Finanssikriisi varjostaa tuntuvasti Kiinan paperi- ja selluteollisuuden näkymiä, koska se rajoittaa voimakkaasti vientimahdollisuuksia ja vaimentaa kotimaista kysyntää. Toisaalta valtion elvytyshankkeet kuitenkin tukevat kysyntää.

**Avainsanat:** kilpailukyky, yksikköarvosuhde, UVR, paperi ja selluteollisuus, NACE 21

## **Tiivistelmä raportista ”Cost Competitiveness of Chinese and Finnish Paper and Paper Product Manufacturing”**

### **Tutkimuksen tavoitteet**

Tässä tutkimuksessa käsitellään sellu- ja paperiteollisuuden kilpailukykyä etenkin työvoiman osalta Kiinassa ja Suomessa. Saksan, Yhdysvaltojen ja Eestin sellu- ja paperiteollisuuden kilpailukykyä analysoidaan vertailukohteina.

Tämä tutkimus syventää aikaisempaa analyysiä samojen maiden teollisuuksien suhteellisesta kansainvälisestä kilpailukykyvystä. Sellu- ja paperiteollisuuden kilpailukykyanalyysin kanssa samanaikaisesti on tehty vastaava tutkimus metallituoteteollisuudesta ja kemian teollisuudesta<sup>1</sup>. Näiden kolmen tutkimuksen tuloksia vertaillaan seuraavassa vaiheessa pyrkien selvittämään yleisemmällä tasolla globalisaatiossa toimivien muutosvoimien voimakkuutta ja vaikutusta maakohtaisen kilpailukyyn muuttumiseen.

### **Maailman taloudellinen kehitys**

Maailman talous kasvoi 1990-luvun puolivälistä saakka vuoteen 2008, joskin ajanjaksoon kuuluu myös kasvun vaihteluita. BKT:n kasvu hyötyi teollisuuden tuotannon globalisoinnista ja etenkin sen kasvusta sekä kansantalouden säästämisasteen noususta uusissa tuotantomaisissa, erityisesti Kiinassa. Kansantalouksien perustekijät loivat keveät rahoitusmarkkinat useissa maissa. Ensimmäiset merkit talouksien riskeistä tulivat esiin elokuussa 2007, ja taloudellinen kriisi valtasi rahoitusmarkkinat syyskuussa 2008, sysäten koko maailman talouden taantumaa. Nykytietämyksen perusteella maailmantalous ei palaa nopeasti vahvalle kasvu-uralle.

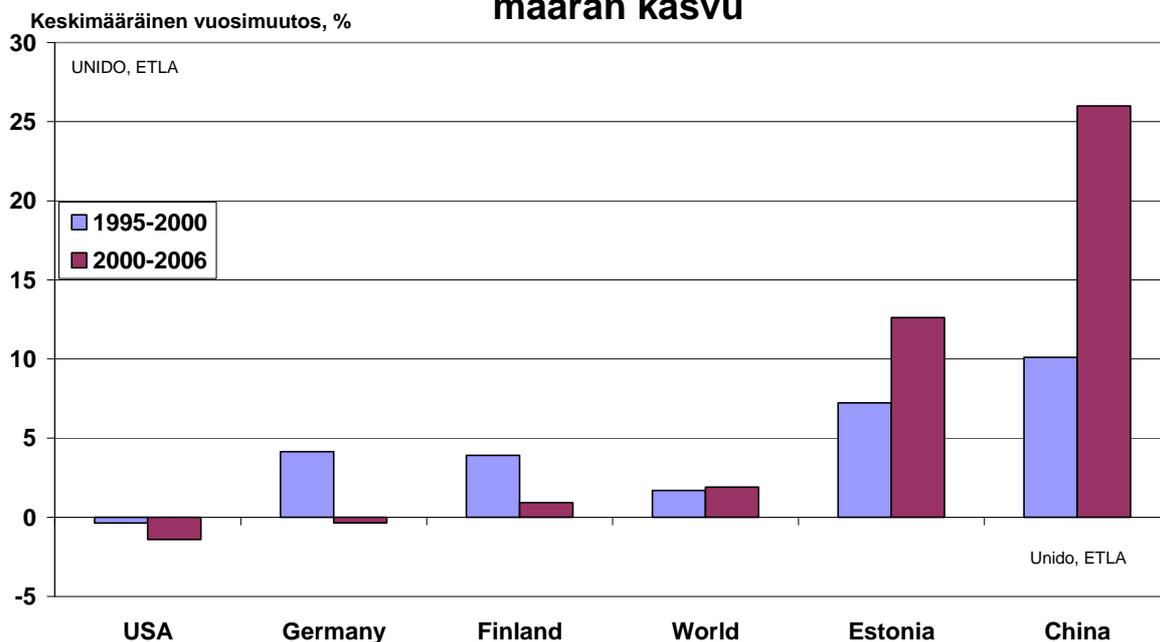
### **Maailman sellu- ja paperiteollisuuden kehitys**

Taloudellisen kehityksen myötä sellu- ja paperiteollisuuden tuotanto on kasvanut mutta kasvuvauhti on ollut hitaampi kuin useimmissa muissa teollisuuksissa. Sellu- ja paperiteollisuus ei ole hyötynyt tuotannon globalisaatiosta samalla tavalla kuin muut teollisuudet, päinvastoin esimerkiksi aikaisemmat paperin ja kartongin tuontitarpeet Aasiassa ovat muuttumassa nettovienniksi paikallisten yritysten tuotannon voimakkaan kasvun seurauksena vaikka samanaikaisesti paikallinen paperin ja kartongin kulutus on lisääntynyt erittäin paljon. Itse asiassa paikallisen kulutuksen erittäin nopea kasvu on luonut edellytykset tuotannon erittäin nopealle kasvattamiselle, ja etenkin Kiinan osuus maailman sellu- ja paperituotannosta kasvoi ajanjaksona 2000–2006 viidellä prosenttiyksiköllä (viidestä prosentista kymmeneen prosenttiin).

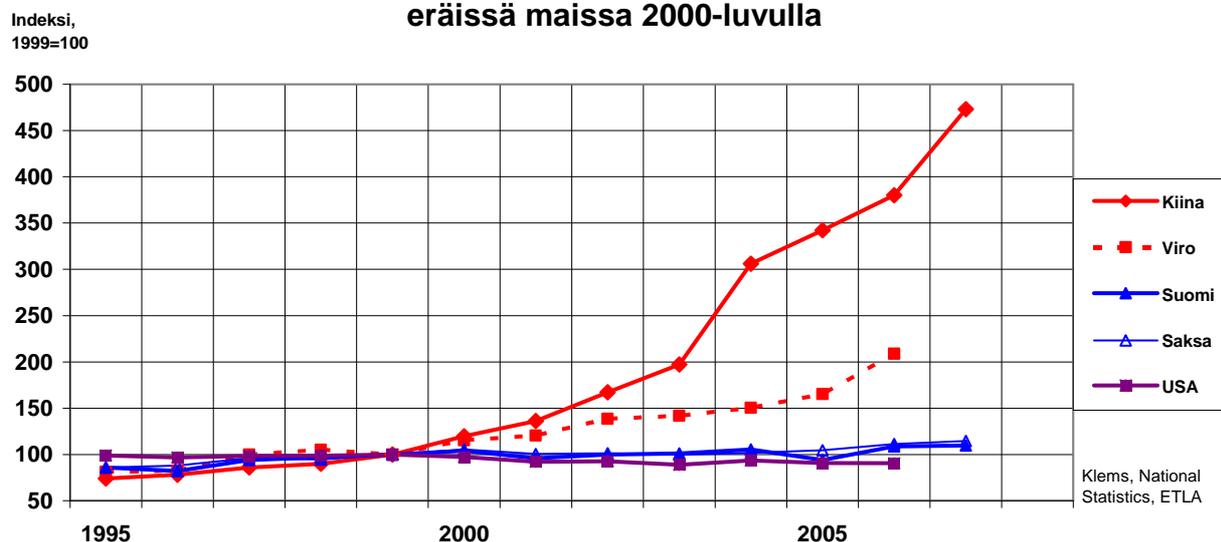
---

<sup>1</sup> Ahveninen, Harri – Suni, Paavo – Zhao, Yanyun and Wu, Eileen, Cost Competitiveness of Chinese and Finnish Fabricated Metal Industries. ETLA DP nro 1173, 2008. Tutkimus on osa hanketta, jossa on tutkittu Kiinan ja Suomen kustannuskilpailukykyä tehdasteollisuudessa (Sunni Paavo - Ahveninen Harri (2007), Cost Competitiveness of Chinese Manufacturing Industries from the Finnish Perspective. Prime Minister’s Office Reports 3/2008.), metallituoteteollisuudessa (ETLA DP nro 1172, 2008) ja kemianteollisuudessa (ETLA DP nro 1171, 2008).

## Sellu, paperi- ja paperituoteteollisuuden tuotanto, määrän kasvu



## Paperi- ja sellun tuotannon määrä eräissä maissa 2000-luvulla



### Sellu- ja paperiteollisuuden tuotannon kustannusrakenne

Teollisuusmaiden sellu- ja paperiteollisuus käyttää keskimäärin suhteellisesti vähemmän ulkopuolisten toimittajien välituotepanoksia kuin mitä tapahtuu vastaavassa teollisuudessa uusissa nopeasti kasvavissa tuotantomaissa. Välituotepanosten tuontiosuus on merkittävä

Eestissä johtuen pienestä sellu- ja paperituotannosta, Kiinassa johtuen jätepaperin sellun suuresta tuonnista, ja Suomessa johtuen koivukuitupuun tuonnista Venäjältä mikä kuitenkin on nopeasti loppumassa Venäjän raakapuun vientiveron vuoksi.

Sellu- ja paperiteollisuuden tuotannon jalostusarvo, bruttokate ja etenkin kokonaistyövoimakustannukset ovat suuremmat teollisuusmaissa kuin uusissa tuotannon nopean kasvun maissa. Kokonaistyövoimakustannukset ovat nousseet eniten Suomessa, mutta kustannusten nousua on tapahtunut myös Saksassa ja Yhdysvalloissa.

### **Kiinan sellu- ja paperiteollisuus**

Kiinan sellu- ja paperiteollisuus on laajentunut nopeammin kuin missään muussa maassa johtuen monen tekijän aikaansaamasta kysynnän noususta kuten mm. hyvin nopeasta taloudellisesta kasvusta ja suuresta väestöstä, kaupungistumisesta ja sen mukana tulevasta maaseudun kulutustapoja suuremmasta paperin ja kartongin käytöstä, ja nopeasti kasvavan muun teollisuuden paperin ja kartongin kulutuksesta. Tuotannon kasvaminen on merkinnyt myös sellu-paperiteollisuuden jatkuvaa rakenteen muuttumista ja teknistä uudistumista. Vaikka sellu- ja paperiteollisuutta on Kiinan kaikissa maakunnissa, suurimmat tuotannot tapahtuvat seuraavissa maakunnissa: Shandong, Zhejiang, Guangdong, Jiangsu ja Henan, joiden jälkeen tuotannon suuruusjärjestyksessä tulevat Hebei ja muut maakunnat. Tuotannon arvon kasvu on perustunut volyymin kasvuun koska hintakehitys on ollut hidasta mm. kilpailusta ja alhaisesta inflaatiosta johtuen. Sellu- ja paperiteollisuuden viranomaisille raportoitu tuotannon bruttokate on ollut alhainen (noin 400 yuania/tonni vuonna 2006) joskin jatkuvasti nouseva 2000-luvulla; raportoitu bruttokate ei kuitenkaan ole suoraan verrattavissa teollisuusmaiden kirjanpidon lukujen kanssa.

Sellu- ja paperiteollisuuden tuottavuus on paranemassa yrityskoon kasvamisen ja tuotannon modernisoinnin myötä. Sellu- ja paperiteollisuudessa toimivaa henkilöä kohti laskettu tuotannon arvo on suurin Hainanin maakunnassa koska siellä sijaitsee suuri, moderni tehdas. Ulkomaalaisten omistajien ja valtion omistamien yritykset ovat menestyneet paremmin kuin kaupunkien ja yhteisöjen omistamat yritykset.

Sellu- ja paperiteollisuus osuus Kiinan puhtaan veden kulutuksesta on noin 7 %, ja noin 51 % siitä kierrätetään uudelleen tuotannossa. Osuus Kiinan teollisuuden jätevesipäästöistä on noin 18 % ja osuus COD-päästöistä noin 34 %. Sellu- ja paperiteollisuuden päästöt suhteessa sen tuotannon määrään ovat laskemassa tuotantorakenteen uudistumisen seurauksena.

Tässä tutkimuksessa arvioitiin sellu- ja paperiteollisuuden maakuntakohtaista kilpailukykyä sitä mittaavalla indeksillä. Kilpailukykyisimmät yritykset sijaitsevat maan itäosassa (rannikkoalue, satamat jätepaperin tuontia ja paperin vientiä varten); Tällä alueella teollisuus käyttää suhteellisen paljon välituotepanoksia ja saavuttaa keskimääräistä korkeamman jalostusarvon sekä käyttökateen tuotannon rakenteen ja koon avulla. Toiseksi kilpailukykyisimmät yritykset sijaitsevat maan keskiosassa (paikallinen kuituraaka-aine ja paikalliset paperimarkkinat). Maan luonnonmetsäalueiden lähellä olevat yritykset ovat kärsineet kuitupuun saannin vaikeuksista ja korkeista kustannuksista. Palkkakustannukset, verot ja poistot ovat suhteellisesti korkeat kaupunkien lähellä sijaitsevissa yrityksissä.

Kiina on ollut paperin ja kartongin nettotuoja, mutta vuodesta 2005 lähtien se on muuttunut nettoviejäksi. Paperin ja kartongin tuonti on kohdistumassa korkeaa laatua vaativien markkinasegmenttien tarpeiden tyydyttämiseen.

Kiinan paperin ja kartongin kysynnän ennustetaan lähes tuplaantuvan nykytasostaan (73 miljoonaa tonnia vuonna 2007) vuoteen 2020 mennessä. Kiinan hallitus on tiedostanut tarpeen luoda edellytyksiä tuotannon kasvulle ja teollisuuden rakenteen parantamiselle.

Sektorille laaditun kehityspolitiikan mukaan pieniä, paljon energiaa käyttäviä ja saastuttavia tehtaita tullaan sulkemaan, uusia suurempia tehtaita tullaan perustamaan, ja yrityskokoja tullaan suurentamaan jotta sektori pystyy hankkimaan tuotannon uudistamisen ja kysynnän tyydyttämiseen vaatimat voimavarat. Tavoitteena on myös paperin ja kartongin viennin lisääminen.

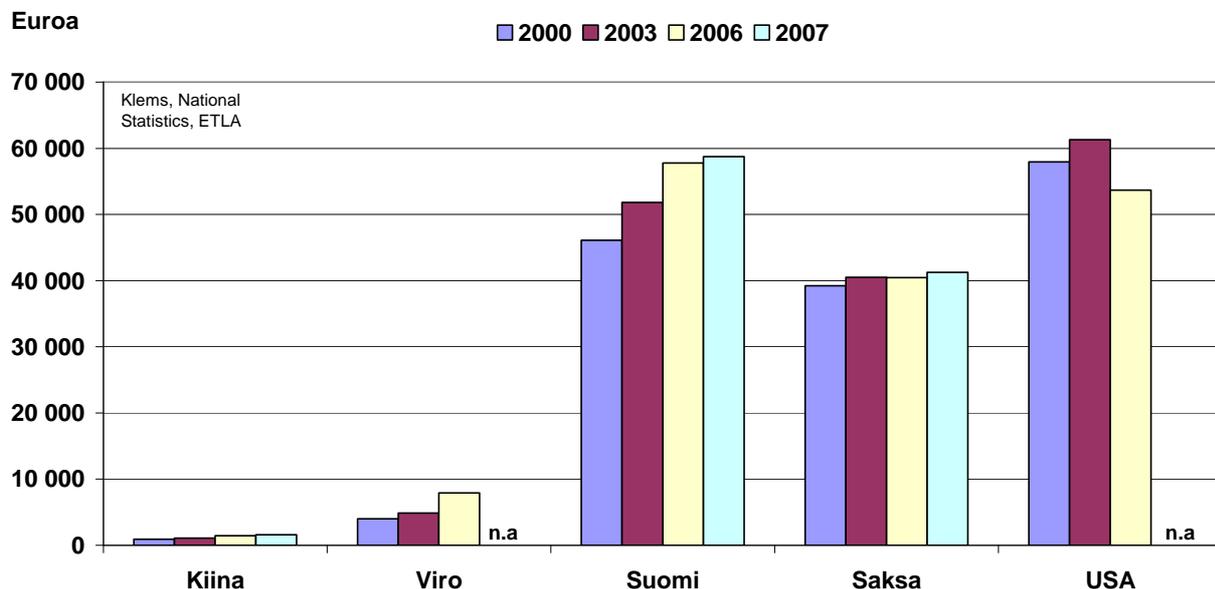
Sektorin kehityspolitiikan tavoitteiden saavuttaminen riippuu merkittävästi siitä miten Kiinassa onnistutaan nopeasti kasvavien ja nimenomaan sellu- ja paperiteollisuuden käyttöön tarkoitettujen istutusmetsien perustamisessa. Olkisellun määrä voi kestää nykytasollaan vain jos uusia, modernia teknologiaa käyttäviä tehtaita perustetaan korvaamaan pienten, vanhojen tehtaiden sulkemisen myötä poistuvaa tuotantokapasiteettia; muussa tapauksessa sen määrä laskee. Vaikka Kiinan oman jätepaperin keräysaste on nousemassa, jätepaperin tuontia joudutaan lisäämään suurella määrällä vuoteen 2020 mennessä. Kiina oman valuutan ennakoitu vahvistuminen edistäisi jätepaperin, sellun ja hakkeen tuontia täydentämään kotimaisen kuituraaka-aineen tarjontaa mikä tulee olemaan tuotannon kasvattamisen suurin pullonkaula.

### Työvoimakustannuserot

Globalisaation kiihtyminen 1990- ja 2000-luvulla on perustunut kylmän sodan päättymiseen ja kehittyvien maiden, etenkin Kiinan avautumiseen, joka on paljastanut uusia kannattavia liiketoimintamahdollisuuksia. Uudessa tilanteessa esimerkiksi Kiina on hyötynyt teollisuusmaihin verrattuna erittäin alhaisesta palkkatasostaan. Suomen sellu- ja paperiteollisuuden kustannustasoon verrattuna Kiinan kokonaistyövoimakustannukset olivat vuonna 2006 noin 3 prosenttia. Suomeen verratut työvoimakustannustasot olivat Virossa 14, Saksassa 70 ja Yhdysvalloissa 93 prosenttia (euroissa laskettuna).

Tarkasteltavien maiden yksikkötyövoimakustannukset (työvoimakustannus/tuotannon määrä) ja niiden kehitystrendit poikkeavat toisistaan tuntuvasti. Kustannustaso on noussut suhteellisen nopeasti Eestissä ja Yhdysvalloissa ja jonkin verran Saksassa, mutta Suomessa ja myös Kiinassa kustannustaso on laskenut, joskin Kiinassa uusi työlaki johtanee kustannustason nousuun.

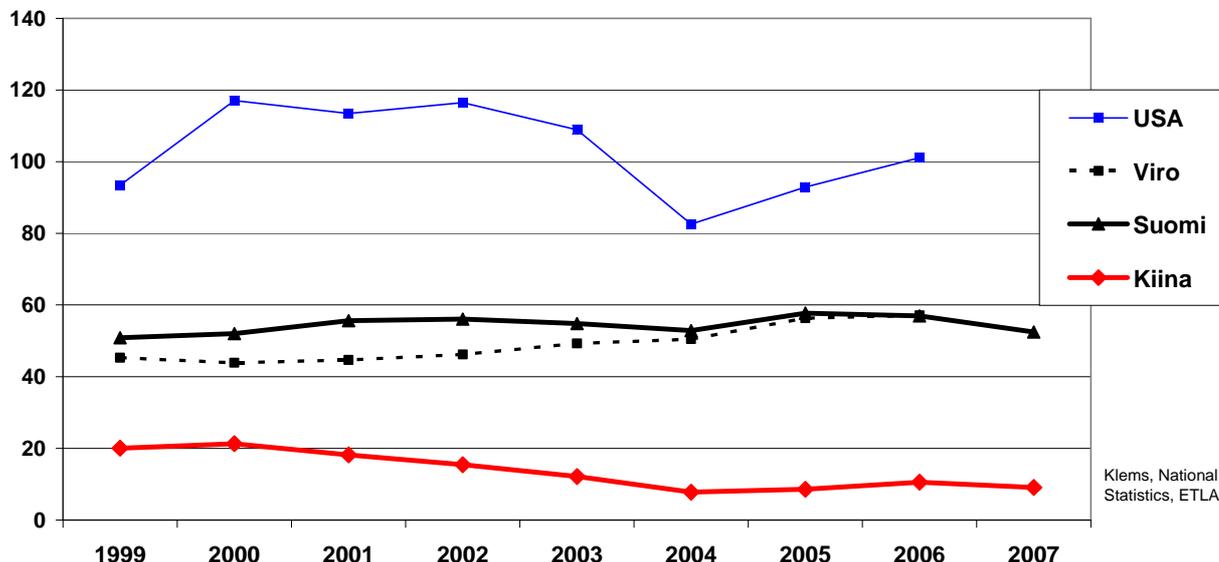
## Paperi- ja selluteollisuuden kokonaistyövoimakustannukset per työntekijä eräissä maissa



## Suhteelliset yksikkötyökustannukset paperi- ja selluteollisuudessa Saksan suhteen, %

Kansallinen ULC per Saksan ULC, %

Kustannukset euroissa, määrät tehty vertailukelpoisiksi UVR'en avulla



Klems, National Statistics, ETLA

### Suhteelliset työvoimakustannukset

Nimellispalkat tai työvoimakustannukset eivät sinällään merkitse hyvää kansainvälistä kilpailukykyä. Alhaiset kustannukset merkitsevät usein myös heikkoa tuottavuutta. Kiinan kustannukset ovat kuitenkin hyvin edulliset myös tuottavuuskorjattuina eli laskettuna yhtä tuoteyksikköä kohden yhteisessä valuutassa kilpailijoiden kanssa.

Suhteellisten työvoimakustannusten perusteella voidaan verrata eri maiden kustannustasoa toisiinsa. Yhdysvalloissa työvoimakustannukset ovat lähes yhtä korkeat kuin Saksassa. Suomessa suhteelliset työvoimakustannukset ovat merkittävästi alhaisemmat koska sellu- ja paperitehtaat ovat suuria, moderneja ja hyvin tehokkaita. Eestissä suhteelliset työvoimakustannukset ovat Suomen tasolla johtuen alhaisista nimellispalkoista ja etenkin huonosta tuottavuudesta.

Kiinassa suhteelliset työvoimakustannukset ovat vain noin 4 prosenttia Saksan tasosta. Uusien tehtaiden parempi teknologia ja työn tuottavuus on kompensoinut palkkojen nousun ja valuutan vahvistumisen vaikutusta. Suhteelliset yksikkötyökustannukset, joissa Kiina työn Saksaa heikompi tuottavuus on otettu huomioon ja tuotannon tasot tehty vertailukelpoisiksi ns. yksikköarvosuhtein<sup>2</sup>, olivat noin 11 prosenttia Saksan kustannuksista.

