

# Quo vadis, cascading use of biomass?

**Policy paper on background information on the  
cascading principle provided  
by nova-Institute**

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## 0 Content and aim of the paper

Cascading use of biomass increases the resource efficiency, the sustainable use and the generation of value added from biomass and is part of the circular economy. This paper will first discuss benefits of and commitments to cascading use. A short look at current policy shows that the existing political framework does not support cascading use – on the contrary: it gives incentives for the direct energetic use of biomass. In a second step, the paper will highlight the most important arguments for and against cascading use that are currently on the table, since parallel to the increasing awareness and political commitments to the cascading principle, activities can be observed to discredit the cascading use of biomass. Showing the arguments against the cascading principle, putting them into context and commenting on them is the core of the paper. Finally, the results of a survey on barriers and hurdles for cascading use of biomass are presented.

The aim of the policy paper on cascading use is to provide experts in the field of bio-based economy with comprehensive background information on the cascading issue in order to be better able to share and join the recent discussion.

## 1 Benefits of and commitments to cascading use

The **cascading principle** is a strategy to increase the productivity of raw material. The European Commission and the European Parliament are aware of the importance of the concept to develop bio-based products, chemicals and materials and so the bio-based economy.

Cascading use of biomass increases the resource efficiency, the sustainable use and the generation of value added from biomass and is part of the circular economy (Carus et al. 2014). Creating higher resource efficiency also means to increase the general availability of raw material supply – because the biomass can be used several times.

Cascading use is an indispensable part of any resource efficiency and sustainability strategy. One is not conceivable without the other.

The UBA glossary on resource conservation (Kosmol et al. 2012) defines the **cascading principle** as a strategy to increase the productivity of raw materials:

“strategy for using raw materials or the products made from them in chronologically sequential steps as long, often and efficiently as possible for materials and only to recover energy from them at the end of the product life cycle. It is based on the use of so-called ‘**cascades of use**’ that flow from higher levels of the value chain down to lower levels, increasing the productivity of the raw material.”

The following references show that the European Commission and the European Parliament are aware of the importance of cascading use to develop the sector of bio-based products:

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“**Biorefineries should adopt a cascading approach** to the use of their inputs, favouring highest value added and resource efficient products, such as bio-based products and industrial materials, over bioenergy. The **principle of cascading use is based on single or multiple material** uses followed by energy use through burning at the end of life of the material, including taking into account the greenhouse gas emissions (GHG) mitigation potential. By-products and wastes from one production process are used to feed into other production processes or for energy. Biorefineries can thus contribute to the principles of a ‘zero-waste society’.” (European Commission 2012)

“**Bio-based products:** granting access to sustainable raw materials at world market prices for the production of bio-based products. This will require the application of the **cascade principle in the use of biomass** and eliminating any possible distortions in the allocation of biomass for alternative uses that might result from aid and other mechanisms that favour the use of biomass for other purposes (e.g. energy).” (European Commission 2014, p. 10)

“The Commission will ensure policy neutrality in access to biomass for different purposes to enable efficient application of the **cascade principle in the use of the biomass** to ensure an efficient and sustainable use of natural resources.” (European Commission 2014, p. 15)

Furthermore, the European Parliament emphasised the cascading use to be a substantial part of the Commission’s Bioeconomy Strategy:

“Emphasise [d] that bioeconomy policies must be better designed to **ensure a cascading use of biomass**; call[ed], in this respect, for the development of a legal instrument that will pave the way for a more efficient and sustainable use of this precious resource; stresse[d] that such an instrument should establish a cascading use principle in the ‘pyramid of biomass’, taking into account its different segments and strengthening it at its highest levels; point[ed] out that such an approach would lead to a hierarchical, smart and efficient use of biomass, to value-adding applications and to supporting measures such as coordination of research along the whole value chain”. (European Parliament 2013)

Cascading use of biomass (i.e. first material use and only then energy use) contributes to rational utilisations of biomass as a natural resource, since material use in bio-based products comes before a raw material is “lost” through burning. Therefore, the cascading use of biomass increases the resource efficiency and the total availability of biomass.