Suuret yksikkökustannuserot yhteisessä valuutassa laskettuina olivat epäilemättä keskeinen muutoksen tekijä poikkeuksellisen nopeassa maailmantalouden tuotannon ja kaupan rakennemuutoksessa 1990-luvun lopulla ja 2000-luvun alussa. Tämä tekijä on myös autta-

<sup>2</sup> Yksikköarvosuhde on yksinkertaistettuna tarkasteltavien maiden tuottajahintojen suhde. Se on ostovoimaparieteitin mittari tuotannon näkökulmasta. Tosin sanoen, jos se on yhtä suuri kuin valuuttakurssi, niin tuottajien kohtaatamat hinnat ovat samat. Tarkasteltaessa kokonaistuotantoa ja sen eriä kansantalouden menopuolen näkökulmasta käytetään markkinahintoihin perustuvia pariteettimittareita. Ne eivät sovellu tuotantopuolenmittaukseen, koska verot ja tukipalkkiot vääristävät helposti hintavertailua tuntuvasti.

nut Kiinan sellu- ja paperiteollisuutta lisäämään tuotantoaan niin nopeasti, että maa on muuttunut paperin ja kartongin nettotuojasta niiden nettoviejäksi.

### **Muutospotentiaali ja sen tekijät**

Edellä kuvattujen maakohtaisiin tilastoihin perustuvien laskelmien valossa Kiinan kasvupotentiaali on edelleen hyvin suuri sellu- ja paperiteollisuudessa, koska lisäksi sen tuotteiden kysyntä Kiinassa kasvaa nopeasti ja suhteelliset yksikkötyökustannukset ovat edelleen vain murto-osa läntisistä kustannuksista. Viron talous on esimerkki pienestä avotaloudesta, joka on esimerkiksi Kiinan taloutta huomattavasti joustavammin sopeutunut muuttuviin oloihin. Viron sellu- ja paperiteollisuus on suureksi osaksi jo hyödyntänyt talouden kehityspotentiaalin (catching up), koska sen yhteisessä valuutassa ilmaistut yksikkötyökustannukset ovat nousseet jo perinteisten teollisuusmaiden tuntumaan. Tämä merkitsee jatkossa tuskallista sopeutumista, koska ripeätä työvoimakustannusten nousua ei pystytä enää kompensoimaan muulla kuin tuottavuuden vahvalla nousulla. Viron kruunun sitominen euroon ehkäisee myös valuuttakurssipolitiikan käytön väistämättömään muutokseen sopeutumisessa.

Kiinan talous on poikkeuksellisen kiinnostava sekä suuren, nopeasti kasvavan paperi- ja kartonkimarkkinan kokonsa että sen kysyntä-tarjontatasapainon muutoksen ja siihen liittyvän maailmanmarkkinavaikutuksensa takia. Kiina on rajussa muutoksessa, mutta talouden perustekijöiden erot muuhun maailmaan ovat edelleen suuret. Palkat nousevat nopeasti, mutta lähtötaso on hyvin alhainen ja talouden rakennemuutos on pitänyt tuottavuuden myös nopeassa nousussa. Tuottavuuden nousu vapauttaa ammattitaidotonta työvoimaa maataloudesta, mikä vaimentaa palkkakustannusten nousua. Ammattitaitoisesta työvoimasta on kuitenkin jo pulaa mikä nostaa uuden työvoimasäädännön ohella työvoimakustannuksia. Kiinan harjoittama renminbi yuanin vahvistumispolitiikka 2000-luvun alkuvuosina pienensi myös kustannuseroja. Syksyllä 2008 tämä politiikka muuttui kuitenkin varovaisemmaksi kansainvälien finanssikriisiin vaikutusten kohdistuessa voimakkaasti myös Kiinan talouteen. Kiinan kustannusetua kaventaa tuotehintojen hidas kehitys suhteessa vertailumaihin. Osa rajusta tuottavuushyödyistä heijastuu hinnoittelussa.

### **Kiinan sellu- ja paperiteollisuus on muutoksessa**

Kiinan kemianteollisuus on rajussa muutoksessa kuten suurin osa maantehdasteollisuudesta. Tuotanto on keskittynyt muutamaan maakuntaan (Shandong, Zhejiang, Guangdong, Jiangsu, Henan, Hebei ja Hainan), mutta tuotantoa on kaikissa maakunnissa. Kiinan hallituksen 11. 5-vuotissuunnitelman mukaan sellu- ja paperiteollisuus kasvaa nopeasti vuoteen 2010 mennessä, ja tuotannon pitkän tähtäimen kasvu tulee perustumaan entistä enemmän kuitupuuhun istutusmetsistä. Tuotannon kasvu integroidaan entistä voimakkaammin teollisuuskäyttöön tarkoitettujen istutusmetsien kasvattamisen kanssa. Tavoitteena on myös energian käytön ja ympäristön kuormittamisen vähentäminen.

Kiinan sellu- ja paperiteollisuus on hyvin kilpailullinen, koska alalla on lukuisa joukko yrityksiä, joista noin 3500 muodostaa pääosan tuotannosta. Kilpailukykyisimmät yritykset, mitattuna Renmin Yliopistossa kehitetyllä alueellisella kilpailukykyindeksillä, sijaitsevat seuraavissa maakunnissa: Shandong, Guangdong, Henan, Jiangsu, Hunan ja Zhejiang.

Hallituksen kehityssuunnitelman mukaan suuri joukko pieniä, saastuttavia ja paljon energiaa käyttäviä tehtaita tullaan sulkemaan vuoden 2010 loppuun mennessä. Tuotantoa pyritään keskittämään suurempiin yrityksiin ja uudenaikaisen teknologian tehtaisiin. Kiinan hallitus käyttää sääöksiä ja taloudellisia kannustimia ohjatessaan teollisuuden kehitystä

tuotantotavoitteiden mukaiseen suuntaan. Tuotannon kasvaessa Kiina vaikutus paperin ja kartongin kansainvälisiin markkinoihin lisääntyy.

### **Kansainvälisen rahoituskriisin vaikutukset**

Sellu- ja paperiteollisuuden näkymiä varjostaa odottamattoman pahaksi syventynyt kansainvälinen rahoituskriisi, mikä toisaalta rajoittaa vientimahdollisuuksia, toisaalta pehmentää kotimarkkinoita. Useat kansainvälisistä markkinoista kuten Yhdysvallat, Japani ja Euro-alue ovat taantumassa ja siitä toipuminen kestää pidempään kuin tavallisesti talouden toimintaan keskeisesti vaikuttavan rahoituskriisin syvyyden takia. Kiinan hallitus pyrkii pehmentämään kansainvälisen rahoituskriisin vaikutuksia Kiinassa talouden tukipaketeilla jotka tähtäävät kotimaisen kysynnän tukemiseen.

### **Kiina – kilpailija ja potentiaalinen yhteistyökumppani**

Kiinan sellu- ja paperiteollisuus nousee pitkällä aikavälillä globaalia merkitystään jo nyt korkealle nousseelta tasoltaan. Tässä kehitysprosessissa kustannuserojen ohella tiedon siirtyminen teollisuusmaista ja nopeasti kasvavat kotimarkkinat ovat tärkeitä osatekijöitä. Kiinan sellu- ja paperiteollisuuden nopea jatkokehitys hyötyy kansainvälisestä yhteistyöstä ja tieto-aidon saamisesta teollisuusmaista.

Raaka-aineiden, energian, työvoiman ja muiden tuotannon panostekijöiden kustannuksissa tapahtuu ajoittain merkittäviä muutoksia. Koska Kiinan sellu- ja paperiteollisuus tulee olemaan alan globaalisti merkittävä toimija, on hyödyllistä sekä Kiinan että muiden toimijoiden kannalta seurata aktiivisesti kansainvälisen kilpailukykykehitystä. Lisätutkimus ja kehityksen seuranta syventäisi tietoa sellu- ja paperiteollisuuden muutosprosessista. Tämä on erityisen merkityksellistä sen takia, että Kiinalla ja eräillä muilla kehitysmailla on vielä paljon kehityspotentiaalia (catching up). Nykyinen kansainvälinen rahoituskriisi hidastaa selvästi muutosprosesseja, mutta normaaliin taloudelliseen kehitykseen palatessa alan kehitysprosessit voimistunevat.

Kiinan sellu- ja paperiteollisuus tulee kasvamaan monissa maakunnissa, mutta maan hallituksen tavoitteena on saada suuria uusia sellutehtaita sellaisiin maakuntiin joissa on edellytyksiä nopeasti kasvavien teollisuuden istutusmetsien kasvattamiselle. Tässä kehitysprosessissa on edullista sekä kiinalaisten että ulkomaisten toimijoiden kannalta löytää ja kehittää aikaisessa vaiheessa parhaat uuden tuotannon tavoiterakenteet ja perustamisalueet.

### **Kansainvälinen kilpailukyky ja yritysten toimintaympäristö**

Meneillään oleva kansainvälinen finanssikriisi ja maailmanlaajuinen taantuma korostavat kustannuskilpailukykykehityksen merkitystä kansallisella ja yritystasolla, koska se merkitsee kilpailun kiristymistä ja yritysten hinnoitteluvoiman heikkenemistä.

Kiinan teollisuudessa työvoimakustannusten nousu, renminbi yuanin vahvistuminen (vaikeuttaa vientiä ja vahvistaa tuontia), pula ammattitaitoisesta työvoimasta, uusi työvoimalainsäädäntö työntekijöiden olojen kohentamiseksi, ja investoinnit ympäristöongelmien parantamiseen ovat heikentämässä jonkin verran sen sellu- ja paperiteollisuuden nykyistä kustannuskilpailukykyä. Kiinan teollisuus hyötyy toisaalta tuntuvasti kotimarkkinoiden vahvasta kasvusta.

Teollisuusmaiden yritykset pyrkivät pienentämään lisääntyviä kustannuksiaan kehittämällä jalostusarvoltaan korkeampaa tuotantoa, tuotteiden laatua ja tuottavuutta. Kiinalaiset yritykset pyrkivät samaan kehityksen suuntaan hyödyntämällä hyvää kansainvälistä kilpailukykyään sekä suuria maan sisäisiä maakuntakohtaisia kehitysmahdollisuuksia.

Maailman sellu- ja paperiteollisuus on merkittävässä muutosprosessissa. Kiinalaisten ja kansainvälisesti toimivien yritysten kannalta on tärkeää aktiivisesti seurata sektorin kilpailutilannetta ja varautua yhteistyömahdollisuuksiin.

## Table of Contents

1. Introduction .....	1
2. Paper and paper product manufacturing in selected countries .....	2
2.1. Background.....	2
3. World paper and paper product industry .....	4
3.1. Paper and paper product manufacturing in selected countries .....	4
3.1.1. Cost structure of output .....	10
3.2. Paper and paper product industry in China .....	15
3.2.1. Paper and paper products industries of Chinese regions .....	19
4. Unit labour costs in selected countries .....	32
5. Relative unit labour costs in selected countries.....	36
6. Conclusions .....	43
Annex 1. Manufacturing production and unit value ratios.....	48
Annex 2 .Growth of World Value Added in Manufacturing, Annual Percentage Change in Volume .....	49
Annex 3. The data.....	49
References: .....	50

# 1. Introduction

This study dealing with the cost competitiveness of the paper and paper products manufacturing in China, Estonia, the US, Germany and Finland is one of four complementary studies. The first study, a general description of the cost competitiveness developments of the manufacturing industry, was made for the Council of the Finnish Prime Minister. The other two studies review the developments in the fabricated metal and chemical industries.

This study starts with the general developments of the industries to give a general framework for the description of cost competitiveness. In the paper and paper product industry, the availability and price of raw materials are more important cost components than labour costs. However, labour costs also matter as they constitute 11 per cent of Chinese paper and paper product output according to national input output table. (China 2008)

This study concentrates on labour costs as it is the differences of unit labour costs between industrialised and developing countries which create large incentives for changes in geographical pattern of production and trade.

This is started by comparing unit labour costs (ULCs), i.e. labour costs per unit of production, in the selected countries on an aggregate level as well as by decomposing the costs into labour costs and productivity. We also have a look at the fragmented nature of China by comparing the developments also by provinces.

Competitive developments in the paper and paper product industries are first analysed by using relative unit labour costs in a common currency, the euro. Comparison is made as usual with indices.

After that, the levels of unit labour costs are constructed using so-called unit value ratios (UVRs<sup>3</sup>) comparing the development with respect to Germany. The level comparison is supplemented by decomposition of relative unit labours costs (RULCs) to relative wage costs, productivity and exchange rates.

In the last chapter the results are reviewed and conclusions put forward.

---

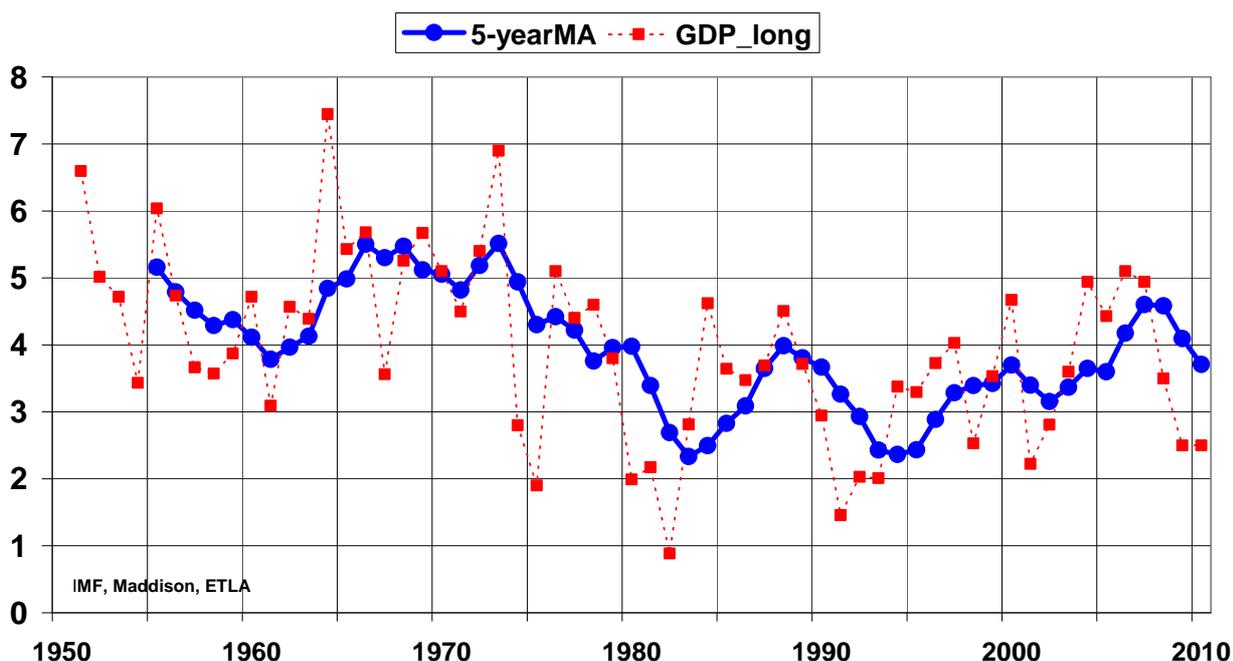
<sup>3</sup> Rs can be used to convert production volumes into comparable figures. See Annex 1.

## 2. Paper and paper product manufacturing in selected countries

### 2.1. Background

World economic growth has greatly benefitted from globalisation via which developing countries, especially China, have gained strong momentum in their economies. In the early 2000s developing countries have made a most significant contribution to the world economic growth. China alone contributed around 1.1 percentage points to the world average growth of 4.8 per cent in 2001-2007. Strong global growth was boosted by emergence of China due to its liberalisation policies since the end of the 1980s into the international community as well as the strengthening growth of other developing countries as technological changes made it easier both to transfer technology and optimise the processes of the multi-national enterprises on a global basis. The more efficient production practises kept inflation under control in spite of strong growth.

### World GDP Growth 1950-2010



The exceptionally strong growth in the early 2000s was, however, also due to very easy monetary circumstances due to strong savings in the developing countries. This phenomenon was coined the savings-glut by the chairman of the US Federal Reserve Paul Bernanke. The easy monetary environment with low interest rates was one reason behind the surge of subprime loans in the US, which by definition are loans with less than a normal probability of pay back. These loans became very popular and their share of the US mortgages rose from a negligible amount to 20 per cent by 2006, when these loans started declining. The usual practise was to package these loans with other loans into a financial instrument called CDOs (Collateralized Debt Obligations). This operation made it possible to spread the risk of these high yielding products to other agents globally. While CDOs

were risky, they were often insured against the default by so-called CDS (Credit Default Swaps). All went fine until housing prices began to decline. This resulted in rising foreclosures and subsequent weakening of banks' balance sheets of banks. These problems developed into an international financial crisis already in August 2007, but the severity of the problem was revealed in autumn 2008, when the international financial markets nearly collapsed after the renowned investment banking institution Lehman Brothers filed for bankruptcy and the largest US insurer AIG was taken under government control. In short, the leverage-based growth changed to deleverage-based problems in the financial sector. These problems have been exacerbating the problems in the real economy during autumn 2008 and the forthcoming winter.

In the autumn 2008, the medium-term economic background for global paper industries substantially worsened in terms of GDP growth compared to the outlook before the crisis.

### **3. World paper and paper product industry**

#### ***3.1. Paper and paper product manufacturing in selected countries***

World manufacturing industries, in general, have gained from globalisation with a few exceptions as far as the growth in the volume of value added is concerned. In the late 1990s, the growth strengthened from the early 1990s. The growth moderated, but remained strong in 2000-2006. The annual averages of the growth in volume of value added were 2.5, 3.2 and 3 per cent (UNIDO 2008) in the periods 1990-1995, 1995-2000 and 2000-2006, respectively. The growth rates, however, varied substantially between different industries. The industry which has gained by far the most is the radio, television and communication equipment industry. Its volume of value added grew 26 and 12 per cent per annum in the latter two periods. On the other hand, paper and paper production grew by below 2 per cent by volume in the respective periods. (See adjacent graph and table in the Annex 1.)

Rapid Chinese growth has changed world share of manufacturing and also the shares in the paper and paper product industries. The share of China of the world paper and paper product industry has risen from 5 per cent in 2000 to 10.3 per cent in 2006 in prices of 2000 (UNIDO 2007).

Forest industries have not gained from the globalisation and a related strong growth in developing economies and China in particular like many other manufacturing industries. World production of forest industries has grown well below the average rate in the manufacturing industries since the mid 1990s. In addition, the world volume of value added of the paper and paper product industry grew by 2 per cent in 2000-2006 compared to 3 per cent average growth in manufacturing. There are many reasons for this slow growth. For example, the demand for forest products, especially for various paper grades has been modest in mature economies (Metsäteollisuus 2006).

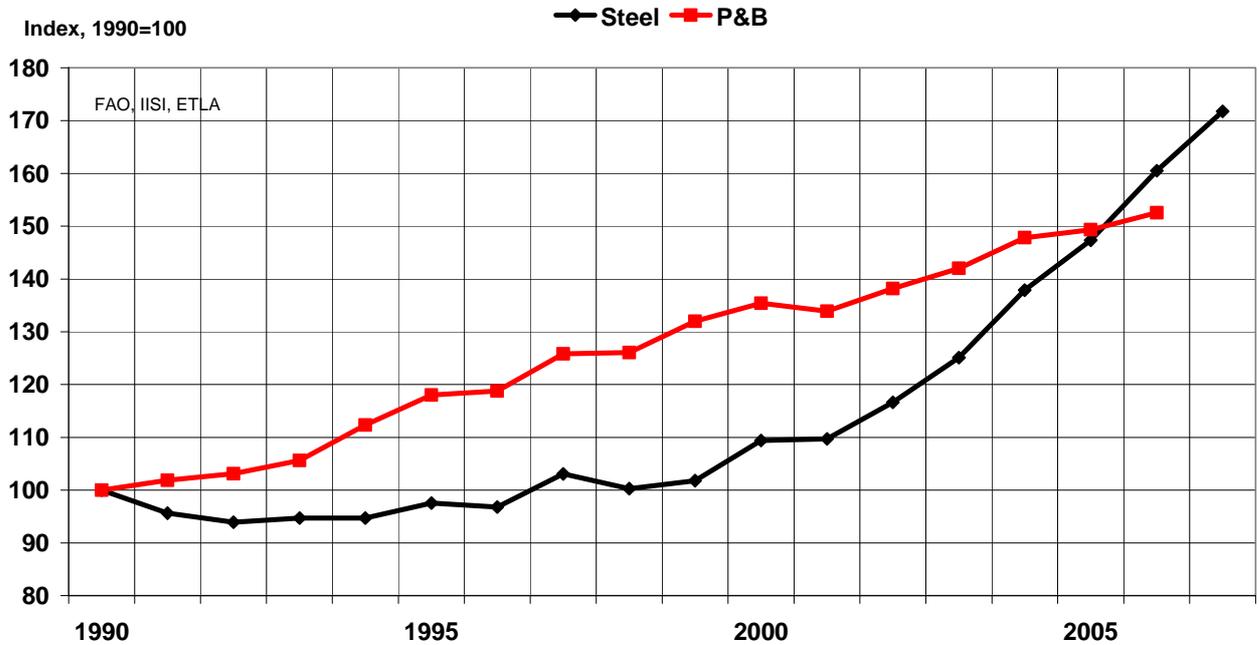
The comparison of the global steel industry and paper and pulp industries is striking. The steel industry incurred very bad difficulties in the 1980s and 1990s but gained a lot of strength in the early 2000s led by Chinese industrialisation (see e.g. Suni 2008). Paper and pulp industries, on the other hand, performed better in earlier decades, but benefited much less from Chinese-led globalisation than the steel industry. There are several reasons for this development. On the one hand, the demand in mature economies has even declined due to e.g. technological change. On the other hand, the growth in developing countries and especially in China has been manufacturing driven, which has not been very paper intensive.

A change in the global structure of paper and paper board consumption and production has been very rapid in the 2000s due to a changing China. Consumption used to be smaller than production in the EU and vice versa in the other areas like Asia and North America. In the US this trend has strengthened, while the European production surplus has diminished. On the other hand, Asian and especially Chinese large production deficits changed into a small surplus for many products in 2006 and surpluses have grown after that. The change has been most marked in the case of printing and writing papers.

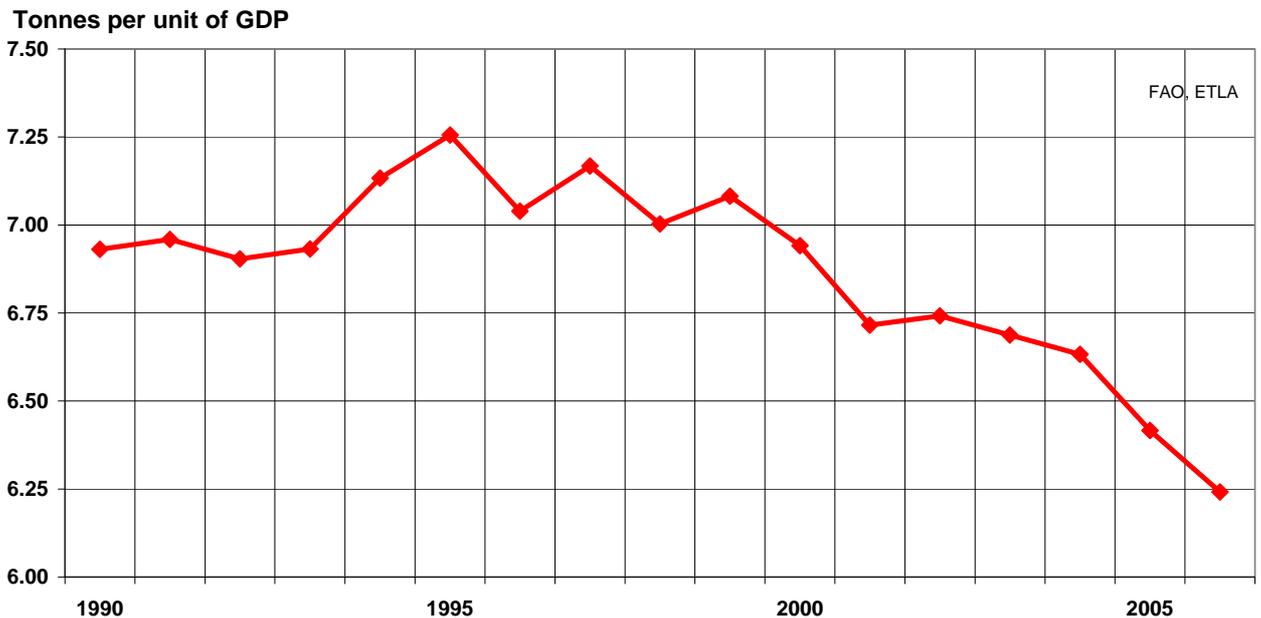
The relatively moderate growth of world paper and paper product production or consumption is clearly visible if compared to the growth of world GDP. The adjacent graph shows that the intensity of paper and paper product consumption in world production has de-

clined strongly during this decade. This reflects the moderation of paper consumption in the industrialised countries and relatively low, although high in international comparison, consumption growth in China.

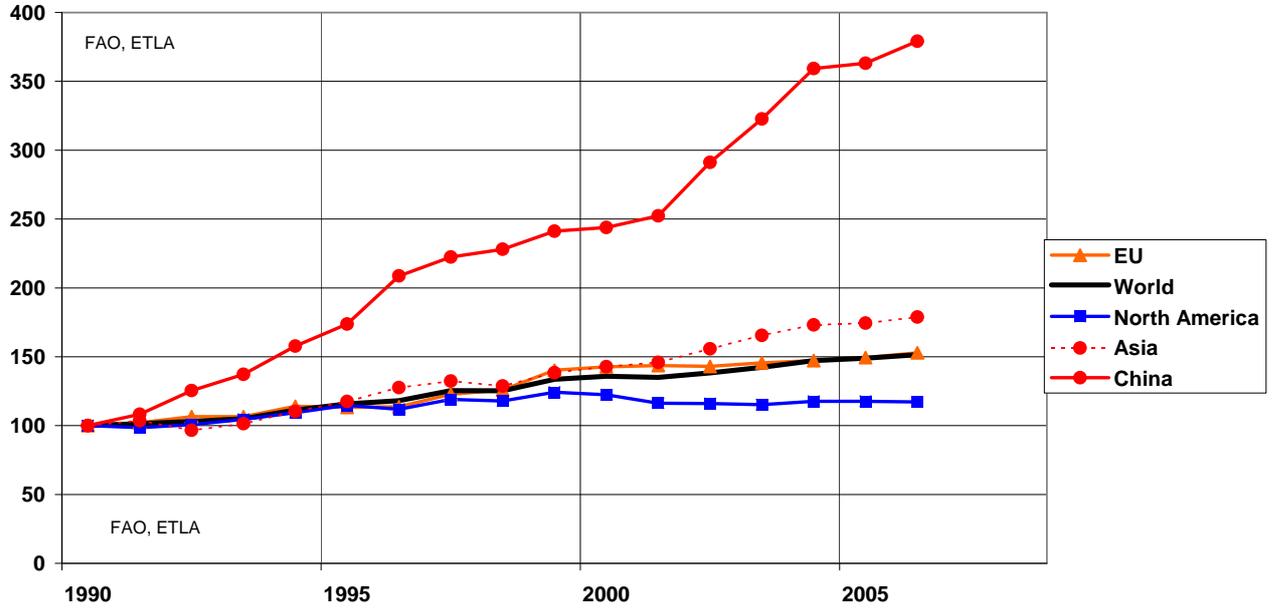
## World Steel and Paper&Board Production



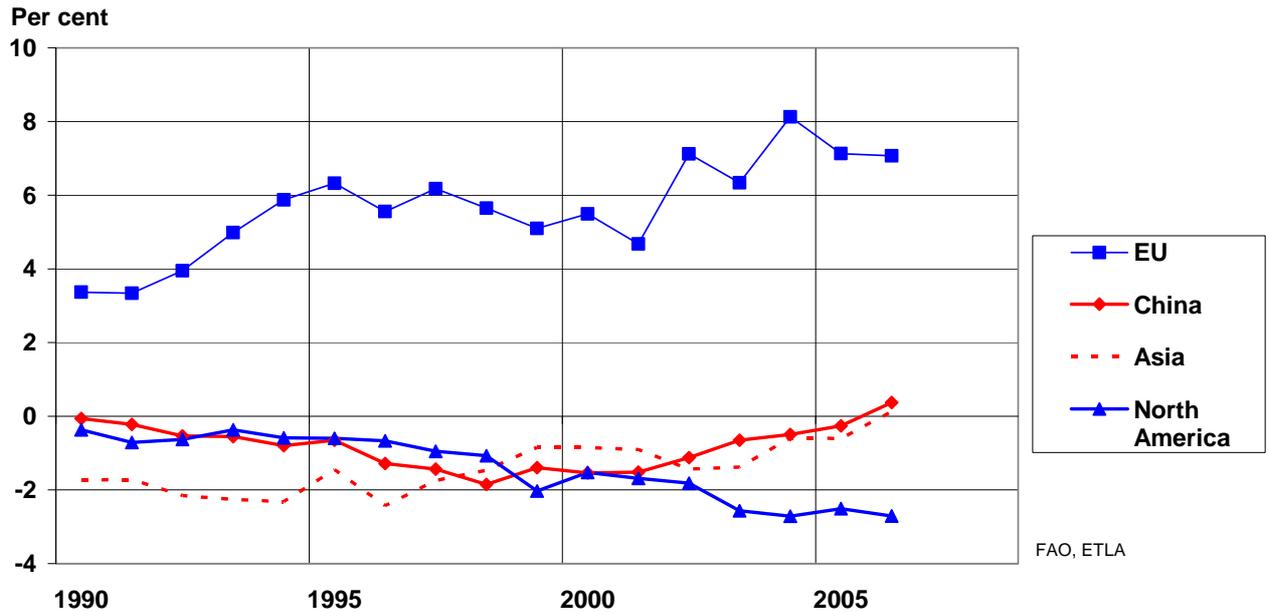
## World Apparent Paper and Board Consumption per GDP in 2005 prices and PPPs



## Paper&Paper Board: Apparent Consumption by Areas

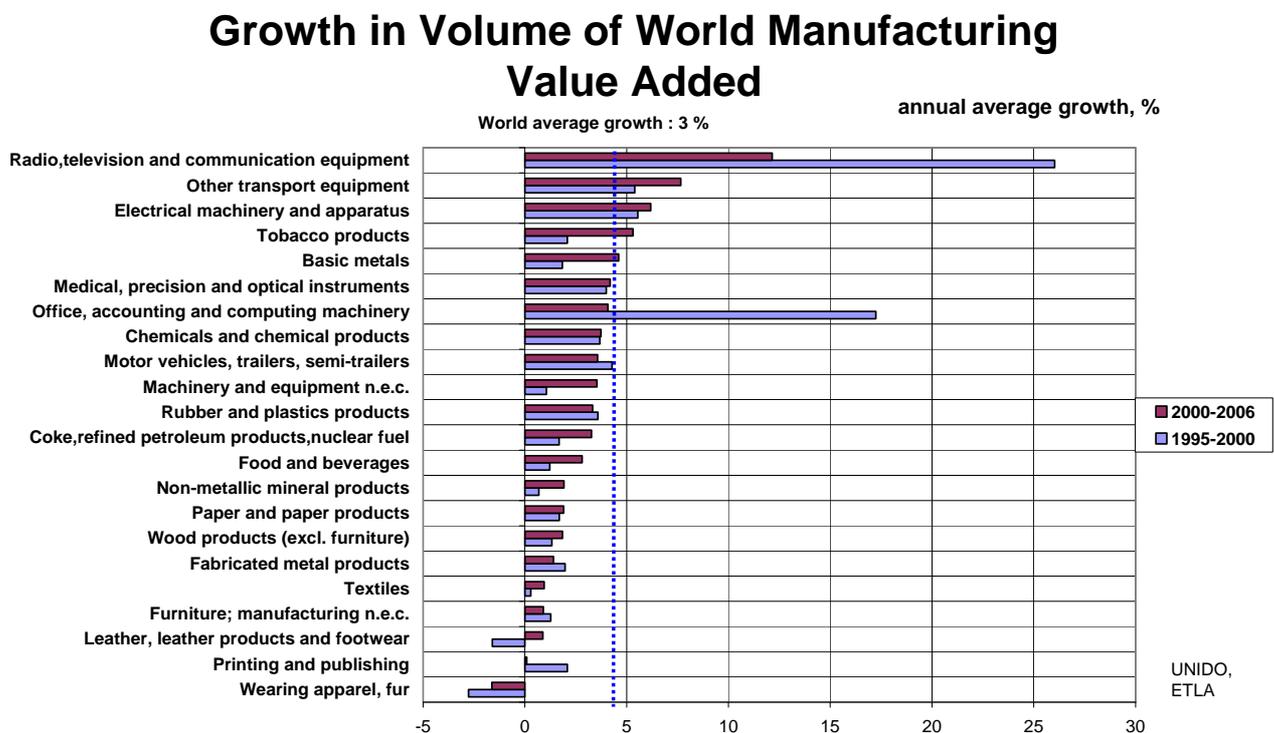


## Net Exports of Paper and Paper Board in Relation to World Production by Areas



Contrary to general global developments, the growth of Chinese production of paper and paper product manufacturing has been very rapid, close to average Chinese manufacturing growth. Chinese demand has progressed rapidly as well, but growth has started from a very low level and it has not been able to compensate for the moderation of demand from industrial countries. The key for good Chinese developments lies in the opening up of China. China, Soviet Union and other centrally planned economies aimed to work together isolating themselves from the other world economy. Planning and co-operation between other planning economies were, however, not as productive as in the firms outside the planning systems or/and countries were not able to expand mutual co-operation well enough. As a result the economic collapse of the planning systems and the opening of these economies created a new setting to international division of labour.

China decided to start changing its economy into a more market-orientated economy in the 1989 by the decision of the communist party. This move has proved to be very fruitful for China. Opening up of the Chinese frontiers revealed huge differences in labour costs per unit of production or ULCs calculated in a common currency. This created a large incentive to invest into China and boost investments in China to profit from this new opportunity. This has led to a huge change in China, which is in a few years making it the world's largest manufacturer and also one of the key producers of paper and paper products.

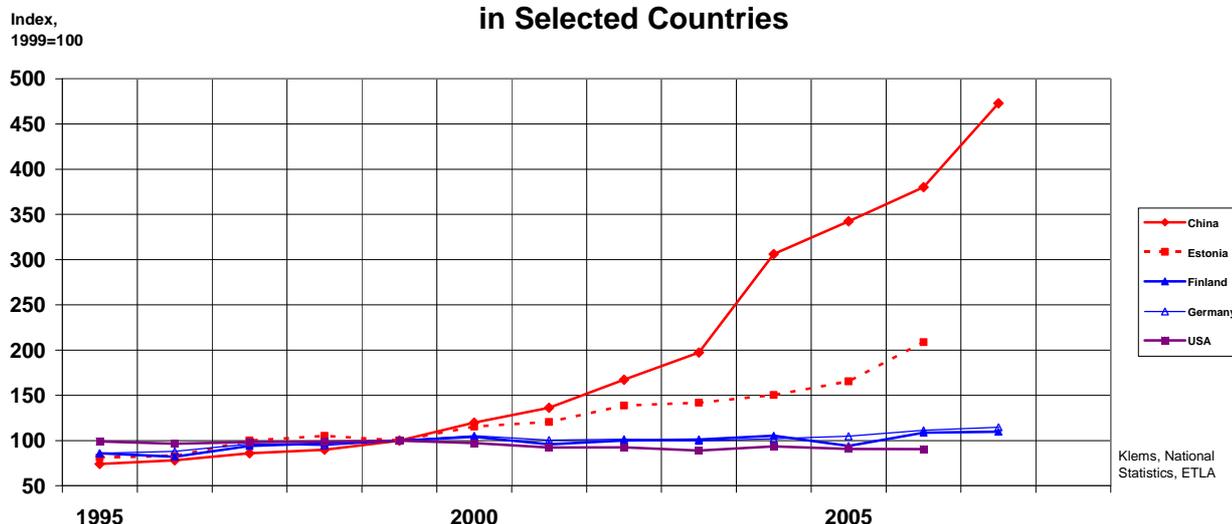


In this study, we usually measure the output as a gross output instead of value added, though the latter is also utilised. By this selection we try to get a general picture of all the costs, although the main focus is on labour costs. In terms of the volume of gross production (nominal production deflated by the ex-factory prices), the growth in Chinese paper and paper product production has been impressive and well above the other selected coun-

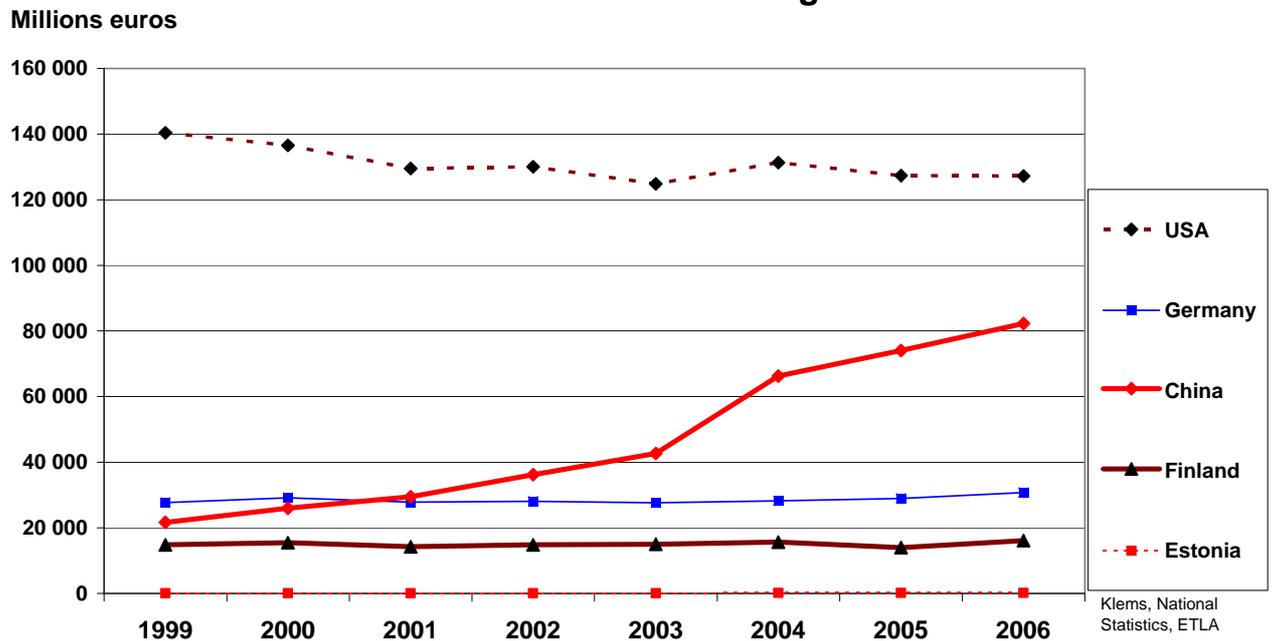
tries. However, the growth has been somewhat below the average in Chinese manufacturing. The annual average growth of paper and paper product output was 21 per cent in 1999-2006 compared to 23 per cent in manufacturing.

<b>15 Leading Countries in Pulp, Paper and Paper Product Manufacturing *</b>		
	Per cent of World Value Added	
	<b>2000</b>	<b>2006</b>
<b>USA</b>	25.1	21.4
<b>Japan</b>	17.6	15.8
<b>China</b>	5.0	10.3
<b>Germany</b>	4.5	4.5
<b>Canada</b>	5.2	4.2
<b>UK</b>	3.6	3.2
<b>Finland</b>	2.9	2.9
<b>France</b>	3.2	2.9
<b>Australia</b>	3.0	2.8
<b>Italy</b>	2.7	2.7
<b>Sweden</b>	2.6	2.6
<b>Brazil</b>	1.9	2.2
<b>Spain</b>	1.9	1.9
<b>Republic of Korea</b>	1.8	1.8
<b>Indonesia</b>	..	1.4
	82.4	80.6
<b>* ISIC 21 in 2000 prices</b>		
Source: UNIDO		

**Volume of Output in Pulp, Paper and Paper Product Industry in Selected Countries**



## Output in Pulp, Paper and Paper Product Industry millions of 1999 euros using UVRs



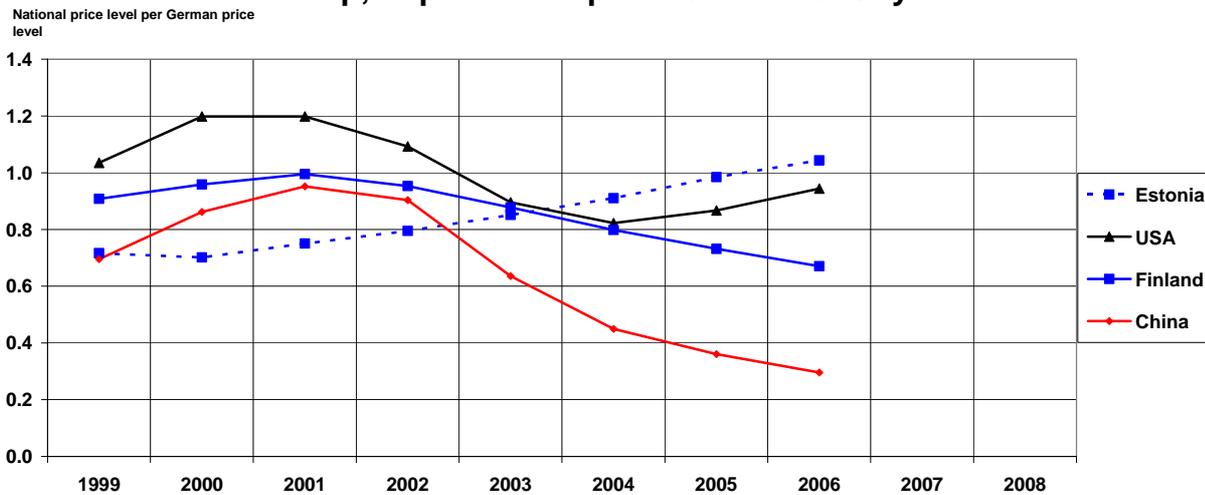
The development of the volume of output in the paper and paper product industries has followed the pattern of value added. The production in the US, Germany and Finland has been rather stagnant compared to Estonia and China. In Finland, the dip of production in 2005 and the subsequent recovery in 2006 were a result of the labour market dispute in summer 2005.

Price levels<sup>4</sup> (measured in euros) of paper and paper product industries in selected countries seem to vary surprisingly much. The price levels in the US and China have declined in the early 2000s in comparison to Germany's level due to their depreciating currencies. The Chinese level has decreased more strongly, which obviously reflects the rise in the productivity due to modernising production capacity.

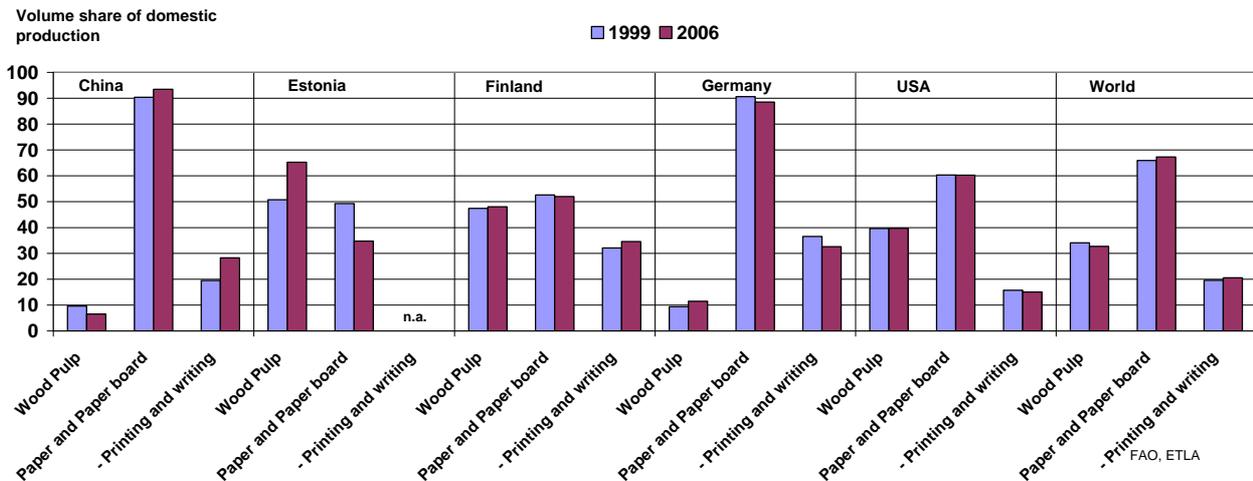
The Finnish price level of this industry has also declined vis-à-vis Germany's level since 2001. This can be explained by both the weakening dollar and raising competition in exports markets due to strongly rising Asian production. The latter is reflected e.g. in a change of large deficits of Chinese markets into surpluses for many products. In Estonia the price level has risen compared to Germany, which reflects the rapid rise in Estonian costs as the exchange rate has been fixed vis-à-vis the euro. Obviously, price differences between the euro area countries reflect to a large degree both the different and changing production structures of paper and paper products on an aggregate level.