“The strategy of cascading use of biomass can make a decisive contribution to raising resource efficiency.” (Essel & Carus 2014)

A recent LCA study on different wood cascades shows in most of the cases lower environmental impacts for cascading compared to an energetic use. (Höglmeier et al. 2015)

## 2 Political framework of cascading today

The existing political framework does not support cascading use – on the contrary: it gives incentives for the direct energetic use of biomass.

“The RED does not offer any incentives for cascading use and is therefore not conducive to promote a circular economy and resource efficiency.” (Carus et al. 2014)

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“The material use of biomass is not financially supported at present. It is hardly competitive compared to energy use. A number of different programmes and regulations encourage the farming of energy crops and their processing for direct use as energy, in part through tax benefits. This increases the demand for biomass and thus its price, which in turn triggers higher prices for farmland and soil and ultimately prevents any cascading use that is ecologically and economically viable.” (UBA 2014)

Negative impacts of this policy on the development of bio-based chemicals and materials have been documented through:

“a collection of evidence illustrating the negative effects of the bioenergy and biofuel support on a variety of branches using biomass for industrial material use. Newspaper articles, primary research and most of all statements from directly affected companies clearly show the extent of the market distortion. All of the companies see an unfair competition for their different bio-based raw materials that stems from the Renewable Energy Directive and they see very concrete negative impacts on their businesses.” (Carus et al. 2014, p. 15-21)

Different national and European expert groups are developing proposals on how to integrate cascading use in existing and new political frameworks.

### 3 Recent arguments against cascading use

Parallel to the increasing awareness and political commitments to the cascading principle, strong and coordinated activities from the bioenergy sector can be observed to discredit the cascading use of biomass. What are the arguments against the cascading principle?

**“A binding cascading principle cannot be implemented – it is too expensive, too complicated and will have negative impacts.”**

„... the cascade principle should not be made legally binding, as there is no economic or practical justification that such provisions will promote the competitive and sustainable use or supply of wood. ... In practice, the functionality of a legally binding cascade principle is highly questionable. National and regional circumstances vary greatly regarding forest resources, as do their development, industry capacity, wood markets, and energy systems. Therefore determining “low-value” or “appropriate” use of wood at EU level would go against the market economy principle and would not guarantee resource efficiency.“ (AEBIOM 2013)

*nova comment:* Nobody has ever seriously proposed to implement a legally binding cascade principle. Instead of creating an extreme scenario, arguing against cascading use and defending the political status quo, it would make much more sense to develop concepts to ensure that those parts of the wood, which can be used as materials, are not allocated to energy (which is exactly what is happening right now).

“It is definitely not a sustainable solution to only support the bioenergy sector and at the same time not even to promote cascading use. The resource efficiency and climate protection gains that are achieved by multiple substitutions of raw materials have been proven several times. So the question left to debate is not whether to support cascading use, but only how to do it. In that regard, the critical remark “in practice, the functionality of a legally binding cascade principle is highly questionable” is indeed justified.

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The paper has one valid point, namely that a “legally binding” approach may not be the most appropriate way to get the best results. It is a legitimate question whether this could be effectively regulated at EU level. However, that is the only instrument being discussed in this context, without acknowledging any other potential instruments.

But several other instruments are conceivable that could support cascading use without a “legally binding cascade principle”. For example, wood utilized as energy that stems from a cascade could receive double counting in the RED, because the energy substitution is already the second (or even third) substitution after the substitution of the wood-based product before, and perhaps of a second wood-based product after recycling. ... The double counting is justified by the fact that a cascading use leads to an – at the minimum – double substitution of fossil counterparts – first by replacing a conventional product, possibly even several times in case of recycling, and at the end of the life, a fossil energy source will be substituted by the same material.” (Carus et al. 2014)

In contrast to a binding cascading principle, the soft implementation of intelligent incentives would make sense, which are under development in several European and national projects. Why should a rational principle like the cascading use of biomass be prevented by policy actions before it has ever been implemented and tested on a larger scale in reality?

Another interesting point is that the fight against cascading use is in reality a fight against the material use of biomass: If a bio-based product is created from biomass, the waste hierarchy governs cascading use anyway – but not before. **That means that the cascading principle closes the gap between biomass utilisation and the waste hierarchy.**

It is a paradox situation: Before the biomass becomes a bio-based product, incentives lead the biomass directly to energetic use, while after the biomass has been turned into a bio-based product, incineration is only the least preferred option in the waste hierarchy.