<sup>4</sup> Unit value ratio vs Germany divided by the nominal exchange rate

## Comparative Price Levels vs Germany in Pulp, Paper and Paper Product Industry



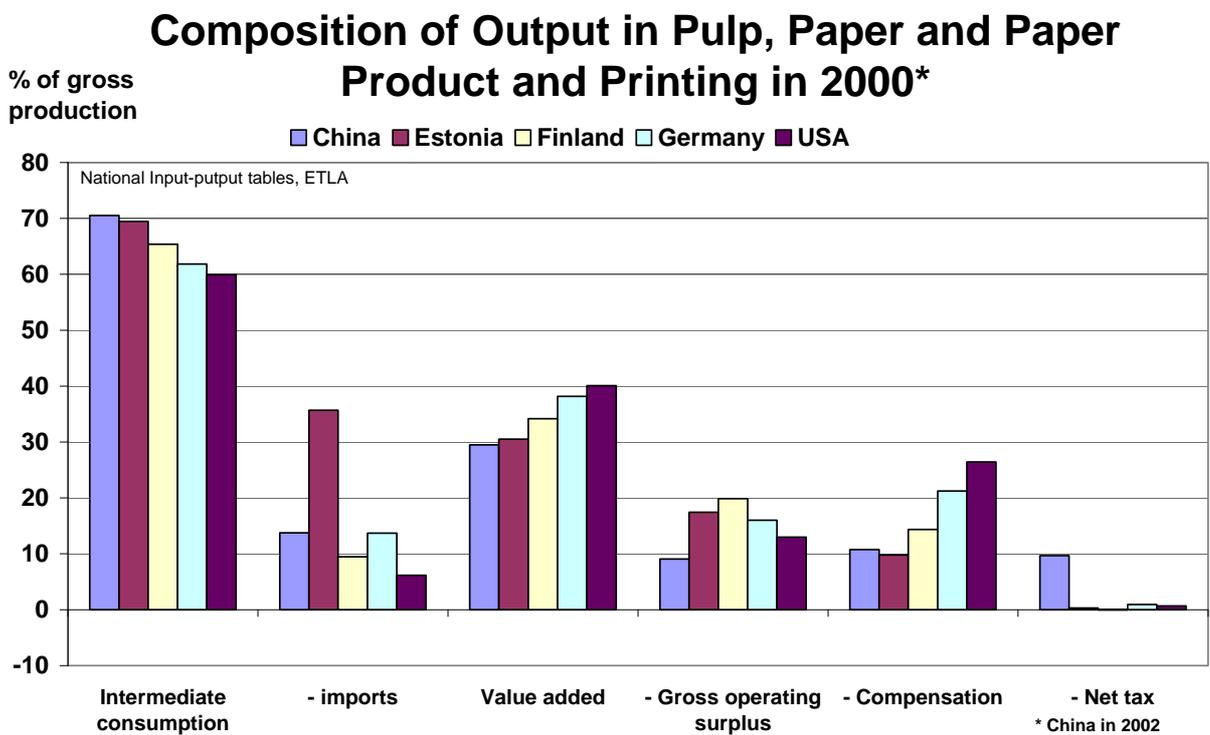
## Structure of Pulp, Paper and Paper Product Industries in World and Selected Countries



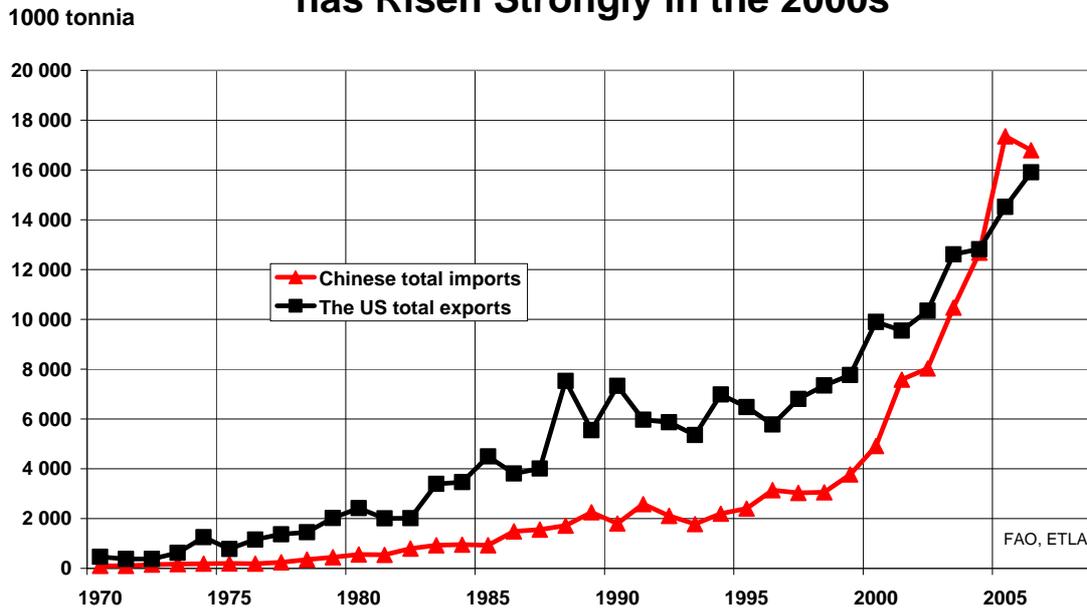
### 3.1.1. Cost structure of output

In the group of the five selected countries, the most developed nations use less intermediate goods in their paper production than the less developed countries. The share of intermediate goods of gross production in China and Estonia is around 70 per cent, while it is lowest in the US at 60 per cent according to the input-output tables in 2000. Import shares of intermediate and final products vary very strongly between the countries. The share in Estonia is clearly the largest due to the small size of the economy as Estonian producers have to import a large part of their raw materials.

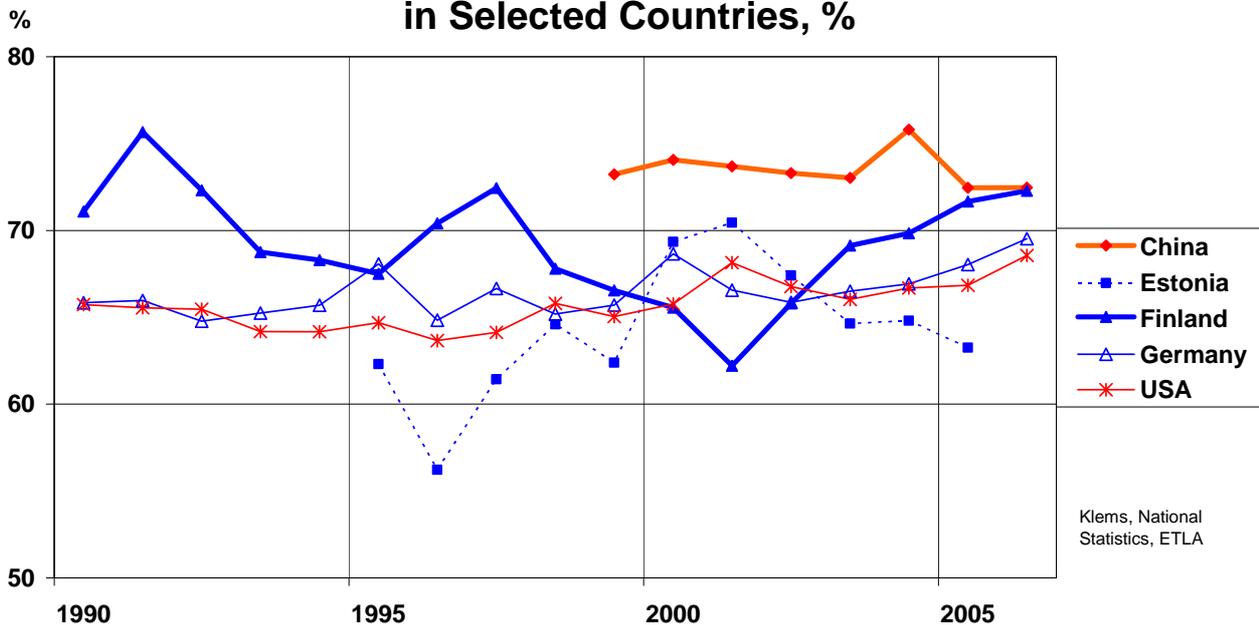
The share is also large in Germany. The Finnish paper and pulp industry (including printing) used about 1/3 of intermediate goods from the same sector and nearly 9 per cent from the chemical sector (excl. pharmaceuticals). The import shares of these two sectors from the respective industrial use were 2.5 and 4.5 per cent. In Germany, the industry depends strongly on the inputs from the other producers in the sector as well as imported wood and pulp due to low domestic resources. In the US, the paper and paper product industry (including printing) is less concentrated than in Finland and it imports more inputs from the same sector than the Finnish industries. On the other hand, the US industry is rather independent of foreign supplies.



### International Trade of Recycled Paper has Risen Strongly in the 2000s



### Intermediate Production per Gross Production in Pulp, Paper and Paper Product Industry in Selected Countries, %



The case of China is especially interesting as it has relatively low wood resources in spite of the geographically very large country. Chinese paper production relies much on imported wood pulp and waste paper. It is well known that China imports much of these raw materials from the United States in spite of the very long distance. This is possible as the size of freight rates depend on the direction of the trade flow. The volumes of exports and

imports between the nations do not match, which has created a situation where the freight rates from the US to China and Asia are substantially below the rates from China to the U.S. The strong rise in trade exploded the freight rates to very high levels by 2008. The turn-a-round in the global economic outlook in 2008 due to much worse-than-expected global financial crisis, however, dropped the rates to a fraction of the recent levels during autumn 2008.

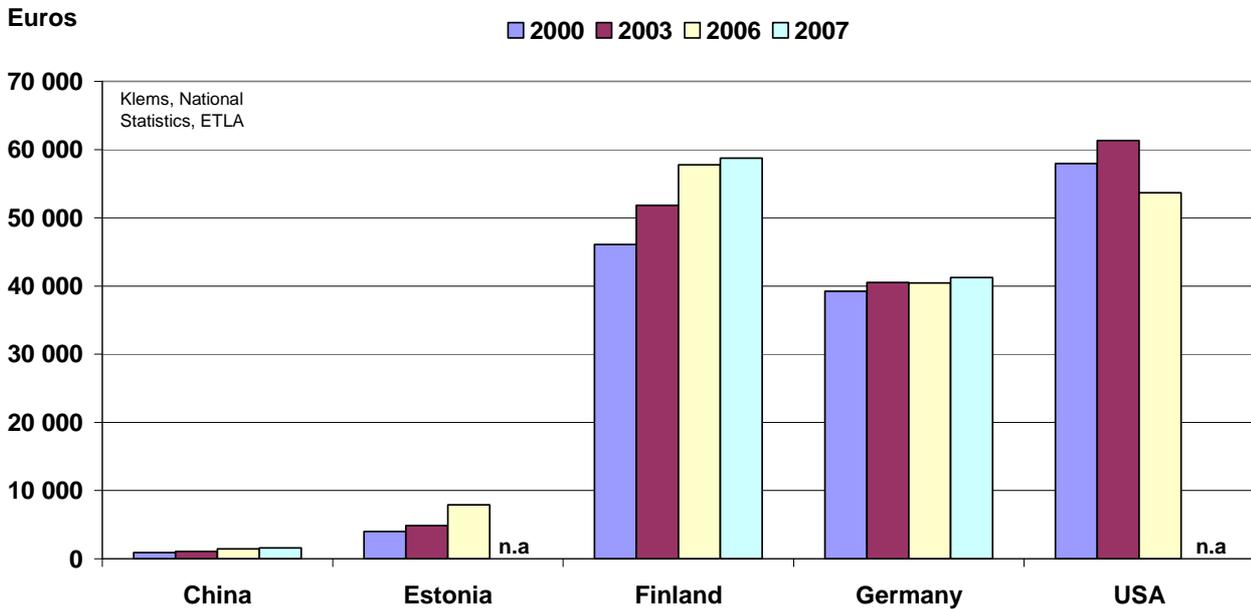
Estonian production, taken from the local input-output tables, is rather low value added production as is the case of China. Estonian producers are very strongly dependent on imports, as they import close to 35 per cent of their intermediate inputs like wood and chemicals.

<b>Use of intermediate goods in pulp, paper, paper product and printing industry in 2000* by sectors</b>						
	<b>% of gross output</b>					
	<b>USA</b>	<b>Germany</b>	<b>Finland</b>	<b>Estonia</b>	<b>China*</b>	<b>China ** excluding printing</b>
<b>Intermediate use</b>	<b>59.5</b>	<b>61.3</b>	<b>65.4</b>	<b>69.5</b>	<b>66.4</b>	<b>70.5</b>
<b>- Paper, paper products, printing and publishing</b>	<b>21.7</b>	<b>25.4</b>	<b>22.1</b>	<b>0.2</b>	<b>23.0</b>	<b>25.3, 24.3 **</b>
<b>- Chemicals and chemical products</b>	<b>3.2</b>	<b>4.4</b>	<b>5.6</b>	<b>1.7</b>	<b>7.3</b>	<b>8.3</b>
<b>- imports, %-points</b>	<b>6.2</b>	<b>13.7</b>	<b>9.5</b>	<b>35.7</b>	<b>7.1</b>	<b>13.8*** 7.0****</b>
<b>* Chinese imports estimated by the OECD (2002), ** Local input tables excluding printing, *** total imports, **** imports of paper industry intermediate goods Source: Input-output tables (OECD), China, OECD and Statistics China</b>						

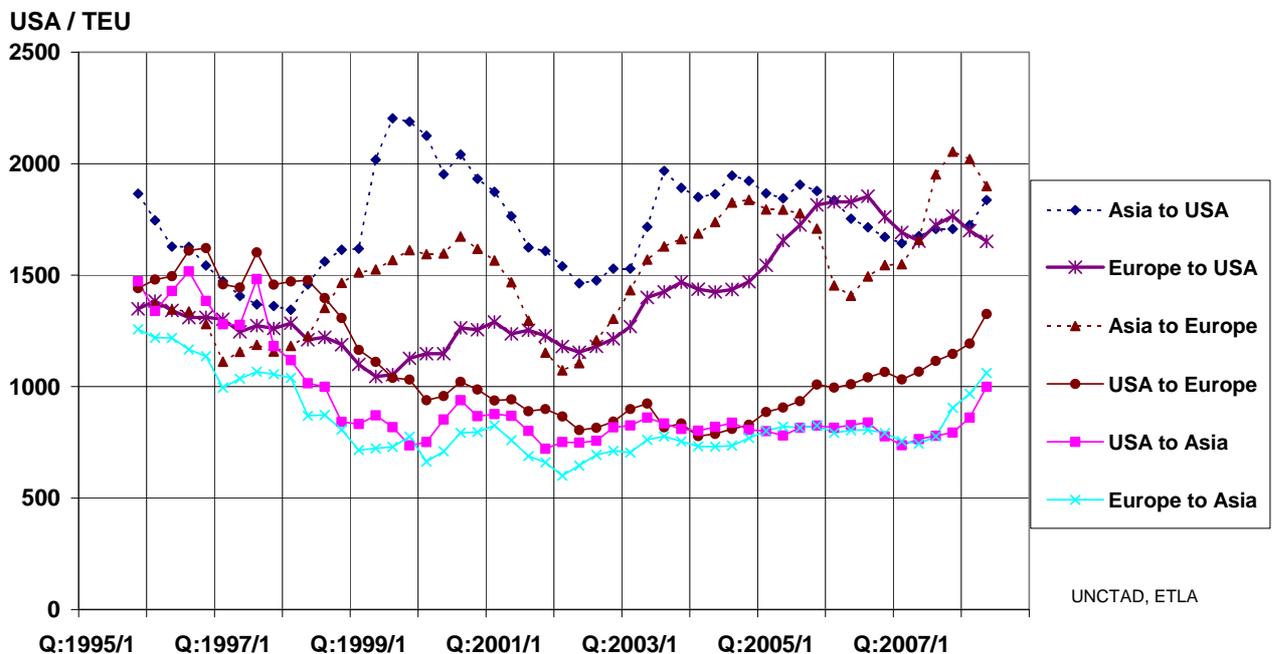
The compensation of employees depends naturally on the stage of development of the country. The share of Chinese and Estonian compensations in the paper and pulp industries are smaller than is the case of the other three economies. However, the cost shares differ greatly also with these countries being clearly the largest in the US and smallest in Finland. The Finnish low share is due to the especially capital-intensive industry.

The annual compensation per person (see adjacent chart) varies significantly by country. In 2006 Chinese annual labour compensation (wages and other costs) was about 1500 euros, while in Finland, they reached up to 56000 euros. (See next section)

## Annual Labour Compensation per Person in Pulp, Paper and Paper Product Industry



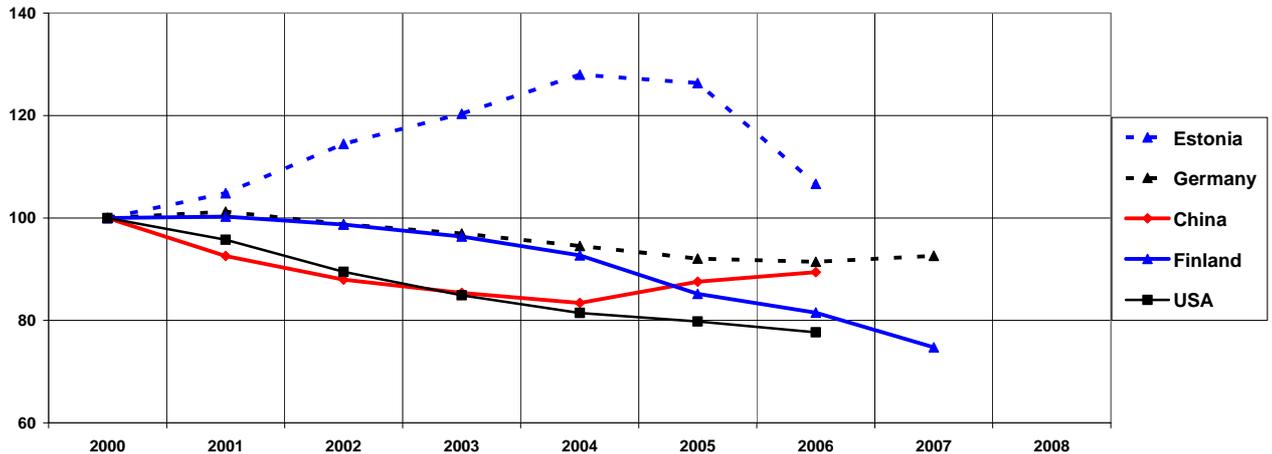
## Selected Global Liner Freight Rates



Employment in the paper and paper product industry has declined in the USA, Germany and Finland in 2000-2006 significantly. The US employment was some 20 per cent lower in 2006 than in 2000. The employment in Estonia rose strongly in 2000-2005 but has declined after that. Chinese employment declined in line with the US in 2000-2004, though

production rose strongly, but has risen somewhat afterwards. China has restructured its paper industry by rapidly modernising the factories and raising its productivity.

### Employment in Pulp, Paper and Paper Product Industries in Selected Countries



Net taxes on production are close to zero or very modest in all the countries except China. This item may be also negative due to subsidies. China taxes enterprises more heavily than the other countries in the review.

One of the most important items for the enterprises is profits, as non-profitable firms are not able to continue their operations. The shown profits are quite small in China compared to its industrial competitors. In 1999-2006 the profits per unit of production have, however, been on the rise in China, while being stable in the USA and Germany.

In Finland the ratio has declined, although it has been higher in Finland than in the USA and Germany. The higher-than-German level of profits in Finland reflect probably to a large extent the bigger depreciation of fixed assets, which is a larger part of the gross profits in Finland than in the other three countries in our comparison. Analysis of profits would call more detailed analysis as production structures vary substantially.

### 3.2. Paper and paper product industry in China

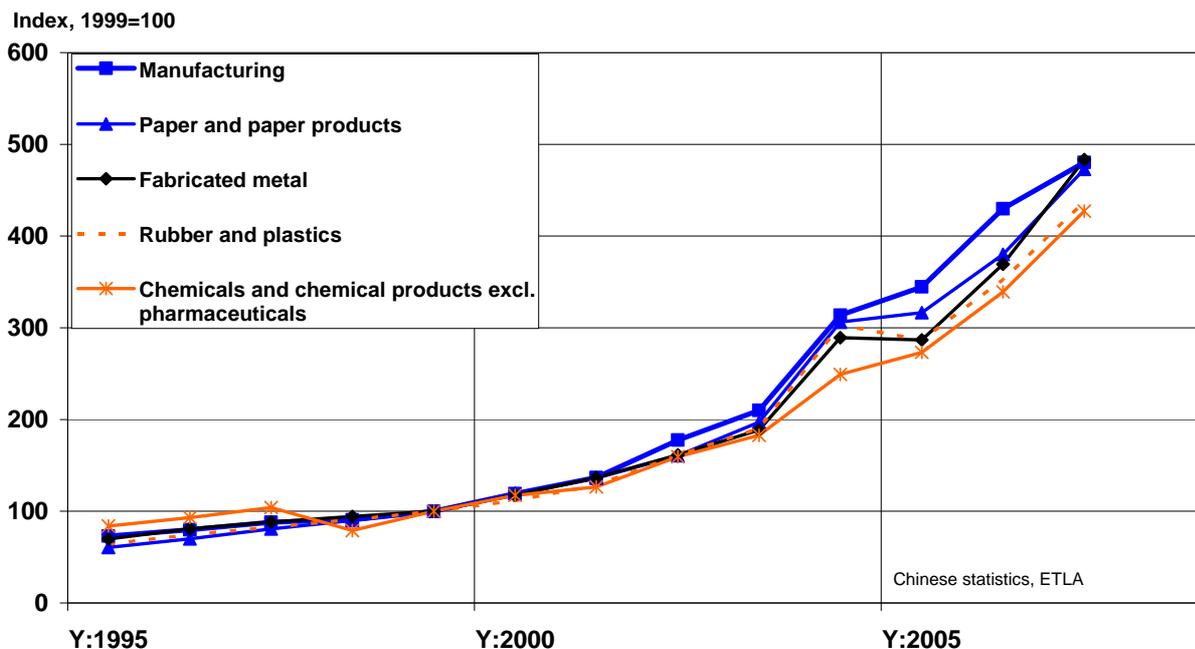
In China the paper and paper product industry has started to grow from a low level, which partly explains the high growth rates. The level of volume of the paper and paper product industry in this huge country was close to the production in Finland in 1999, but in 2006 the level was around 4 times higher than in Finland.<sup>5</sup>

<sup>5</sup> Volumes converted to comparable units with unit value ratios

The volume growth of Chinese paper and paper product production has been fast by international standards. It has been also faster than growth in the chemical industries in China. However, the paper and paper product industry like the fabricated metal industries has grown in line with the average manufacturing in 1999-2007.

China is a huge country with large differences in production possibilities by provinces. Paper and paper product production is concentrated into a few provinces. Provinces like Beijing, Shanghai and produce 1-3 per cent of Chinese paper and paper product production. Shandong is by far the largest pulp & paper producer in China by producing 22 per cent of production. Zhejiang on the other hand has a production share of 12 per cent of these products and Guangdong produces 16 per cent of Chinese production. Growth in Zhejiang has been almost 25 per cent in a year between 1999 and 2006, which is faster growth than national average of about 21 per cent. The paper industry in Guangdong grew as fast as the national average.

## Chinese Gross Output in volumes



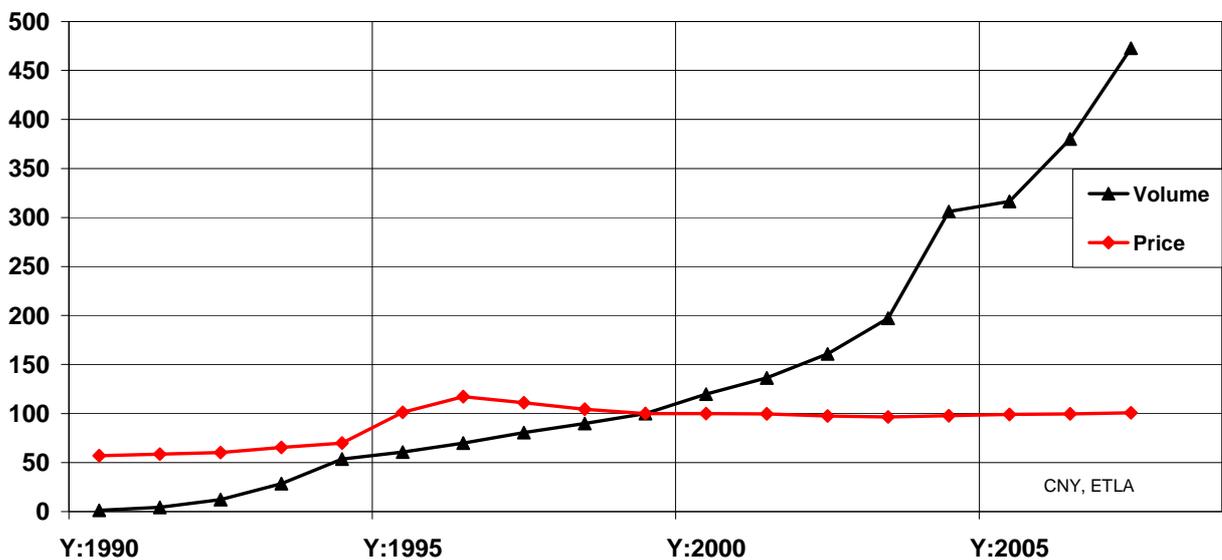
China is a country severely deficient in forest resources. Because of the forest depletion problem, the material of papermaking companies - pulp, mainly relies on importation, which greatly restricts the development of China's papermaking industry. In order to resolve this conflict, the China government is establishing a new industry - material base construction, which deserves great encouragement.

Chinese factories can gain long-term development by benefiting from collaboration between Chinese and foreign firms. Through this cooperation, companies could form even bigger and stronger enterprises, and get more competitive advantages.

Though eastern coast areas have obvious advantages in resource and environment, if competitiveness is beyond geographical factors, their statuses would be threatened by other provinces. For example, enterprises in the Shandong province have developed by attracting more investments and labor. If the situation permitted, they could expand to other resourceful areas. It is inevitable that after gaining sufficient capital and technologies, companies will not be constrained by locations. Hence there is still a long way for the pulp & paper industry of China to go.

## Pulp, Paper and Paper Product Production in China

Index, 1999=1000



### Demand factors

The demand for paper & paperboard in China has risen due to the expanding population and economy. The fast economic growth has lasted for two decades during which time China has become increasingly industrialized and urbanized, with both of these factors constantly causing further demand for paper & paperboard.

The population of China is forecast to rise by almost 200 million people in the period 2005-2030. The urban population is expected to reach 620 million by the year 2010 and 850 million by year 2020. The disposable income and expenditure is many times higher in urban than rural areas, hence the advancing urbanization has a very strong impact on demand for all goods and services. The urbanization has also been the main driver of the great expansion of the building and infrastructure construction, causing demand for all kinds of wood products. The construction market has been fuelled by the high savings rate, which has enabled the very high construction expenditure by the public and private sector.

The GDP growth has been about 9-10 per cent per annum. The Chinese government seeks to maintain a growth rate of 7-8 per cent per year until 2020. With this assumption, the per capita GDP would be at the level of upper-middle income countries. The GDP per capita

in the coastal cities is already at a level of the GDP/capita in Russia, Turkey, Malaysia, and Chile. The rapidly rising population with constantly increasing income in urban areas has brought about new consumption patterns calling for more and more paper & paperboard

All industry sectors have expanded very rapidly in China, first catering to worldwide export markets (globalization), but the domestic market is becoming an increasingly important sales outlet. The very great but still expanding and comprehensive industry is a large consumer of paper & paperboard, and therefore the industrial grades account for a relatively higher share of the paper & paperboard demand in China than in the other major world markets.

### **Pulp & paper vs. other industries**

Volume growth of Chinese paper and paper product production has been fast by international standards. It has been also faster than growth in chemical industries and about the same as in the fabricated metal industry. All these are selected industries, which we study separately. All these industries are, however, growing more slowly than the Chinese manufacturing industry on average.

### **Paper & paperboard production in China**

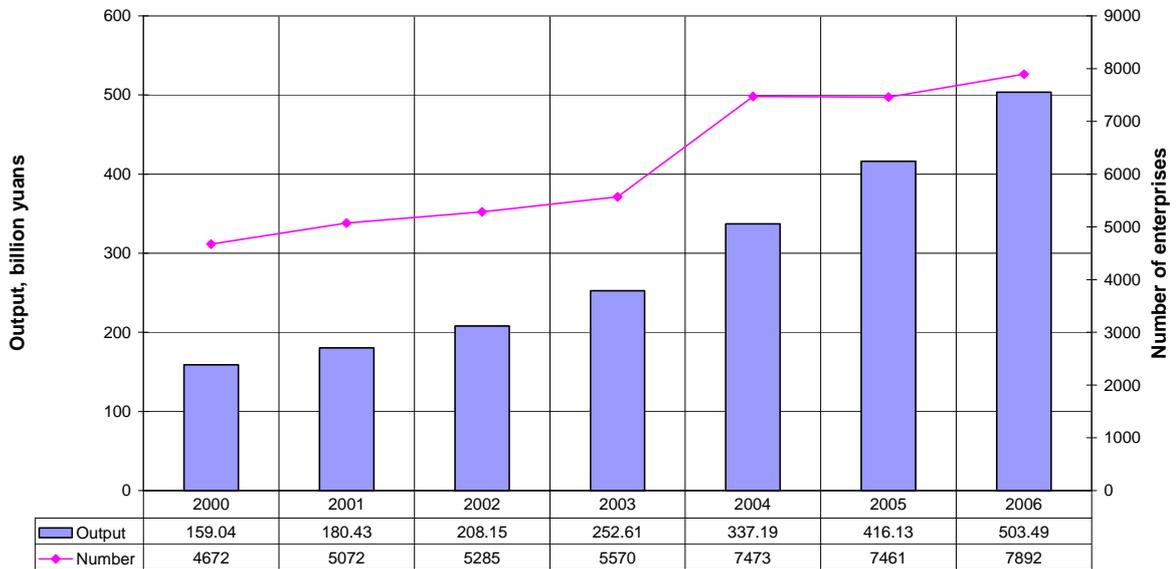
China has been a net importer of paper & paperboard until the last few years. Then it became a net exporter, thanks to the large capacity expansions as can be seen in a table below.

#### **Chinese paper & paperboard production and consumption**

<b>Year</b>	<b>million tons</b>	
	<b>Production</b>	<b>Consumption</b>
<b>2000</b>	<b>30.5</b>	<b>35.75</b>
<b>2001</b>	<b>32</b>	<b>36.83</b>
<b>2002</b>	<b>37.8</b>	<b>43.32</b>
<b>2003</b>	<b>43</b>	<b>48.06</b>
<b>2004</b>	<b>49.5</b>	<b>54.39</b>
<b>2005</b>	<b>56</b>	<b>59.3</b>
<b>2006</b>	<b>65</b>	<b>66</b>
<b>2007</b>	<b>73.5</b>	<b>72.9</b>

The pulp & paper industry in China has undergone a rapid process of expansion and structural development. Chart 1 below reviews the gross industrial output and number of companies in pulp & paper industry during 2000 and 2006. While the number of companies has indeed increased, there are about 3500 pulp & paper companies which account for the most of the pulp & paper output.

## Gross Industrial Output and Amount of Companies in Pulp & Paper Industry



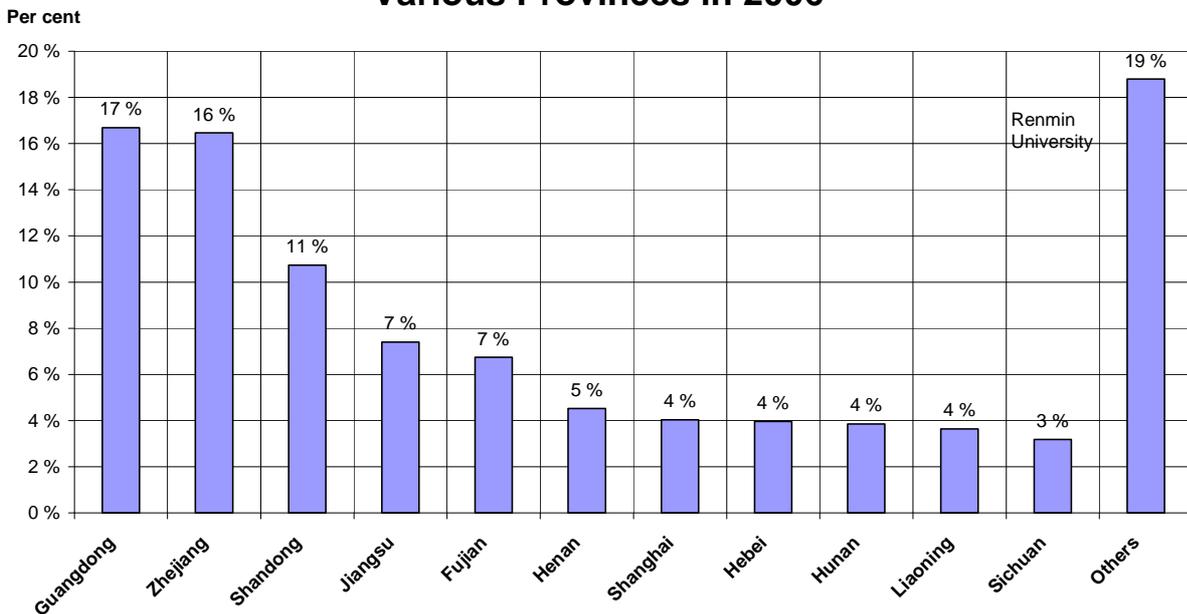
### 3.2.1. Paper and paper products industries of Chinese regions

Paper and paper production has changed substantially in China as the old paper factories are replaced by the new ones based on pulp. The industry is very import-intensive due to relatively low raw material base in spite of the huge size of the economy. Production as well as the growth varies greatly between the regions. Cities like Beijing and Shanghai are small producers. Large producers are situated near the coast e.g. in Zhejiang and Guangdong, where there is good access to imported raw materials.

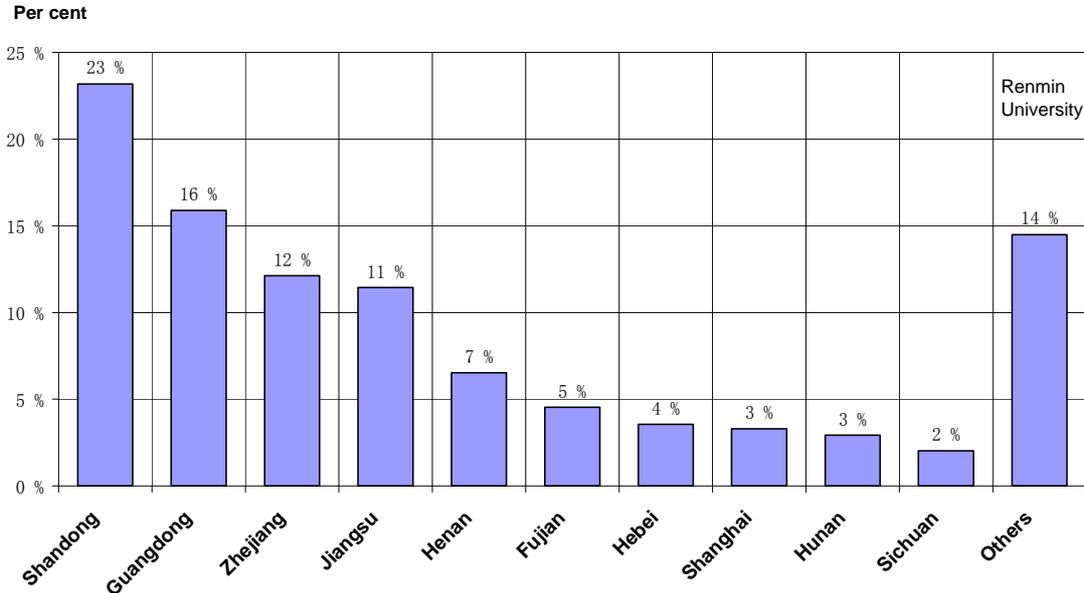
As China is a huge country, the industrial level differs by regions, and the same situation has happened in the pulp & paper industry.

The accompanying chart shows the proportion of the number of pulp & paper enterprises by provinces. Guangdong has always been the pioneer in this industry, accounting for 17 per cent of the pulp & paper companies of the whole country, and the percentage has kept on rising in recent years. Guangdong is followed by Zhejiang, Shandong, Jiangsu and Fujian, which together account for almost 40 per cent. All in all, the provinces with the most papermaking companies are located inshore of the South-East China, cultivated in a prosperous economic atmosphere and benefiting from the expanding overseas market. That is why rather many pulp & paper companies with a foreign investment have chosen to open their mills there.

### Number of Enterprises of Pulp & Paper Industry in Various Provinces in 2006



### Distribution of Total Production Cost of Pulp & Paper Industry in Various Provinces in 2006



The chart above describes the distribution of gross output of the pulp & paper industry, and its contents are linked to chart 2 and chart 3. Guangdong is number two in terms of the number of mills and the production share. However, Shandong overrides Guangdong as the actual number one producer: 11 per cent of the Chinese pulp & paper enterprises exist in Shandong and they created 22 per cent of the output! The same situation exists in the case of Jiangsu with a 7 per cent of the companies vs. 11 per cent of the output. On the contrary, Zhejiang produces 12 per cent of the output with 16 per cent of the companies.

These data show the company size in Shandong and Jiangsu is much bigger than that in Guangdong and Zhejiang. This phenomenon happens in almost all industries, because the mill size and the share of the output are determined by the locations of these provinces. Zhejiang and Guangdong are in the South part of China with less natural resources and a more unrestricted market which allows a new firm to set up there more easily. Shandong and Jiangsu belong to the northern part of China, where most heavy industries are located due to a better access to resources, technology and overseas markets, which are all important conditions for bigger factories, a large part of which are state-owned.

Actually, since the beginning of the 21st century, new strong company groups have suddenly risen in the pulp & paper industry in Shandong; the world's famous papermaking companies settled there successively, outspreading an international cooperation upsurge. Several large enterprises with modern management, advanced equipment, and high efficiency emerged there, such as Chenming, Huatai and Bohui papermaking corporations.

Guangdong has realized its production scale problem and is beginning to seek economies of scale. In 2005, 11 big factories in Guangdong have produced 5.5 million tons of paper, accounting for 80 per cent of the whole province's production.

The charts below illustrate the distribution of pulp & paper production costs and the production cost value per person in the various provinces. By comparing the number of mills with the share of the output and production costs we can draw indirect conclusions about the performance of the pulp & paper industry in the various provinces.

From adjacent chart on the previous page we can see that the main paper production provinces account for most of the production costs. Compared with the gross output above, we find that the other provinces have relatively low cost shares while Shandong has a relative high proportion of the production costs.

The actual production amounts in the provinces with large productions in 2007 are shown in the adjacent table.

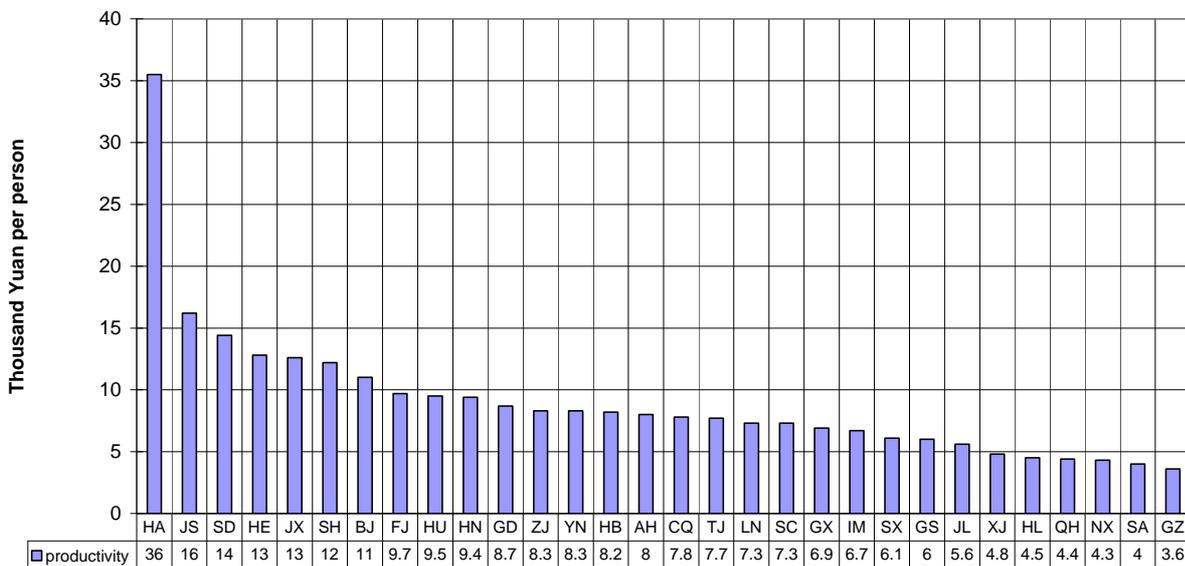
#### **Top 10 provinces in pulp and paper production in 2007**

	<b>Million tons</b>
<b>Shandong</b>	<b>12.8</b>
<b>Zhejiang</b>	<b>12.09</b>
<b>Guangdong</b>	<b>10.29</b>
<b>Jiangsu</b>	<b>8.93</b>
<b>Henan</b>	<b>6.85</b>
<b>Hebei</b>	<b>4.25</b>
<b>Fujian</b>	<b>2.88</b>
<b>Hunan</b>	<b>2.23</b>
<b>Sichuan</b>	<b>1.77</b>
<b>Anhui</b>	<b>1.37</b>

### Productivity indicators of existing Chinese pulp & paper industry

The chart below shows the productivity (as measured by production value/person) in the pulp & paper industry. Hainan reaches the number one just because its production is concentrated into a large-scale operation with a high efficiency. As to the comparable provinces, Jiangsu has the highest productivity, followed by Shandong, Henan, Jiangxi, Shanghai and Beijing, with all of them having a productivity higher than 100 000 Yuan per person. The high efficiencies are attributed to their economies of scale and longer history in this industry.

**Productivity of Pulp & Paper Industry in Various Provinces in 2006**



The growth of the Chinese pulp & paper industry has been based on the volume expansion, rather than on the price development.

Given the fast expansion and the global importance of the Chinese pulp & paper industry, the features of its financial performance are interesting as such and also in terms of international benchmarking. The table below shows the financial indicators of the pulp & paper industry including production value, sales, assets and profits indicate sustained growth that was especially steep after 2002. The gross industrial output of 2006 was 503.49 billion Yuan, almost 4 times of that in 2000; the current assets were 222.55 billion Yuan, 2.1 times of that in 2000; the fixed assets were 2.15 times of that in 2000; The total assets and sale incomes grew 2.12 and 3.29 times, respectively. Noticeably, the profits in 2006 have reached 26.26 billion Yuan, with the highest growth rate among all the financial indicators, which is 20.68 times of the profits in 2000, resulting from a very significant restructuring and technical development.

**Main financial indicators<sup>6</sup> of pulp & paper industry in China from 2000 to 2006  
(Billion Yuan)**

Year	Gross Industrial Output with Fixed Price	Current Assets	Fixed Assets	Total Assets	Sale Incomes	Profits
2000	138.97	105.88	123.25	251.20	150.31	1.27
2001	160.33	107.61	137.45	270.98	168.54	6.20
2002	188.20	117.96	146.44	294.02	196.81	9.83
2003	222.30	134.62	161.85	329.32	243.22	11.71
2004	337.19	171.80	200.12	414.68	323.22	15.39
2005	416.13	188.37	238.91	466.00	403.43	19.41
2006	503.49	222.55	265.22	532.55	494.45	26.26

Indications about the restructuring and productivity improvement process of the Chinese pulp & paper industry are described in an adjacent table. Costs of various activities have increased at different speeds. The sale costs (product value) grew most rapidly at an average rate of 22.5 per cent, and the sale cost in 2006 is 3.34 times of that in 2000. The management cost and the financing cost realized an average rate of 12.23 per cent and 12.34 per cent, correspondingly 1.98 times and 1.93 times the costs in 2000, reflecting the expansion of capacity.

**Cost and productivity of pulp & paper industry in China from 2000 to 2006**

Year	Sales Cost	Management Cost	Financing Cost	Overall Labor Productivity
	Billion Yuan	Billion Yuan	Billion Yuan	Thousand Yuan/Person
2000	126.76	8.56	4.75	36.37
2001	137.45	9.08	4.92	41.72
2002	164.73	10.13	5.45	49.64
2003	206.65	10.68	6.13	59.80
2004	279.74	13.43	6.74	67.49
2005	347.96	15.17	6.52	88.08
2006	423.28	16.93	9.16	102.83

Although the costs increased fast, compared to the increase of output and income, strict cost control has been promoted in the last 6 years, which implies that the development of all these papermaking companies was not based on a wasteful use of resources; rather it was based on technical development and on innovation. It is also very significant that the labor productivity grew at an annual rate of 19.04 per cent, which contributed to the development of this industry. The officially reported profit margin/ton produced was low (Yuan 42) in the year 2000, rising to a still modest level of 404 Yuan in 2006.

<sup>6</sup> **Total assets** refer to all economic resources, in monetary terms, which are owned or controlled by enterprises, including properties, creditor's equity and other economic rights of all forms. Total assets are classified by the degree of equitability, including circulating assets, long-term investment, intangible assets, and deferred assets and other assets. Net value of fixed assets = original value – cumulative depreciation. Total profit = profits, subsidies, investment earnings and net income from any operation – losses during the current year or carried forward from previous years

### Ownership and performance

The total number of paper & board mills increased by 77 mills in 2007, as shown in the table below.

The foreign-funded mills have performed in a good and sustained manner. The performance of state-owned mills has improved in the last few years. The collectively-owned mills have had difficulties to cope with the new business environment, suffering from reduced financial performance.

Indicator	State-owned (% of total)	Foreign funded (% of total)	Collectively owned (% of total)
Share of mill numbers	3.69	11.05	85.26
Change of mill numbers	- 52	+ 13	+116
Share of paper & board incomes	18.12	33.75	48.13
Share of pre-tax profits	17.39	32.92	49.69
Share of total paper & board industry profits	15.46	36.44	48.10

A number of companies producing relatively large amounts have emerged in China during the last 10 years. Such companies have had access to financing, production inputs, markets and mill sites. The leading companies consist of single-mill operators and operators with several mills. The activities of such companies are based on the usage of modern technology, and the companies are effectively changing the structure and the technical status of the Chinese pulp & paper industry by creating compelling operative productivity as well as product quality environment for the rest of industry.

### Environmental protection

The pulp & paper industry consumes about 7 per cent of the annual fresh water amount in China (year 2006). The fresh water consumption/output is declining. The waste water recycling rate was about 51 per cent, being on the increase. The waste waters of the pulp & paper industry account for about 18 per cent of the industrial waste waters in China.

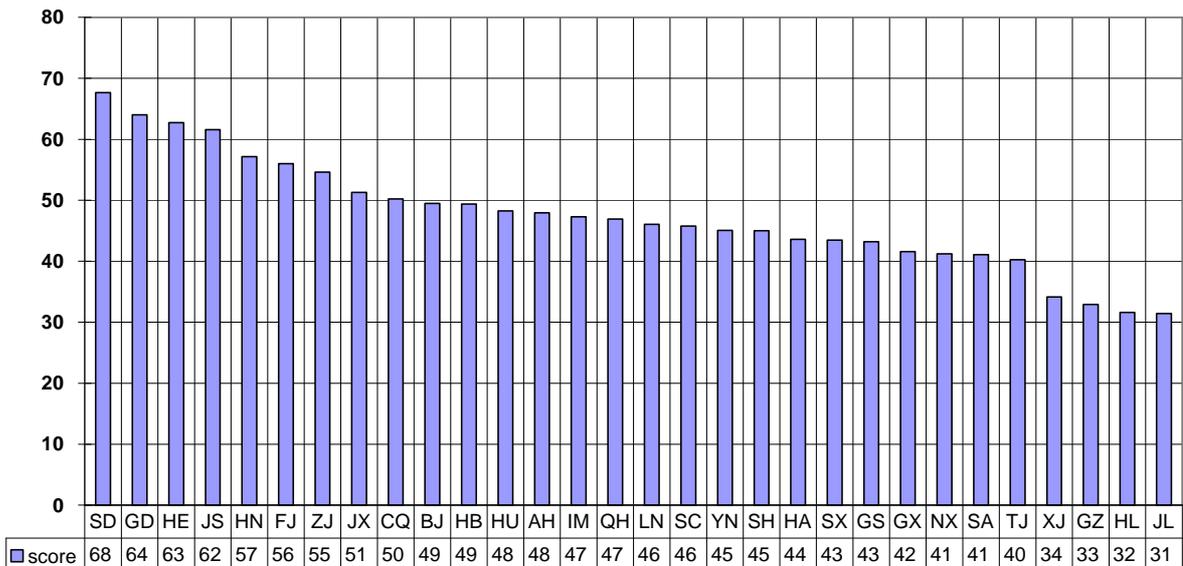
The COD discharge from the pulp & paper mills accounts for about 34 per cent of the total COD amount. The COD discharge amount of the pulp & paper industry/output is on the decline.