Imagine someone would state that the functionality of the legally binding *waste hierarchy* is highly questionable – because they would like to incinerate the waste and fear complicated regulations and market interventions. They would be someone of the past. The waste hierarchy is widely accepted in the political sector. But only the cascading principle guarantees that biomass enters the waste hierarchy at all, since direct energy use circumvents it.

### **“Fear of strong market interventions, new regulations and bureaucracy”**

Biomass producers fear that they will no longer be able to sell their raw materials on a free market to the customers of their choice – if a binding cascading principle is implemented.

*nova comment:* The bioenergy and biofuel sector is a regulated market with incentives and artificially high prices for biomass. So there already is a strong market intervention and the cascading principle can level this existing market distortion. Therefore, the promotion of the cascading principle would foster a level playing field for the use of biomass.

Another option could be to stop all incentives, to implement no incentives for cascading use and to abolish the incentives for bioenergy and biofuels. Then the biomass would mainly go to those applications with the highest value added – which would be mostly material use as a starting point for cascades.

If the support for bioenergy were to remain as it is, the material use should also receive some incentives to create a level playing field.

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## **“Fear to have limited access to biomass”**

The bioenergy and biofuel sector fears to have limited access to biomass. There already is a competition for biomass between the different sectors food, feed, materials, bioenergy and biofuels. If the biomass is channelled into the material sector first (bio-based products) and then in the cascade, there will be a long delay until the bioenergy sector can access this biomass. Another argument is that the material sector is small and will create a bottleneck for the bioenergy sector if there is a binding cascading principle.

*nova comment:* It will be an advantage for resource efficiency and sustainability and the overall amount of available biomass, if more biomass is used as material first. If the cascading principle is applied, the biomass allocation will change definitely. This is the target of the cascading principle.

Increasing the resource efficiency also results in the increase of the general availability of biomass and in a strengthening of the raw material supply – because the same amount of biomass can be used several times.

## **“How to meet the climate targets if less biomass is utilized for energy?”**

A further concern is that the binding reduction targets for greenhouse gas emissions will not be reached if the energy sector loses biomass.

Heinz Kopetz, President of the Board of the World Bioenergy Association. “Europeans are getting lost in minor issues such as cascading [a hierarchy of use], ILUC [indirect land-use change] and opposition to first generation biofuels, when the most urgent problem is climate change.” (Van Renssen 2015)

*nova comment:* This is paradox but the bioenergy industry is not to blame: It is much more a deficiency of the political framework, since the material use of one tonne of wood saves at least just as much CO<sub>2</sub> as the energy use of the same amount (each compared to their fossil counterpart), it is just not accounted for in the RED or the ETS.

Relatively recent changes of the accounting rules for greenhouse gas (GHG) emissions and removals from the LULUCF sector consider at least the carbon stored in the lifetime of harvested wood products, which are the most relevant product group in the cascading discussion, in the national inventories of the member states. The perambulatory remarks of Decision 529/2013/EU state that

“the increased sustainable use of harvested wood products can substantially limit emissions into and enhance removals of greenhouse gases from the atmosphere“ (529/2013/EU).

In cascading use biomass can substitute several fossil counterparts and the GHG emission reduction can be much higher compared to bioenergy or biofuel (per tonnes of biomass). Cascading use of biomass should be included in the policy agenda to reach the climate targets.

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“Through the double substitution achieved by material use, more CO<sub>2</sub> is reduced over the whole lifecycle (from-cradle-to-grave) than compared to direct energy use.” (Carus et al. 2014, p 37)

## **“How can we guarantee energy security and less dependency on imports if the cascading principle will come into force?”**

*nova comment:* It makes no difference whether we substitute for example imported natural gas or crude oil in the energy sector or in the chemical industry. Both sectors can reduce the dependency on imports and we have to foster not only energy, but also material security. (Furthermore, bioenergy and biofuels already depend on the import of biomass; the share is estimated to lie at about 20 % of the overall amount of biomass used in the European energy sector).