One of the policy goals of the government is to reduce the number of small, energy-intensive and highly polluting mills. The volume target is to reduce the amount of such pulp & paper capacity by 6.5 million tons in the period 2006-2010. By the end of the year 2007, already 4.5 million tons of such production capacity was closed. This process will have a clear impact on the paper & board market, as the low-priced low-quality production will be reduced.

**Internal competitiveness of the Chinese pulp & paper industry**

The Center of Applied Statistics (CAS) of the Renmin University has developed an analytical tool (competitiveness index) to illustrate the competitiveness level of each province. Unlike the general description, the industry competitiveness index is an integrated evaluation system. Besides the overall competitiveness, the system integrates the effects of seven factors (economic performance, growth capability, market exploration capability, cost efficiency, innovation capability, investment capability and management capability) in a balanced manner to determine the overall competitiveness. This system not only reflects the production scale level but also the efficiency difference. It pays attention to both assets and benefits, production and sales, input and output in order to judge the competitiveness of the industry in a province (in this case the papermaking industry) as a whole. Since there are only a few companies in Tibet, they are excluded from our analysis below. Therefore our comparison consists of 30 provinces or areas.

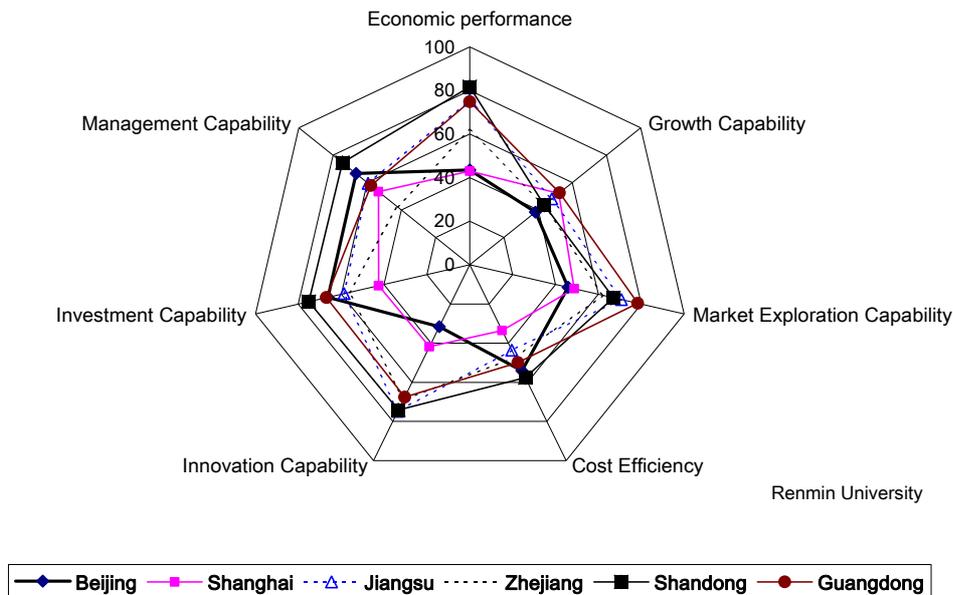
**Regional Competitiveness of Pulp & Paper Industry in Various Provinces in 2006**



From the regional competitiveness chart, we can see that the pulp & paper industry competitiveness level ranges between 30-70, implying that there are significant differences of competitiveness between the provinces. Besides the provinces we mentioned above as main papermaking provinces, the top 9 provinces of competitiveness also include Henan, Hunan, Jiangxi, Chongqing all of which score over 50. Most of the top provinces are in the East. Henan (third), Hunan and Jiangxi are located in the middle area. It seems that the middle provinces are beginning to develop their pulp & paper industry and indeed incur great success. But the provinces with rich natural forest resources, such as Heilongjiang and Jilin, are nearly at the bottom of the competitiveness index comparison. Hence, this industry in China has a long way to reach the best usage of the resource base. It is also worth noticing that Shanghai as a significant industrial center is not well positioned in this industry.

The six most prosperous provinces of the Chinese pulp & paper industry are highlighted below as to the factor status of the competitiveness. The six areas are Beijing, Shanghai, Shandong, Jiangsu, Zhejiang and Guangdong. The radar chart below demonstrates the factor – level of their competitiveness.

### Factors of Regional Competitiveness Indicator



As regards economic performance, Shandong holds the absolute superior position with a score of 82.6 points higher than the second best. Jiangsu, Guangdong and Zhejiang are following Shandong, but their common weakness is the lower performance in value added. As to growth capability and cost efficiency, none of the six provinces have a strong relative competitiveness, since this industry has been quite mature in them and the scale of factories is relatively bigger than that in the Middle and West China. It is quite hard for them to control the costs as compared with the developing provinces. The best one in terms of the production growth among them is Guangdong, ranking as 8<sup>th</sup> all in all. Guangdong also has a long lead on the market exploration capability because of its location and as the economic “model development province”. The innovation, investment and management factors are the advantages of Shandong, which enable Shandong to be the best province in this measurement of competitiveness. Indeed, the innovation, management and investment are the three most prominent ways to improve the performance on the company level.

Shanghai is relatively weak in all aspects, while Jiangsu is good at innovation, and Beijing is good at investment. Each province has its own way of developing the pulp & paper industry.

Table 3 shows some details data of the advantages and disadvantages of these six provinces. We can see that Shandong and Guangdong both have six advantages and are without any disadvantages. Therefore they are representing the best level of the pulp & paper industry in China. Jiangsu and Zhejiang must improve their cost efficiency and management methods to regain the motivation for growth. Beijing and Shanghai have good envi-

ronments for industry and they must make good use of them to maintain the advantages and improve the disadvantages.

### The competitive advantages and disadvantages of main provinces

		Economic performance	Growth Capability	Market Exploration Capability	Cost Efficiency	Innovation Capability	Investment Capability	Management Capability	Number of Advantages	Number of Disadvantages
SD	rank	1	21	3	5	2	2	1	6	1
	score	81.73	43.51	67.02	57.52	74.08	75.11	74.51		
GD	rank	4	8	1	20	4	3	11	6	0
	score	74.81	52.48	78.41	49.99	67.54	66.96	57.79		
JS	rank	3	14	2	24	1	6	9	5	1
	score	75.55	47.98	70.79	43.59	74.88	58.77	59.44		
ZJ	rank	5	22	6	22	3	9	22	4	3
	score	61.85	43.46	62.18	47.28	68.97	56.17	42.48		
BJ	rank	13	26	9	12	22	4	5	3	2
	score	43.57	38.42	45.91	54.02	31.59	66.23	66.51		
SH	rank	14	9	8	29	14	19	15	2	1

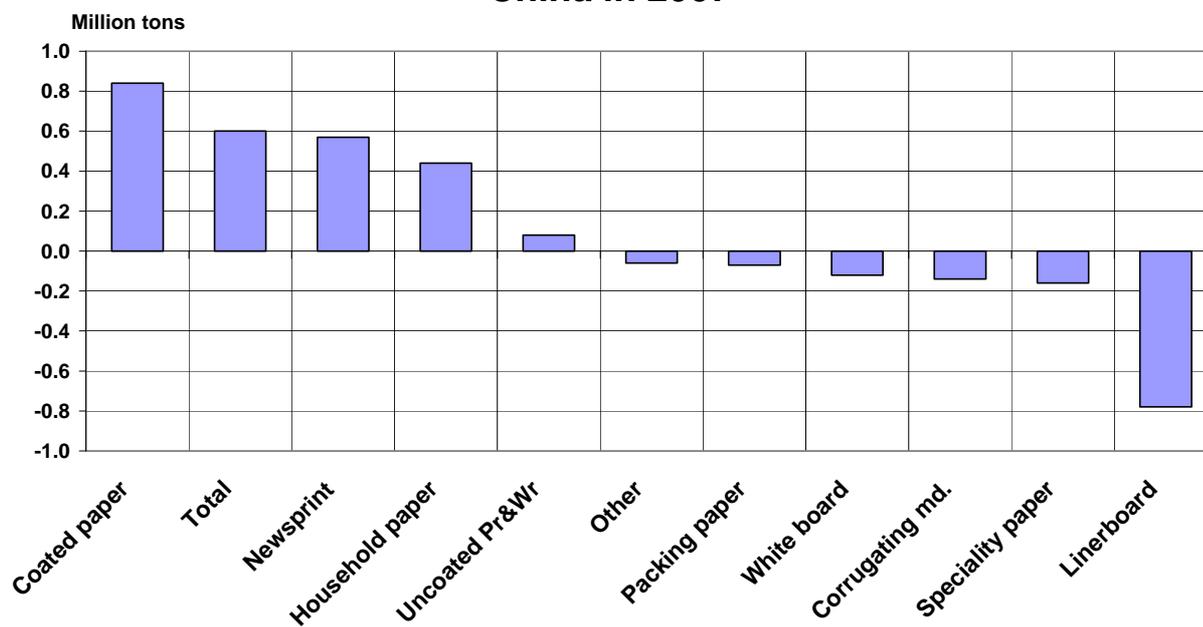
#### Supply – demand balance by product grade

Very substantial consumption and production increases have taken place in all grades. The supply – demand balances are as follows:

- Newsprint: Net exporter after the year 2005
- Pr & Wr: Marginal net exporter after the year 2005
- Coated paper: Sustained net exporter after the year 2005
- Coated art paper: As overall coated paper
- Household paper: Net exporter since the year 2000
- Packing paper: Net import disappearing
- White board: Net import turning into net export
- Coated white board: As overall white board
- Linerboard: Net import turning into net export
- Corrugating medium: Net import turning into net export

The Chinese production is taking over the domestic markets. Imports will continue to take place, but they will be increasingly focused onto the higher priced speciality market segments where the volume is constantly under price pressures.

## Net Foreign Trade of Main Paper & Board Grades in China in 2007



### Demand outlook

The global consumption of paper & paperboard followed closely the trends of economic development until the years 1998-2000. The consumption of printing & writing paper as well as containerboard grew faster than the GDP.

After 1998-2000, however, the global propensity to consume paper & board (measured by paper & board consumption/GDP amount) has declined for printing & writing paper, tissue and newsprint, whereas containerboard has still maintained well its consumption link to the GDP development. The decline of the consumption propensity is partly due to the impact of the electronic media and other substitution, but partly it stems also from the expansion of the service sectors with low consumption of paper & board. The consumption propensity has declined especially in North America and relatively much less in the emerging markets such as China.

The world demand for paper & board amounted to about 425 million tons in year 2007. It is predicted to reach 555 million tons by 2020-2025. The most of the demand growth is predicted to take place in China, followed by increases in the other Asian countries, Latin America, Russia and Eastern Europe. China will clearly be the largest market of paper & board in the world already around the year 2010.

The Chinese consumption/capita of paper & board (about 50 kg) is below the world average (55 kg in year 2005), higher than the average in Asia (33 kg), and much lower than the average in the North and Central America (213 kg) and in Europe (129 kg). The specific demand factors prevailing in China (economic growth, population growth, urbanization and consequent consumption pattern for paper & board, industrial demand, relative expansion of cultural paper & board grades) will continue to fuel the demand. The demand is predicted to reach the level of 135-145 million tons by year 2020, meaning a doubling of the demand in the next 13 years.

### **Paper & paperboard production outlook in China**

China has a very long history of state-owned/city-owned and collectively-owned localized pulp & paper production, largely based on the utilisation of non-wood fibres from local farmers. Rather low caps on mill size were used to retain the viability of local mills. Income from selling straw to pulp mills has been an important means of earning cash in the countryside where the disposable cash income is still nowadays very low.

China has also a long history of inadequate wood supply. Timber harvesting has been subjected to complicated permit schemes and consequently timber prices have been relatively high. Therefore, as demand for paper & board has been on a continuous increase, the usage of recycled paper (mostly imported) and imported wood chips as well as pulp have risen.

Due to the history and fibre base, the Chinese pulp & paper industry all in all is less advanced than many other industries there. To improve the situation, the Chinese Government has paid a lot of attention to the restructuring of the pulp & paper industry during the last 10 years (10<sup>th</sup> and 11<sup>th</sup> 5-year plans). The current (11<sup>th</sup> plan, period 2006-2010) provides a clear policy guideline for the development:

- Small, energy-intensive and highly polluting (non-wood) mills must be closed (target shall be reached); Estimated number of such mills is 2000, and their capacity about 6.5 million t/a. This will bring about a major restructuring of the capacity and paper & board market
- 26.5 million tons of new capacity shall be added to the industry in order to reach an effective capacity of 90 million tons by year 2010
- The government will support the restructuring by enabling mergers, joint ventures, reorganization and expansions, with the target to have about 10 large-scale companies formed, each producing up to 3 million tons/a
- The government will create enabling conditions to form a number of large company groups each producing more than 3 million tons/a, on a cross-regional and cross-ownership basis so as to attain international competitiveness
- By the year 2010, top 30 pulp & paper companies are to produce 40 per cent of the total amount
- In the South of River Yangtze area, pulp & paper capacity expansion shall be based on integration with plantation forestry
- In the North of River Yangtze area, concentration of production shall be promoted to optimize the usage of raw materials
- Energy consumption and water as well as air-borne pollution shall be reduced, applying the concept of “polluter pays”, on-line measurement of emissions, and transparent reporting of emissions.

The policy drive contains elements for which some of the original ideas were adopted from the Finnish practices as well as from the export-oriented pulp & paper mill investments in South America and South-East Asia. The ultimate aims of the policy are to supply paper & board in line with the demand from the Chinese market and to foster paper & board exports. The government uses directives and development financing to guide the enterprises towards the targets. The accomplishment of the targets will crucially depend on the availability and cost of fibre.

### **Fibre supply outlook for pulp & paper industry in China**

In the year 2007, the pulp consumption and its composition by source and fibre type was as follows (million tons):

- Wood pulp: 14.5, of which 8.45 imported; domestic part increasing faster than imported
- Pulp from waste paper: 40.17, of which 18.05 imported; double the growth rate of wood pulp, domestic part increasing faster than imported
- Non-wood pulp: 13.02, only marginal increase

The policy drive of the government will make the lower end of the non-wood pulp industry disappear. The policy does not favour the non-wood pulp production but new capacity of modern technology will emerge; Yet the volume of non-wood pulp is expected to decline relatively and gradually also in absolute volume, despite the fact that still untapped resources of non-wood fibre exist in China.

As the consumption of paper & board increases in China, the recovery of waste paper is better organized and the supply to paper mills rises. But China will have to increase the import volume still in the foreseeable future by some 50-60 million tons. China is already the major importer of recycled paper, sourcing it traditionally from North America but increasingly also from Europe, Japan, Oceania and Asian countries. The increasing Chinese demand will cause a pressure on supply and prices. While the landed CIF cost depends also on the freight rate, any appreciation of the Chinese Yuan improves the competitiveness of imported waste paper.

The Chinese wood pulp production has suffered from short supply and high cost of wood (annual timber supply deficit about 130-140 million wood raw material equivalents, combining timber and wood in the form of its products), complicated timber harvesting and transport permit system, taxes on timber sales and transport, etc. After the major floods, the government further reduced timber harvesting from natural forests and made a master plan for the development of industrial forest plantations (5.9 million hectares) to be established in the period 2001-2015, distributed as shown in the attached table and to be integrated with new pulp mills:

#### **Industrial forest plantations in China in 2001 - 2015**

	<b>Million hectares</b>
<b>North-East/Inner Mongolia</b>	2.4
<b>Middle/lower Yellow River region</b>	0.8
<b>Middle/lower Yangtze River region</b>	1.3
<b>South</b>	1.4
<b>Sum</b>	5.9

The pre-conditions of plantation forestry are not in general favourable (e.g. land scarcity, competition for land and traditional patterns of land tenure, collective or unclear land ownership, typhoons, pests and diseases, fires, logistic and operation costs, unsatisfactory growth rates of plantations, etc), but captively produced wood shall be cheaper than wood purchased from the timber market and imported wood chips. The Chinese government keeps on working to enable the industrial plantation program, using subsidies and development financing as its intervention means. The most favourable locations for new plantation may be taken into use under this program.

China is importing wood chips from Australia, Thailand, Vietnam, Malaysia and Indonesia. Imported wood chips are rather costly, especially for mills not located close to the import harbour. But the chip import supply will be needed in the foreseeable future as the target of plantation wood supply may not be fully reached within the planned timeframe. Alternatively, the larger paper producing companies may increasingly set up their captive pulp productions in overseas countries (South America, Australia, South-East Asia, and Africa) where the pre-conditions for plantations and pulp production may be better than in China.

All in all, the government shall push forward the implementation of the integrated forest plantation and new pulp mill program, as a means of securing the pulp supply for the better quality of paper & board, and as a means of enabling further economic activity in the countryside.

:

## 4. Unit labour costs in selected countries

In this chapter we describe the development of unit labour costs and its components in the selected countries. Unit labour cost (ULC)<sup>7</sup>, i.e. labour costs per unit of gross output in volume terms, has developed in a strikingly different way in China than in the other countries reviewed. Chinese ULC declined in 1999-2005 and started to rise after that. The reason for the decline is the quick modernisation of the old-fashioned capacity, although labour costs have risen rapidly.

In Finland, unit labour costs have been in a decline in 2002-2006 after a rapid rise in 2001. In 2001 ULC was raised by a rapid rise in labour compensation per person at the same time as production declined. In 2005 there was a severe labour dispute, which stopped production for several months. Unit labour cost stayed stable, however, as also labour compensation was halted. The rapid growth of production in 2006 was achieved by recovering export markets.

The Finnish relative unit labour costs are only about half of the German ones like in the case of Estonia. Firms situated in Finland are large capital-intensive multinational companies acting on a global basis. The Finnish markets as such are very small and consequently e.g. paper and paper board exports are 90 per cent of production. Domestic sources provide a large part of the raw material and energy supplies to the factories, although imports of wood are also important.

In China, unit labour costs declined in 1999-2004 amid strongly rising production. The Chinese paper industry was rapidly modernising with the help of foreign investments into paper production as well as on the paper machine production. The growth of nominal labour costs far undercut the rise in production or productivity. China is very dependent on raw material imports in the paper production in spite of its huge size. This diminishes the role of labour costs in the production process. Potentially huge and rapidly growing markets, on the other hand, add to the attractiveness of the country for the foreign investments.

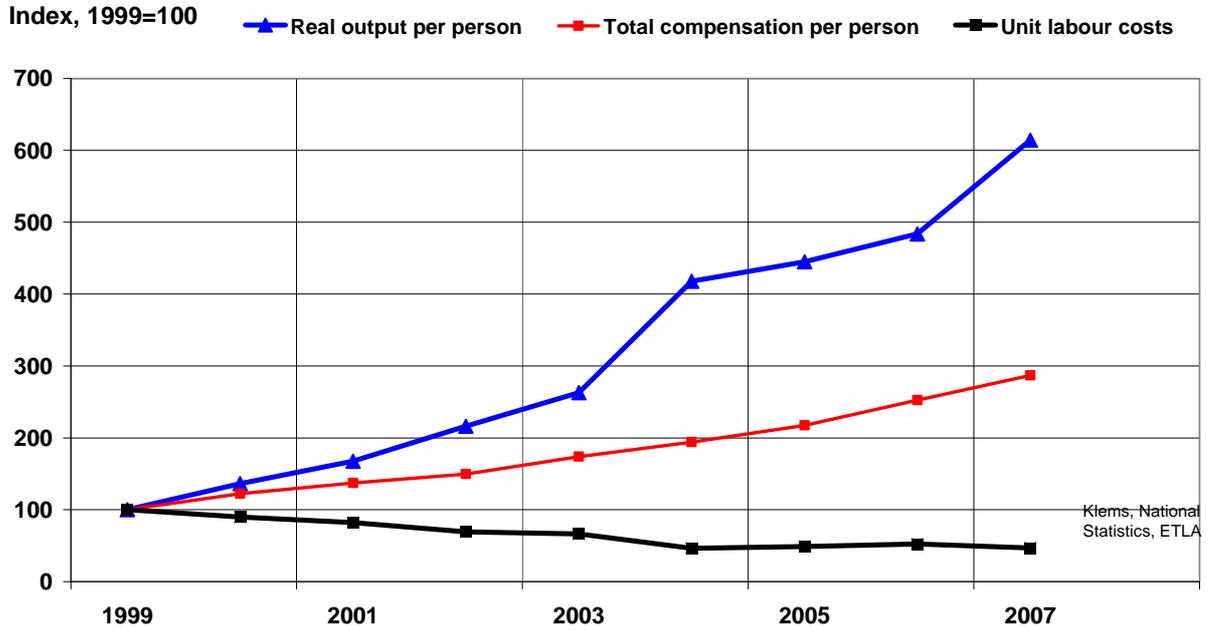
In Estonia, the long-lasting growth of the economy started to accelerate labour costs strongly in 2006. In 1999-2005 unit labour costs rose moderately. The development in 2006 and afterwards is very worrisome as nominal labour costs rose rapidly while production declined. Obviously, the Estonian Economy has to a large extent utilised its catching up potential, which has overheated the economy resulting in rapid labour cost rises.

In Germany, nominal labour costs per person rose very moderately in 1999-2006. The early years of the 2000's were stagnant after the bubble year of 2000. The year 2000 was an exceptionally rapid growth year in Europe due to overinvestment in the IT sector. The German economy was severely affected by the downturn, which was reflected also in its paper and paper product industry. In Germany nominal labour costs of this industry even declined in 2002 and 2005.

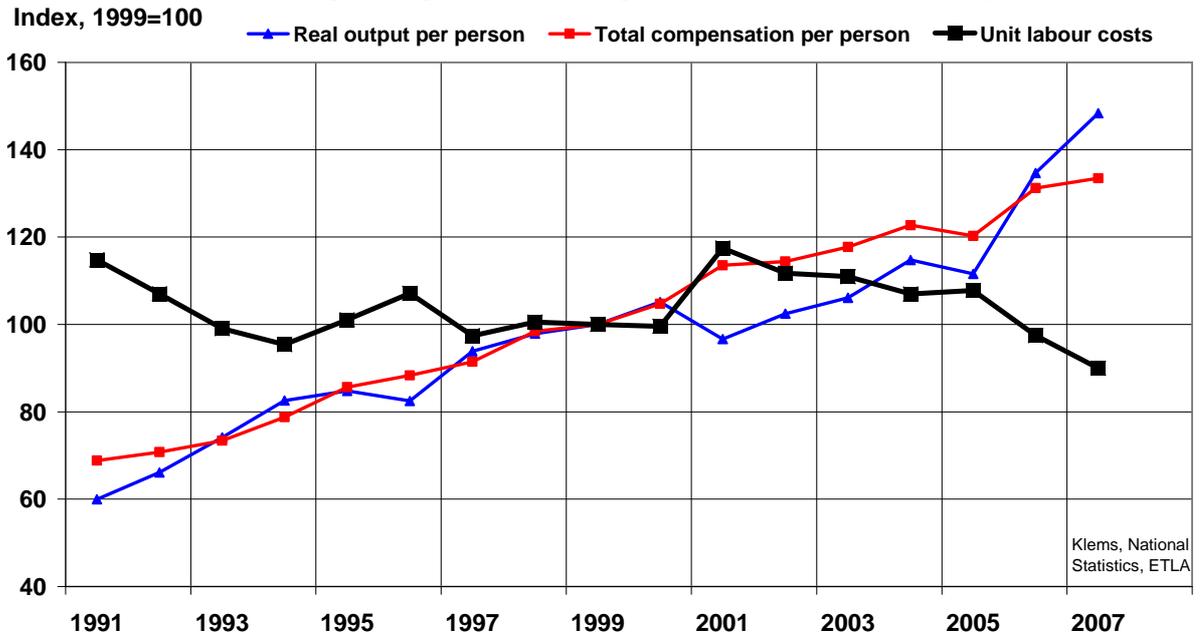
---

<sup>7</sup>  $ULC = \text{Comp} / Q = \text{Comp}/L / Q/L$ , Comp = total labour compensation, Q = volume of production, L= employment, Q/L = productivity.

### Chinese Wages, Productivity and Unit Labour Costs in Pulp, Paper and Paper Product Industry



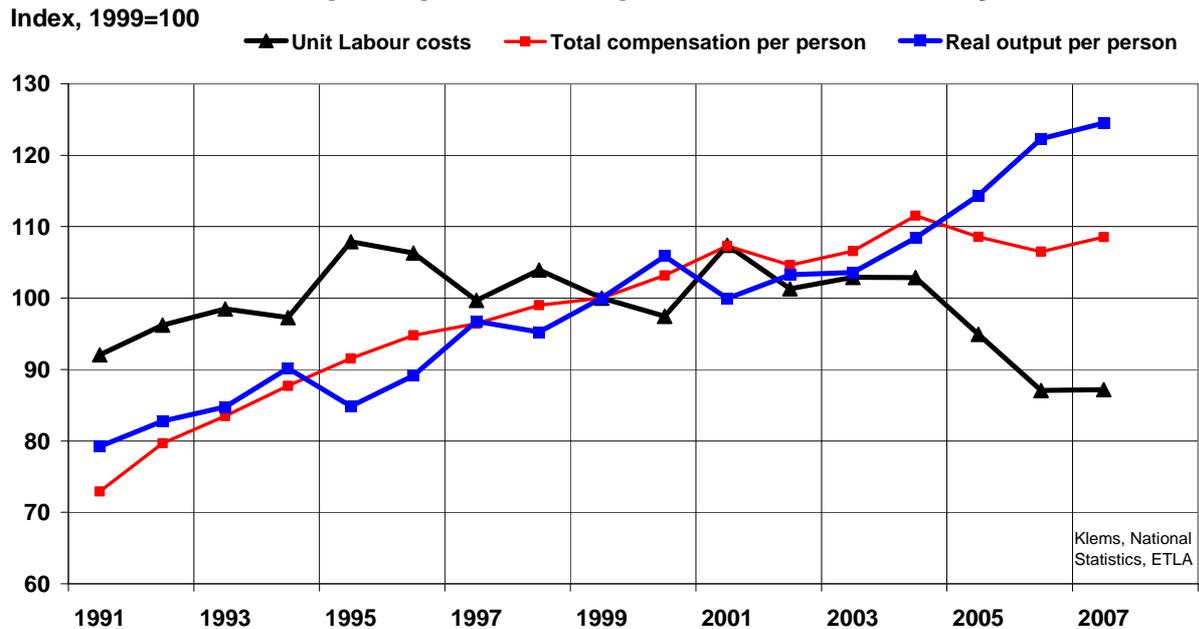
### Finnish Wages, Productivity and Unit Labour Costs in Pulp, Paper and Paper Product Industry



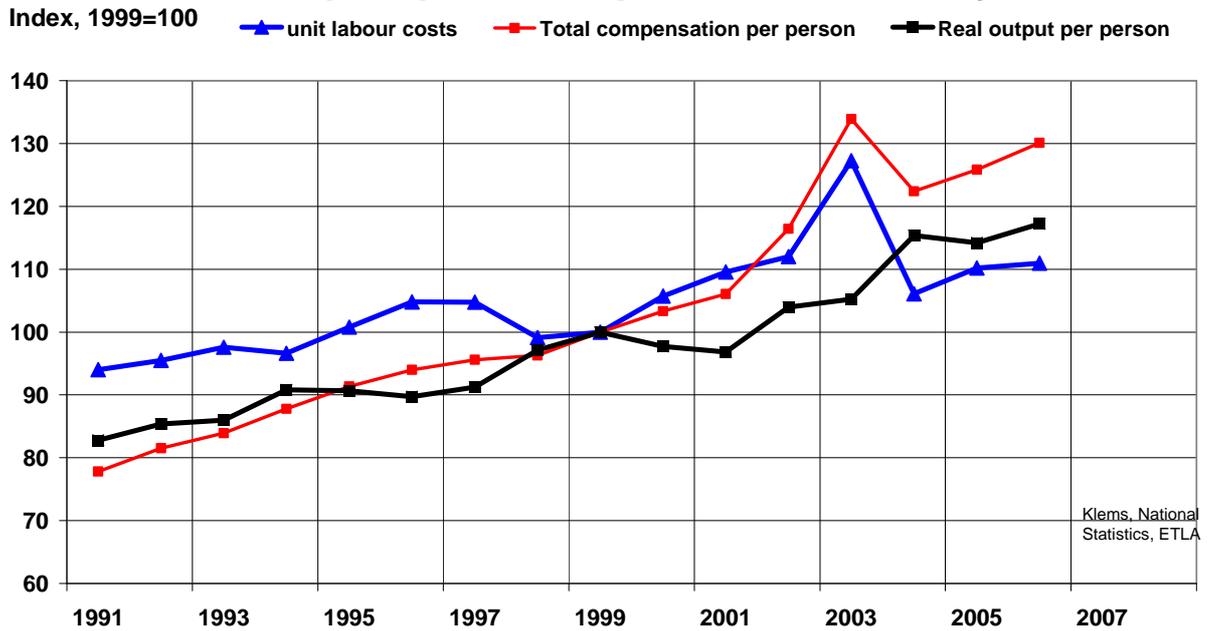
## Estonian Wages, Productivity and Unit Labour Costs in Pulp, Paper and Paper Product Industry



## German Wages, Productivity and Unit Labour Costs in Pulp, Paper and Paper Product Industry



## The US Wages, Productivity and Unit Labour Costs in Pulp, Paper and Paper Product Industry



## 5. Relative unit labour costs in selected countries

In this chapter we compare labour costs of paper and paper product industries in selected countries. In comparison of labour costs, the labour compensation in different countries is converted into euros. In addition to this, we calculate the levels of relative unit labour costs (RULC)<sup>8</sup> using German costs as a basis of comparison to achieve relative productivity-corrected wage levels. This is achieved by converting labour compensation into euros and volumes of production into comparable units by using unit value ratios, UVRs<sup>9</sup> from 1999.

The Chinese nominal labour compensation per employee is less than three per cent of Finnish and more than three per cent of German annual labour costs. Estonian labour costs were 14 per cent of the Finnish costs in 2006. Labour costs differ substantially between nations even if calculated in a common currency. It is basically not an odd situation. In normal circumstances unit wages in each country should be close to the wages in the other countries.

<b>Annual total labour compensation of employees in paper industry</b>									
	<b>Euros per employee</b>					<b>%</b>	<b>%</b>	<b>%</b>	
	<b>2000</b>	<b>2003</b>	<b>2005</b>	<b>2006</b>	<b>2007</b>	<b>Newest /2005</b>	<b>Newest /2000</b>	<b>Newest vs Finland</b>	<b>Newest vs Germany</b>
<b>China</b>	926	1076	1234	1458	1593	129.1	172.0	2.7	3.9
<b>Estonia</b>	4014	4865	5695	7928	..	100.0	141.9	13.7	19.6
<b>Finland</b>	46094	51811	52936	57764	58746	111.0	127.4	100.0	142.4
<b>Germany</b>	39207	40503	41258	40467	41252	100.0	105.2	70.2	100.0
<b>USA</b>	57939	61307	52377	53659	..	102.4	92.6	92.9	132.6
Source: KLEMS, Chinese statistics, ETLA									

It is the wage costs per unit of production in a common currency which matters in international competitiveness assessment instead of nominal labour costs as such. The differences in unit wage costs take into account differences in productivity and thus reflect true competitive potential of the industry or the firm. Countries with low wages suffer in normal circumstances from poor infrastructure, low level of skills of the labour force, politi-

<sup>8</sup>  $RULC = e * ULC^* / ULC = (e * Comp^* / Q^*) / (Comp / Q) = (e * Comp^* / L^* / Q^* / L^*) / (Comp / L / Q / L)$ , ULC = unit labour costs, e = exchange rate Comp = labour compensation, Q = volume of production (converted to comparable units with UVRs), L = Employment, \* denotes foreign country

<sup>9</sup> UVR = unit value ratio. Converts volumes into common currency. See Suni-Ahveninen 2008.

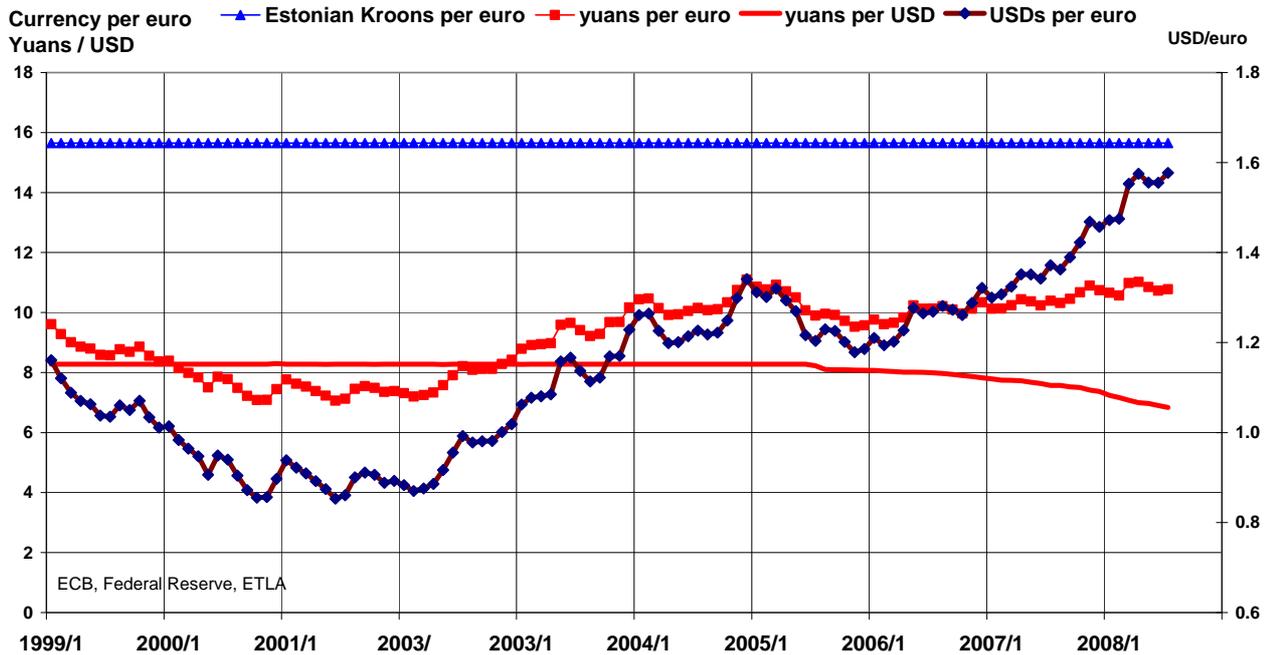
cal instability and/ or isolation from the other economies. Thus, before globalisation either labour costs in a common currency and per unit of production have been close to each other giving little incentive to expand production in low-wage countries, or there has been limited access to these markets. In fact, in the end it is the profitability which matters and thus also the developments in the other costs and their productive use also matters.

<b>Wages and wage compensation in China in 2004 in paper and paper product industry</b>							
	<b>Average wage per employee (in yuan)</b>	<b>Pension, medical insurance as % of wage</b>	<b>Housing fund &amp; subsidies as % of wage</b>	<b>Welfare fund per employee as % of wage</b>	<b>Labour, unempl. insurance as % of wage</b>	<b>Average compensation per employee (in yuan)</b>	<b>Costs per average wage.%</b>
<b>Paper and paper products</b>	11699.3	8.60	2.14	10.54	2.20	14446.3	14.9
<b>Manu- facturing</b>	13974.3	10.90	2.86	11.59	3.77	18043.6	18.2
<b>Source: Banister 2007</b>							

In the process of globalisation differences in relative unit labour costs in common currency will gradually diminish as labour costs rise more slowly in expensive countries than in low-wage countries and/or the exchange rate will appreciate in low wage countries vis-à-vis high wage countries. This may happen rather quickly like it seems to be happening in Estonia or slowly like in China. In Estonia, the economic adjustment takes place quickly as the economy is very small, which makes it possible to benefit from the catching up potential quickly.

China is huge, the most populous nation in the world with very large labour reserves. In China, there is, in principle, very large labour force potential in rural areas as the increase in the productivity of low-productive farming and other labour-intensive production will release unskilled low-wage labour force for other purposes. Basically, this hinders rises in the labour compensation of un-skilled labour force and keeps the differences between China and especially industrial countries wide. In fact, this difference has even widened in manufacturing in general and in paper and paper product industry in particular. Alternatively, relative unit labour costs have even diminished.

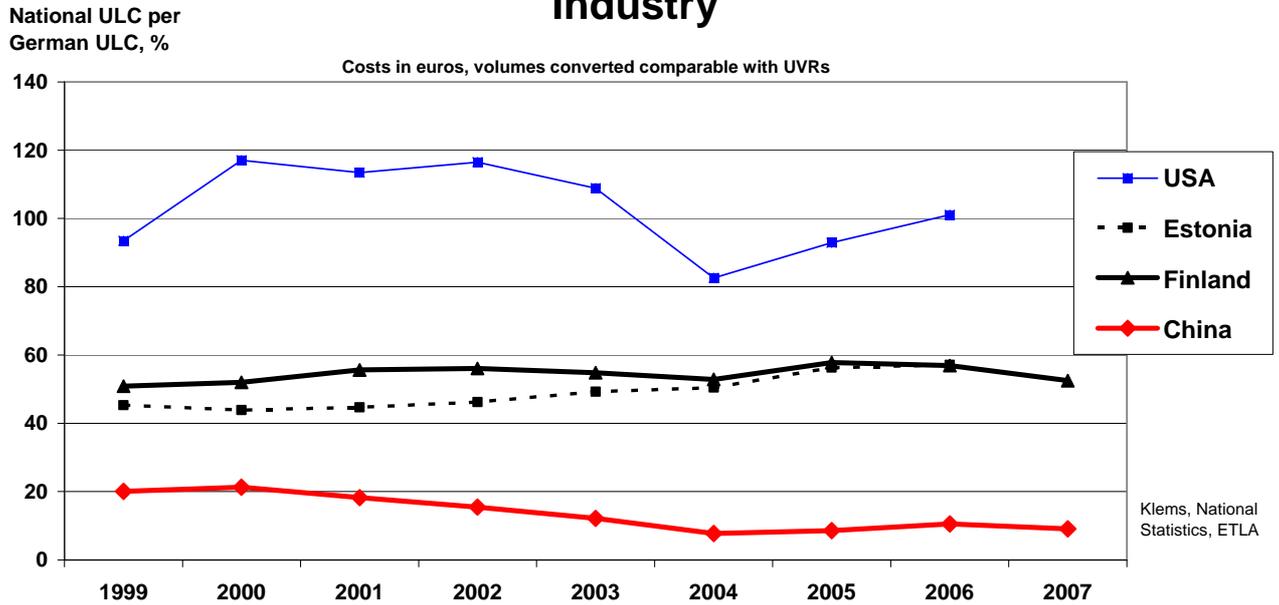
## Selected Bilateral Exchange Rates



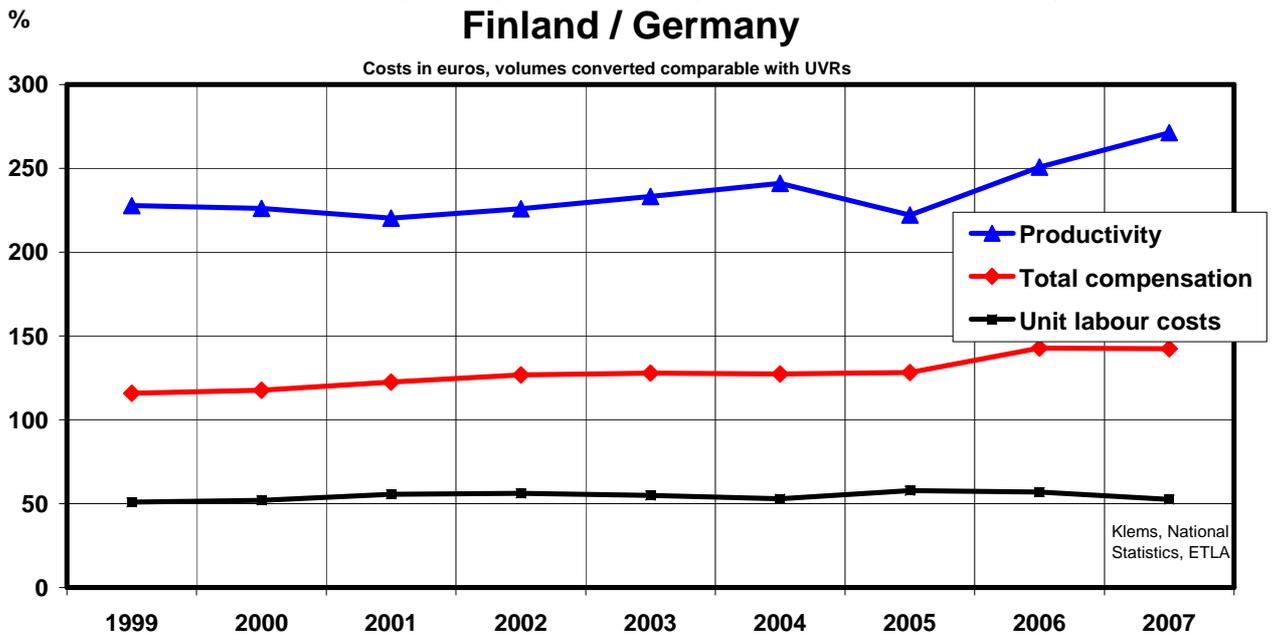
### Unit Value Ratios and Exchange Rates vis-à-vis euro in Selected Industries and Countries in 1999

	Germany	USA	Finland	Estonia	China
<b>Manufacturing</b>	1.0	0.98	0.98	10.80	5.62
<b>Paper and paper products</b>	<b>1.0</b>	<b>1.10</b>	<b>0.91</b>	<b>11.20</b>	<b>12.00</b>
<b>Chemical products excl. pharmaceuticals</b>	1.0	1.17	0.72	9.07	4.77
<b>Rubber and plastics</b>	1.0	1.36	1.08	14.30	4.77
<b>Fabricated metal production</b>	1.0	1.02	0.84	9.20	2.79
<b>National currency/€</b>	1.0	1.07	1.00	15.65	8.82

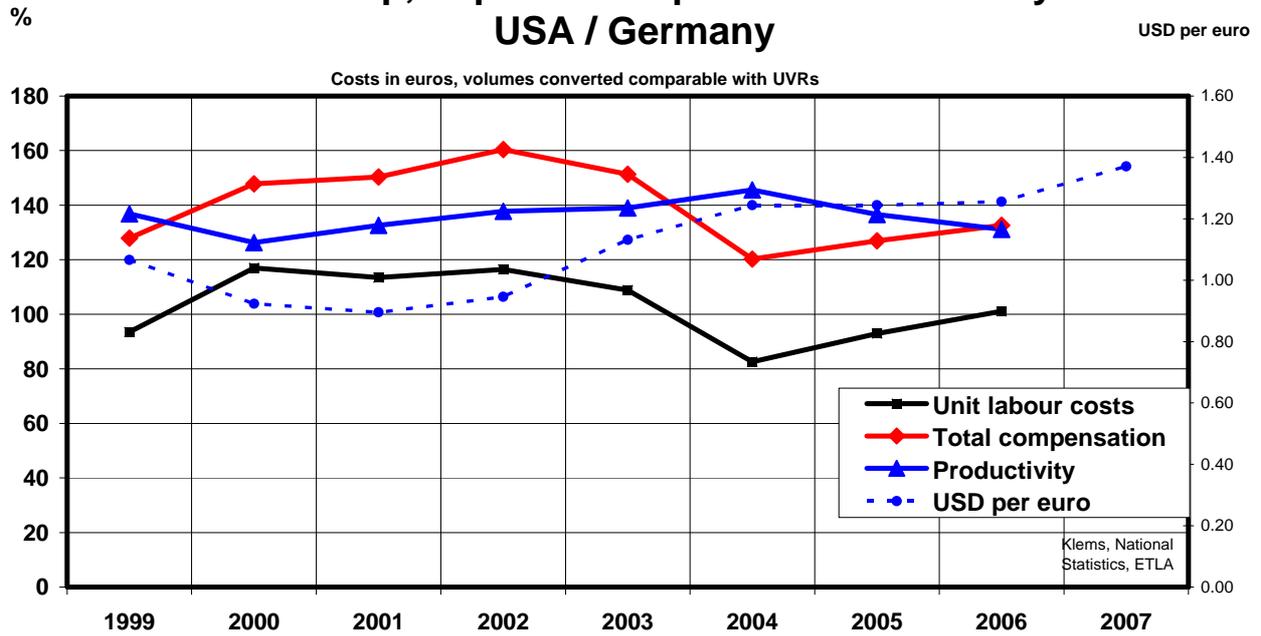
## Relative Unit Labour Costs in Common Currency vs. Germany in Pulp, Paper and Paper Product Industry



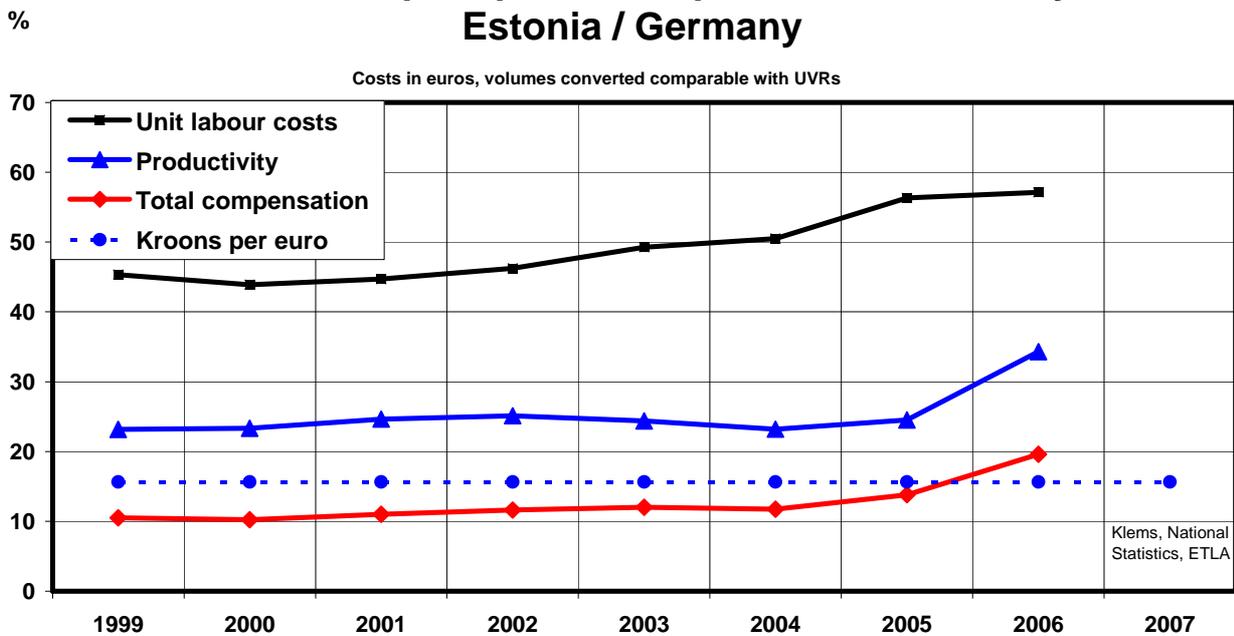
## Relative Unit Labour Costs, Productivity and Labour Costs in Pulp, Paper and Paper Product Industry: Finland / Germany