It is important to guarantee the supply security of feedstocks for high value industries, in order to prevent them from leaving Europe and taking their value and employment with them. The affordable access to biomass plays a crucial role in this. Every development of the political framework for the bio-based economy should keep this in mind.

Another argument against the cascading principle is that bioenergy and biofuels are the only way to store renewable energy in solid, gaseous or liquid form. However, since Carbon Capture & Utilization (CCU) technologies can transform solar and wind energy into gaseous and liquid fuels with high efficiency (power-2-gas and power-2-liquid), there is an interesting alternative to bioenergy and biofuels. (Dena 2015)

## **4 Survey on barriers and hurdles for cascading of biomass**

In 2014, nova-Institute conducted a survey on barriers and hurdles for cascading use of biomass. 38 associations, companies, public services and research organisations took part in the survey.

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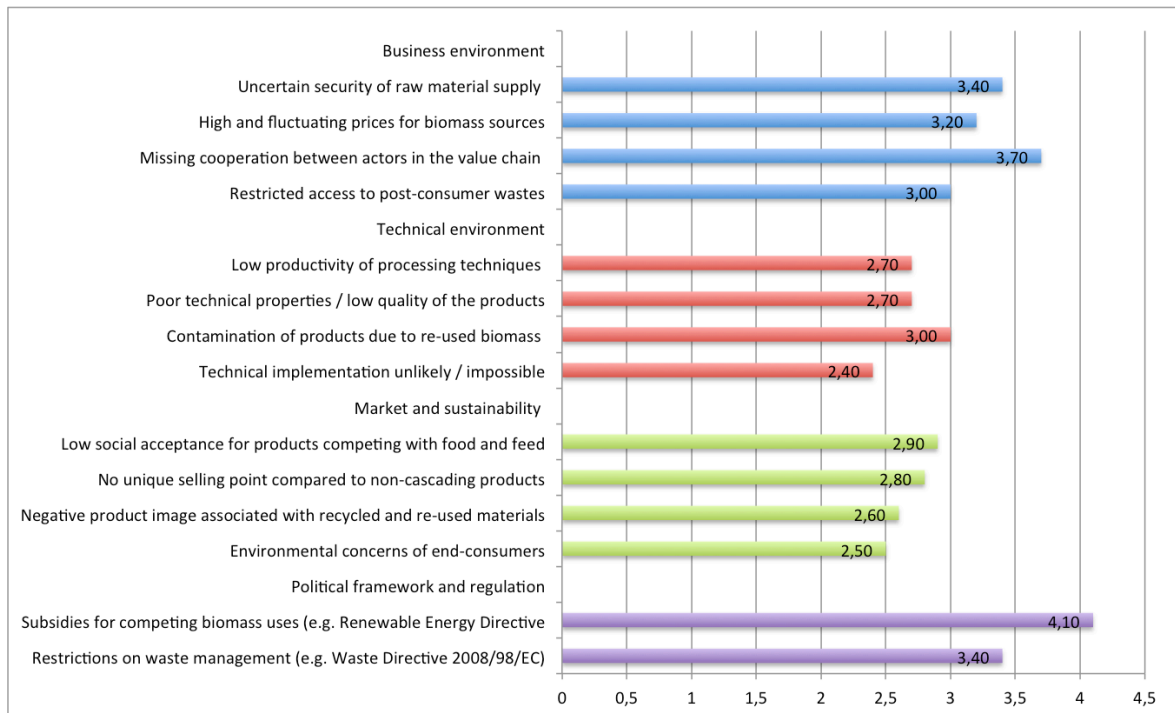


Figure 1: Overview of average rating values of all barriers on a scale from 1 (no barrier) to 5 (strong barrier) (Source: Essel et al. 2014)

In the section “Political Framework and Regulation”, both factors were rated as strong barriers. With an average value of 4.1, “Subsidies for competing biomass uses” was rated as the strongest impeding factor, which includes most prominently the incentive scheme for bioenergy based on the RED. Restrictions based on the Waste and Product Recycling Law are of high importance (average value 3.4) from the perspective of the participants, but not as crucial as the subsidies for competing biomass uses. Market interventions by the state are seen as strong barriers for the cascading material use of biomass.