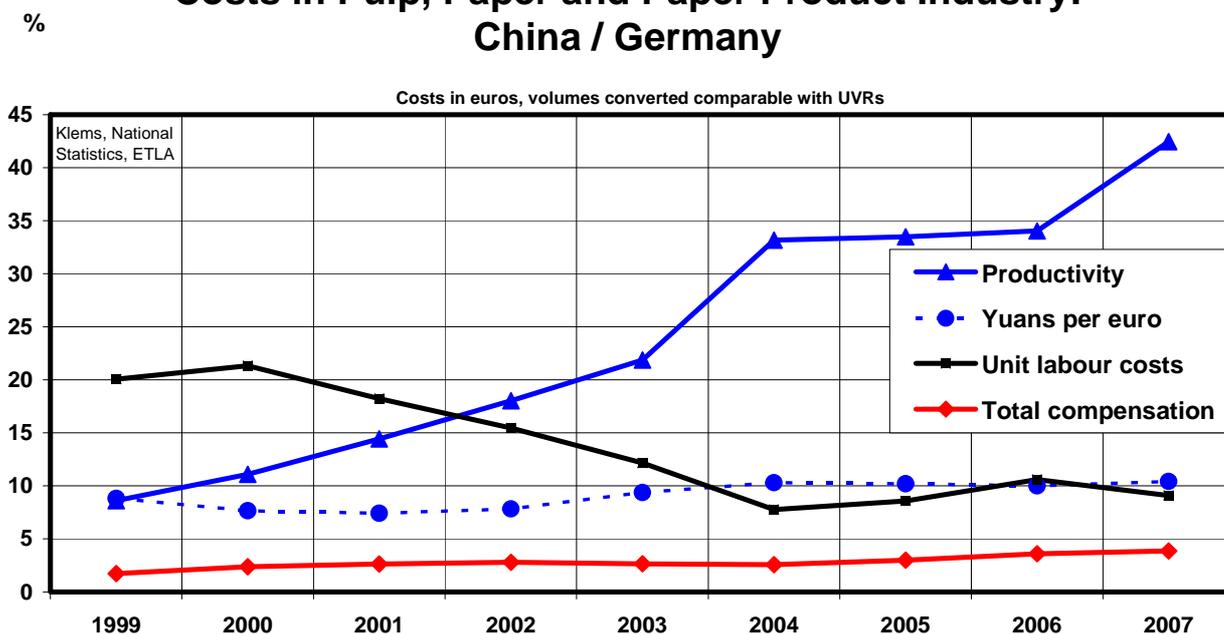
### Relative Unit Labour Costs, Productivity and Labour Costs Pulp, Paper and Paper Product Industry: USA / Germany



### Relative Unit Labour Costs, Productivity and Labour Costs in Pulp, Paper and Paper Product Industry: Estonia / Germany



## Relative Unit Labour Costs, Productivity and Labour Costs in Pulp, Paper and Paper Product Industry: China / Germany



The level of the Finnish labour productivity is about 2.5 times higher than the productivity of the German industry. The large difference in the productivity is explained by the massive investments by the industry for most sophisticated technologies and very large production volumes. As a result the contribution of the labour, in the context of growth accounting, to the growth has been negative on average in 1971-2004 in the industry including printing and publishing according to Klems-studies (2008). The contribution of the capital has been an average 0.5 percentage points since 1971, but it turned also negative in 1999-2004. The contribution of total factor productivity on the other hand, was an average 0.8 percentage points in 1971-2004, while it rose to 1.2 percentage points in 1999-2004. There are unfortunately no results on the industry excluding printing and publishing, but in the case of Finland, the share of printing and publishing of the paper industry (Nace DE) is less than a quarter, which dampens the impact of this subsector on the contributions.

The strong level and even slightly risen productivity has kept Finnish relative unit labour costs relative to those of Germany stable in 1999-2006 in spite of the severe labour dispute in 2005 (See Suhdanne 4/2005). The dispute, which halted production in this sector for nearly two months affected productivity strongly, but this effect was compensated by a decline in the Finnish labour compensation.

While unit labour costs have been stable, the final indicator of the state of the Finnish paper industry, namely profitability, has deteriorated as discussed earlier. Profitability has deteriorated due to rising material costs in spite of a depreciating US dollar in circumstances of intense competition depressing the prices of the Finnish products. It has not been possible to pass the rising costs to prices.

The US unit labour costs relative to Germany decreased in 2003-4 due to the strong depreciation of the USD vis-à-vis the euro in 2004-6, the USD was relatively stable as was the RULC. The further depreciation of the USD vis-à-vis the euro in 2007-8 will push the US RULC downwards, though the final outcome will also depend on the development of relative productivities and labour compensations. The US unit labour costs in euros were about 90 per cent of the German costs.

Development of Chinese paper industry differs significantly from the development in other countries in comparison. Very rapid growth of paper and paper product production in relation to Germany, and other countries as well, has raised the Chinese relative productivity close to 70 per cent of the German productivity in 2006, while the ratio of labour compensation was close to four per cent and finally the Chinese relative unit labour costs were about 9 per cent of those in Germany. Chinese development has been remarkable. It should, however, be stressed that this development has taken place mostly in a few provinces of which Zhejiang and Guangdong have been under review in this study. The development inside the provinces may also greatly differ due to their large sizes.

In Estonia, the exchange rate is tied to the euro and the convergence is taking place by rapidly rising labour costs.

## 6. Conclusions

### Objectives

This study focuses on the labour cost competitiveness of the pulp & paper industries in China and Finland in particular, using the corresponding German, US and Estonian industries as points of comparison.

This study deepens the analysis of the earlier study of the cost competitiveness of the manufacturing industries in the same group of countries. Separate sector studies focusing on the labour cost competitiveness are carried out in a parallel manner on the fabricated metal industries and chemical industries. The results of these three sector studies will be evaluated in due time, with the objective of drawing conclusions on the driving forces of globalization and international competitiveness.

### Global economic outlook

The world economy was on an upward trend from the mid-1990s onwards until year 2008, despite the cyclical fluctuations. The GDP growth benefited from the globalization of production and the high savings rate in the emerging markets, especially in China, creating easy monetary conditions. The first signs of economic risks arose in August 2007, and the crisis overtook the financial markets in September 2008, pushing the world economy to a recession path. A modest recovery is expected only from year 2010 onwards.

### Global development of pulp & paper industry

The production of pulp & paper has been increasing, but at a lower rate than that of most other industries. The pulp & paper industry has not gained much from the globalization. On the contrary, previous paper & board supply deficits in e.g. Asia have been transformed into emerging net exports despite the high growth rate of the consumption there. The increasing demand has enabled significant production increases, with especially China's share of the world pulp & paper production doubling from 5% to 10 % in the period 2000-2006.

### Cost structure of pulp & paper production

In general, the pulp & paper industry in industrialized countries is using relatively less intermediate inputs from external suppliers than the corresponding industry in the emerging countries. Imports of intermediate inputs are important in Estonia due to the small production, in China due to the high amount of fibre imports, and in Finland due to the pulpwood imports from Russia (now declined).

The value added, gross operating surplus and total labour compensation are higher in the industrialized countries than in the emerging ones. Labour compensation has increased the most in Finland, followed by Germany and the USA

### Pulp & paper industry in China

The industry has expanded more rapidly than elsewhere in the world thanks to the high economic and population growth, advancing urbanization with more usage of paper & board/capita than in countryside, and increasing demand for paper & board from the other swelling industries. The expansion has also resulted into a continuous restructuring process carried out in industry. While pulp & paper production takes place in all provinces, the provinces with the largest productions are Shandong, Zhejiang, Guangdong, Jiangsu and Henan, followed by Hebei and other provinces. The production growth has been based on

the volume, with the price level remaining almost constant due to the competition and low inflation rate. The officially reported gross profit margin of the production is rather low, though on the increase (about 400 Yuan/ton) in the year 2006. The Chinese gross profit margin concept is not directly comparable with that used in the industrialized countries.

The productivity of pulp & paper industry is increasing because of the restructuring and modernization. The highest value of production/person takes place in Hainan (large modern mill). The foreign-funded and state-owned companies have performed better than the collectively owned companies.

The pulp & paper industry is using about 7 per cent of the annual fresh water supply, recycling 51 per cent of it, and accounting for 18 per cent of industrial waste water and 34 per cent of COD amount. The pollution load of the pulp & paper industry is declining.

The competitiveness of the pulp & paper industries in the various provinces was measured by an indexing system. The most competitive companies are located in the Eastern area (coastal belt, with access to imported recycled paper and export markets), followed by the companies in the Central area (local fibre and markets). The companies in the areas of natural forests were less competitive, because of the wood supply difficulties. The use of intermediate inputs, value added and operating surplus is relatively high at the mills of the coastal provinces using imported recycled paper. The labour compensation, taxes and depreciation of fixed assets is relatively high at companies located in the major cities.

China used to be a net importer of paper & board, but since year 2005 it has been a net exporter. Imports are increasingly confined to market segments requiring high paper & board quality.

The demand for paper & board in China will almost double by the year 2020 from about 73 million tons in year 2007. The government has recognised the need to further expand and improve the structure of the industry. Small energy-intensive and highly polluting mills are to be closed, new large-scale mills are to be established, and large company groups are to be developed to accumulate the resources that are needed to respond to the increasing demand. The development policy also aims at expanding the paper & board exports.

The accomplishment of the pulp & paper production target depends on the success of the industrial forest plantation development programme, which is linked to the industrial plan. The volume of non-wood pulp may remain constant if new mills of modern technology are established; otherwise its volume will decline. China is increasing the recovery rate of waste paper, but imports of recycled fibre must be increased by a large amount by the year 2020. Any appreciation of the currency will facilitate the imports of recycled paper, wood pulp and wood chips to augment the domestic fibre supply.

### **Unit labour costs**

The revitalisation of globalisation in the 1990s and early 2000s has revealed new profitable production possibilities in the emerging economies such as China. China in particular, has benefited from very low wages. For example, the Chinese level of the annual nominal labour compensation in euros was only about 3 per cent of the corresponding Finnish labour compensation in 2006, and the compensation level as compared with Finland was in Estonia 14 per cent, in Germany 76 per cent, and in the USA 95 per cent.

The unit labour costs (cost/output volume) have developed in different ways during the last few years, rising the most in Estonia and the USA, rising a little in Germany, declining in Finland, and declining marginally in China until recent times (modest rise).

### **Relative unit labour costs**

Nominal wages as such do not imply good international competitiveness. Chinese wages are, however, low even if the lower labour productivity is taken into account and the costs per unit of production are compared with other countries in a common currency.

The relative unit labour cost compares the situation of a country with another country. The US relative unit labour costs are almost as high as in Germany. The Finnish relative unit labour costs are significantly lower, thanks to the very high productivity resulting from the large-scale modern technology. The relative unit labour costs in Estonia are at the level of Finland because of the low nominal wages.

The Chinese relative unit labour costs are only about 5 % of the German level. The improving mill technology and labour productivity in China has compensated for the effects of rapidly rising wages and an appreciating Chinese currency.

Large relative unit labour cost differences in a common currency were obviously a key factor behind exceptionally rapidly changing international production and trade structures in the late 1990s and early 2000s. This factor has helped also the Chinese paper & board industry to turn from a net importer into a net exporter.

### **Development potential and its drivers**

According to the calculations, which are based on the available statistical information, there is still a large potential for a continuation of the strong growth of the paper & board industry in China as the demand shall keep on increasing and the relative unit labour costs are still only a fraction of those in industrialised countries. The Estonian economy as an example of a small emerging economy has been more flexible than that of China, and it has already mostly exploited its catching up potential as its unit labour costs have risen to be close to those in the industrialised countries. This implies painful adjustments of the economy there as further rapid wage increases are not possible and the productivity should be the main source of maintaining the competitiveness as the Estonian kroon (currency) is tied to the euro, the currency of its main trade partners.

The case of China is especially interesting due to its huge and increasing paper & board market size and its consequent big impact on the world trade. The economic growth is fast, but the foundations of the huge economy change slowly. Wages are rising fast, but the starting level has been very low and so far the productivity has risen strongly as well. The productivity rise in agriculture can release the low-skilled labour force for all kinds of manufacturing and help to alleviate the labour cost pressure. However, there is a lack of skilled labour, which in addition to the obligations set up by the new labour law adds up to increasing labour compensation. The policy of the currency appreciation is also diminishing the labour cost differences, but this policy is now very cautious, because of the global financial crisis. The Chinese product price level has developed more moderately than the prices in the other countries of the comparison as a part of the productivity gain has been reflected in the modest price developments.

### **Chinese pulp & paper industry in a process of change**

The Chinese pulp & paper industry production is undergoing a process of profound change in the same way as the most of the other Chinese manufacturing industries. Production is so far concentrated into the coastal and central provinces (Shandong, Zhejiang, Guangdong, Jiangsu, Henan, Hebei and Hainan) but smaller production takes place in many other provinces. The pulp & paper industry shall grow fast according to the 11th five-year plan of the Chinese government, and its production shall increasingly be based on the utilization of wood from forest plantations. The pulp & paper production plan is integrated with the plan of industrial forest plantations. Special attention shall be paid to reducing the energy consumption and environmental pollution.

The pulp & paper industry consists of a very large number of enterprises, so the business environment is very competitive, but about 3500 enterprises account for most of the production. The most competitive existing paper & board producing enterprises (as measured by the competitiveness index created by the Renmin University) are located in the provinces of Shandong, Guangdong, Henan, Jiangsu, Hunan and Zhejiang.

A large number of small polluting and energy-intensive mills shall be closed by the year 2010. The production is to be concentrated into larger company groups and mills using modern technology. The government is using directives and financial instruments as its means of guiding the industry towards the production development targets. China will also increasingly figure as a player in world export markets.

### **Impact of current global financial crisis**

The outlook of the pulp & paper industry is clouded by the difficult global financial crisis, which dampens domestic markets and restricts export possibilities. Many of the important export markets of the paper & board industry like the US, Japan and the Euro Area are in a recession, and the recovery will take more time than in normal downturns as the financial crisis appears to be extremely severe. The Chinese government seeks to maintain the economic activity by a large stimulus package benefiting the pulp & paper industry there.

### **China – a competitor and a partner**

In a longer term, the Chinese pulp & paper industry shall raise its impact on the global markets from an already significant level. In this process, in addition to attractive production costs, the know-how from the industrialised countries as well as the strongly expanding market in China play key roles in establishing projects and partnerships.

The important impacts of changes in raw material costs, especially with respect to energy and even labour compensation, on the international competitiveness of the Finnish and Chinese paper & board industries merit further monitoring from time to time.

The Chinese pulp & paper industry will expand in a number of provinces, but the large-scale pulp mills shall be set up in the provinces where the government is facilitating the large industrial forest plantation program. It is in the interests of Chinese and international partners to develop project concepts at an early stage in locations where adequate conditions for forests and mills exist.

### **Implications of international competitiveness**

The current global economic recession will accentuate the importance of international cost competitiveness at the national and corporate levels.

The industries in China will face the impacts of increasing labour costs, strengthening value of the currency (affecting exports negatively but enabling imports), shortage of skilled human resources and costs of pollution abatement investments, which will somewhat reduce the current cost competitiveness advantage of the Chinese pulp & paper industries. The Chinese pulp & paper industries will greatly benefit from the high growth rate of the domestic market. The companies in industrialised countries will attempt to alleviate the cost increases by moving towards products with higher value added, overall quality improvements, and constant productivity gains. The Chinese companies also share this view while the companies have large catching up potential both internationally and by provinces as shown by the competitiveness indicators.

Global production of pulp, paper and board is in a strong process of change. It is advisable for Chinese and foreign companies that operate internationally to monitor closely the competitiveness of the Chinese pulp & paper industries and act on the emerging opportunities at an early stage.

## Annex 1. Manufacturing production and unit value ratios

When comparing manufacturing production volumes in different countries, neither the exchange rates nor expenditure-based PPPs are suitable. Taxes, subsidies and similar other items disturb the market price information from the perspective of a firm. In practical terms, however, both of these two approaches, in addition to the nominal exchange rates, are sometimes utilised (Klems 2007). The first PPP-based correct approach is to use prices of the expenditure side of National Accounts on a detailed basis after correcting for the disturbing items. This is in many cases both difficult and cumbersome. The second, a more practical approach, which is adopted also in this study, is the use of so-called unit value ratios (UVRs).

UVRs are calculated at the first stage on a rather low disaggregation basis as unit value ratios. These ratios are weighted together to get a higher level aggregates of different industries as well as ratios for manufacturing (Ruoen-Manying 2001).

$UVR_{i,j} = \sum w_i * uvr_k$ , aggregated unit value ratio in the first aggregation level

$w_i$  = volume weight

$k$  = commodity  $k$

$uvr_k = (\text{value}_k / \text{quantity}_k)_i / (\text{value}_k / \text{quantity}_k)_j$ , the unit value ratio of the commodity  $k$  between countries  $i$  and  $j$ .

The UVRs are usually calculated using weights of both countries. The final UVRs are usually calculated as a geometric average of these two UVRs. The ratios are usually calculated for a certain year, e.g., 1997 like in the case of the KLEMS project (KLEMS 2007). The UVRs for the other years, if needed, are estimated using suitable price indices in the two countries as the basic calculation is very burdensome.

In this project the UVRs calculated in the KLEMS project for the year 1997 were used as a starting point. The UVRs in 1999, in the first year of the introduction of the euro were, however preferred in order to decrease potential sources of inaccuracy due to a change in currency regimes. The 1999 UVR were calculated from the 1997 values (1995 in case of China) by using gross output price indices (ex-factory price indices in China) in respective countries.

## Annex 2. Growth of World Value Added in Manufacturing, Annual Percentage Change in Volume

ISIC	Industry	1995-2000	2000-2006
		% p.a	% p.a
18	Wearing apparel, fur	-2.8	-1.6
22	Printing and publishing	2.1	0.1
19	Leather, leather products and footwear	-1.6	0.9
36	Furniture; manufacturing n.e.c.	1.3	0.9
17	Textiles	0.3	1.0
28	Fabricated metal products	2.0	1.4
20	Wood products (excl. furniture)	1.3	1.9
21	Paper and paper products	1.7	1.9
26	Non-metallic mineral products	0.7	1.9
15	Food and beverages	1.2	2.8
23	Coke, refined petroleum products, nuclear fuel	1.7	3.3
25	Rubber and plastics products	3.6	3.3
29	Machinery and equipment n.e.c.	1.1	3.5
34	Motor vehicles, trailers, semi-trailers	4.3	3.6
24	Chemicals and chemical products	3.7	3.7
30	Office, accounting and computing machinery	17.3	4.1
33	Medical, precision and optical instruments	4.0	4.2
27	Basic metals	1.8	4.6
16	Tobacco products	2.1	5.3
31	Electrical machinery and apparatus	5.6	6.2
35	Other transport equipment	5.4	7.7
32	Radio, television and communication equipment	26.0	12.2
	<b>Manufacturing</b>	<b>3.2</b>	<b>3.0</b>

Source: UNIDO, ETLA

## Annex 3. The data

Data for Estonia, Finland, Germany and USA are provided by KLEMS-project (KLEMS 2007) and it is updated by the more fresh data from Stan data bank, OECD and national sources.

Klems data: <http://www.euklems.net/>

STAN ( STructural ANalysis Database) data:

[http://www.oecd.org/document/62/0,3343,en\\_2649\\_34445\\_40696318\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/62/0,3343,en_2649_34445_40696318_1_1_1_1,00.html)

Chinese data is collected from Chinese Statistical Yearbooks, Chinese Labour Statistical Yearbooks and Chinese Regional Yearbooks.

Input output tables or 2000: Finland, Germany, USA and China (2002). Provided by the OECD.

[http://www.oecd.org/document/26/0,3343,en\\_2649\\_34445\\_38069722\\_1\\_1\\_1\\_1,00.html](http://www.oecd.org/document/26/0,3343,en_2649_34445_38069722_1_1_1_1,00.html)

In case of China, the national input-output table differs from the table provided by the OECD. Both are utilised in this study. OECD has calculated the import-table, which is not available from the national sources. Regional input-output tables of China are provided by Statistics China.

The Chinese data is not very exact due to the developing nature of the country as well as developing statistical techniques. However, it can be utilised for the analysis and government uses it in its decision making. There are studies, which show inaccuracies in the statics.

We agree with the conclusions made by Gregory Chow, Princeton University (2005) "... official data are by and large reliable, granted unavoidable errors in certain cases ... Needless to say, any serious scholar using the Chinese official data, as in using any other data, would need to exercise caution in his research even if the data are not purposely falsified".

## References:

Banister Judith 2007

China 2008 National input output table of China

Chow G. (2005) Are Chinese Official Statistics Reliable? Princeton 2005. CESifo Economic Studies 2006 52(2):396-414; doi:10.1093/cesifo/ifl003  
<http://cesifo.oxfordjournals.org/cgi/content/full/52/2/396>

FAO, 2008 ForeStat, <http://faostat.fao.org/site/626/default.aspx>

Paper industry 2006, The Finnish Paper Industry. Current State and Future Challenges. Report of the Working Group of the Finnish Paper Industry. May 31, 2006. Finnish Forest Industry Federation. Finnish Paper Worker's Union.

IISI, 2008 Steel Statistical Yearbook .Yearbook. International Iron and Steel Institute (IISI.) <http://www.worldsteel.org/?action=publicationdetail&id=4>

KLEMS 2007 An overview of the EU KLEMS Growth and Productivity Accounts. by Douglas Koszerek, Karel Havik, Kieran Mc Morrow Werner Röger and Frank Schönborn. Directorate General for Economic and Financial Affairs. European Economy. Economic Papers Number 290 – October 2007.

Li, Enjing,

Suni Paavo,

Zhao, Yanyun (2008) Cost Competitiveness of Chinese and Finnish Fabricated Metal Industries. Helsinki. ETLA 2008.

Li, Enjing,

Suni Paavo,

Zhao, Yanyun (2008) Cost Competitiveness of Chinese and Finnish Chemical Industries. Helsinki. ETLA 2008.

Metsäteollisuus 2006, Paperiteollisuuden tulevaisuustyöryhmän raportti 31.5. 2006. Metsäteollisuus ry, Paperiliitto ry.

Suhdanne 2005/4. ETLA.

Suni Paavo, 2007 The 2000's and the Renewal of World Steel Market, Suhdanne 2008:1. Helsinki.

[http://www.etla.fi/files/2158\\_SUH\\_08\\_1\\_the\\_2000s\\_and\\_the\\_renewal\\_of\\_world\\_steel\\_market.pdf](http://www.etla.fi/files/2158_SUH_08_1_the_2000s_and_the_renewal_of_world_steel_market.pdf)

Suni P., Ahveninen H.: Cost Competitiveness of Chinese Manufacturing Industries from the Finnish Perspective. Prime Minister's Office Reports 3/2008.

UNIDO, 2008 UNIDO Statistics.