In the section “Business environment”, all factors were evaluated to be rather strong barriers, too. The lack of cooperation between actors in the value chain was evaluated as the biggest hurdle (3.7). Uncertain security of raw material supply was rated at 3.4, while high and fluctuating prices for biomass as well as restricted access to post-consumer wastes were deemed to be relevant barriers, too (3.2 and 3.0). The cooperation within the value chain is especially important for those companies that utilize by-products or wastes. Since in these cases, raw material supply is directly dependent on the availability, processing and use of the main product, this is not surprising.

In the technical environment, especially the contamination of products due to the re-use of biomass is seen as a relevant barrier (3.0), followed by low productivity of processing techniques and low quality of products (2.7 each). A general unlikelihood or difficulties in implementation is not seen as a truly important barrier (2.4).

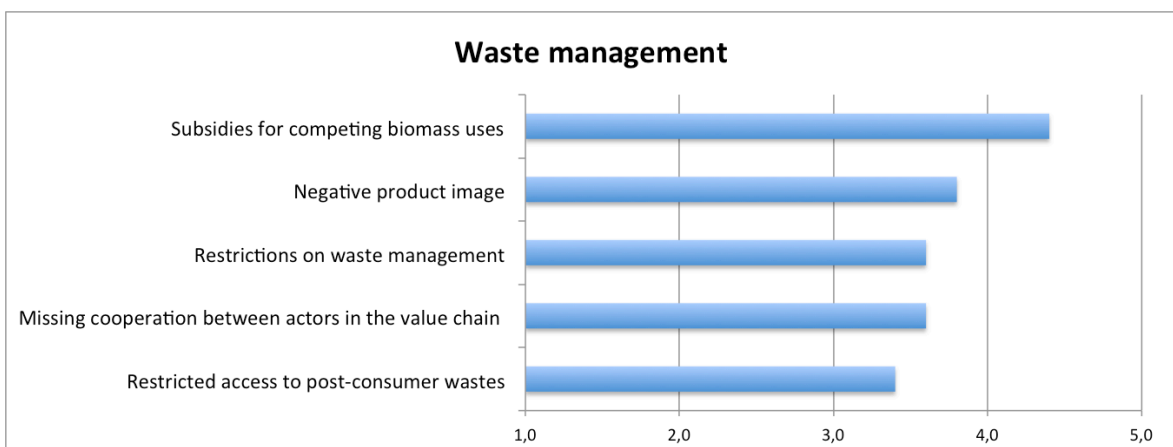
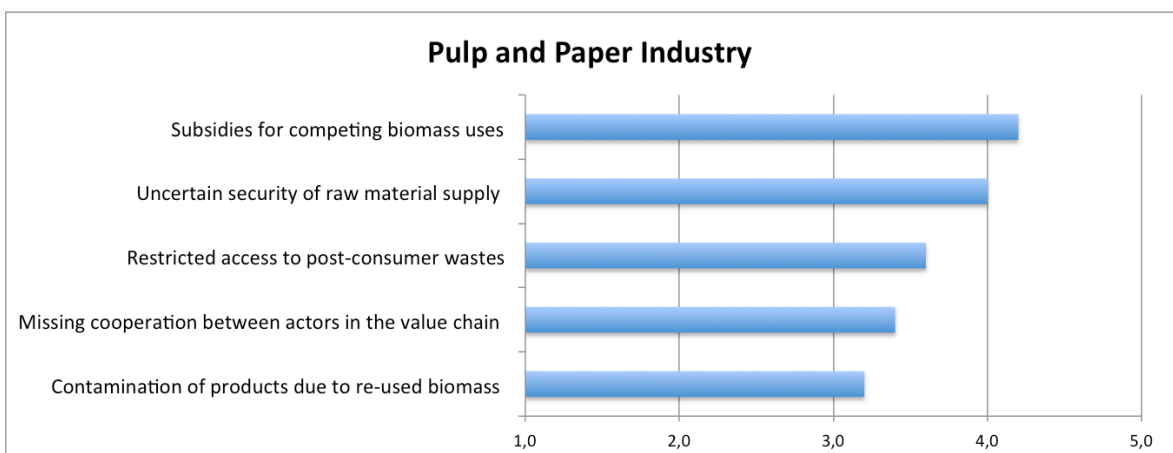
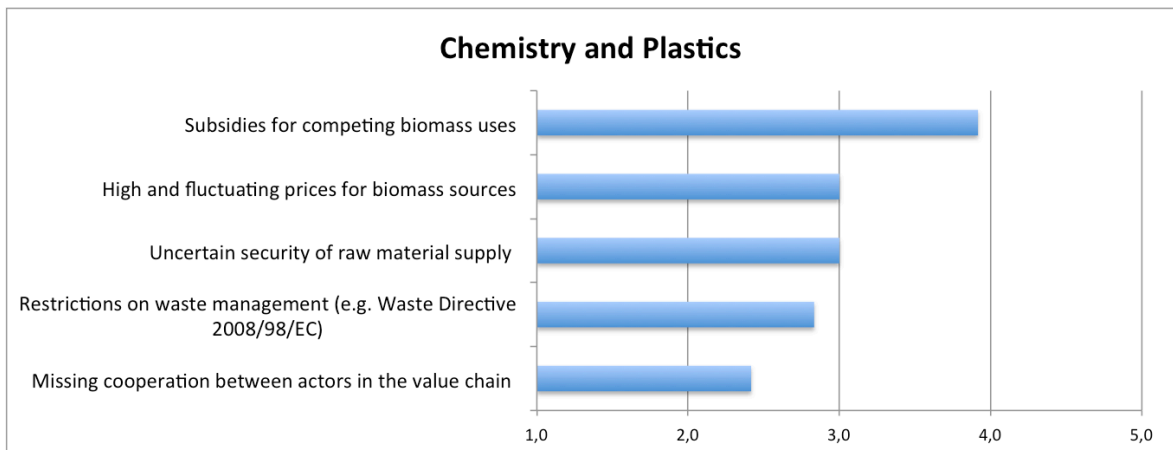
In the section “Markets and Sustainability”, the competition of bio-based products with food and feed and the resulting low market acceptance of these products were seen as a relatively strong barrier (2.9). Respondents predominantly think that their products from a cascade will have no unique selling point compared to non-cascading products (2.8), which means that cascading use does not give any marketing advantage. However, it is not really feared that the re-use of raw materials will lead to a bad product image either (2.6). There-



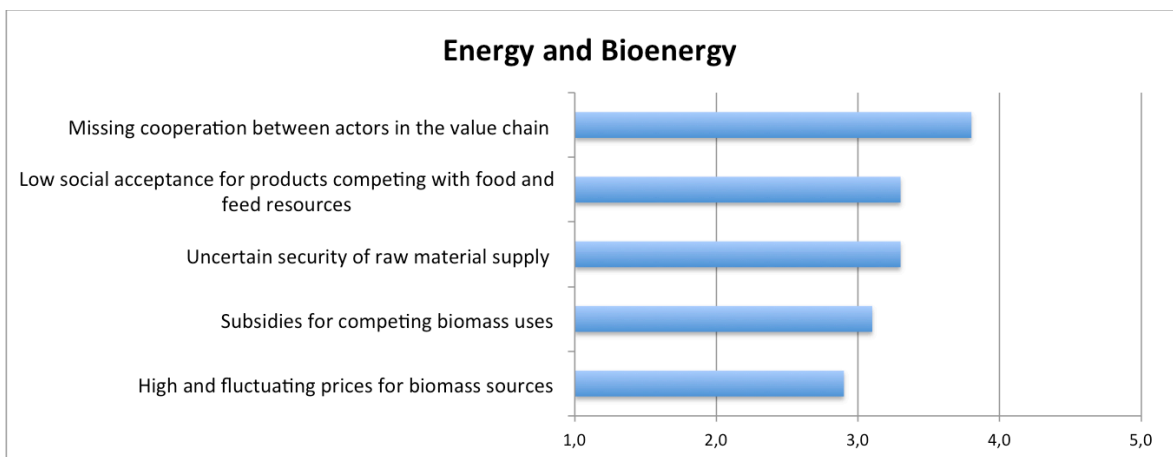
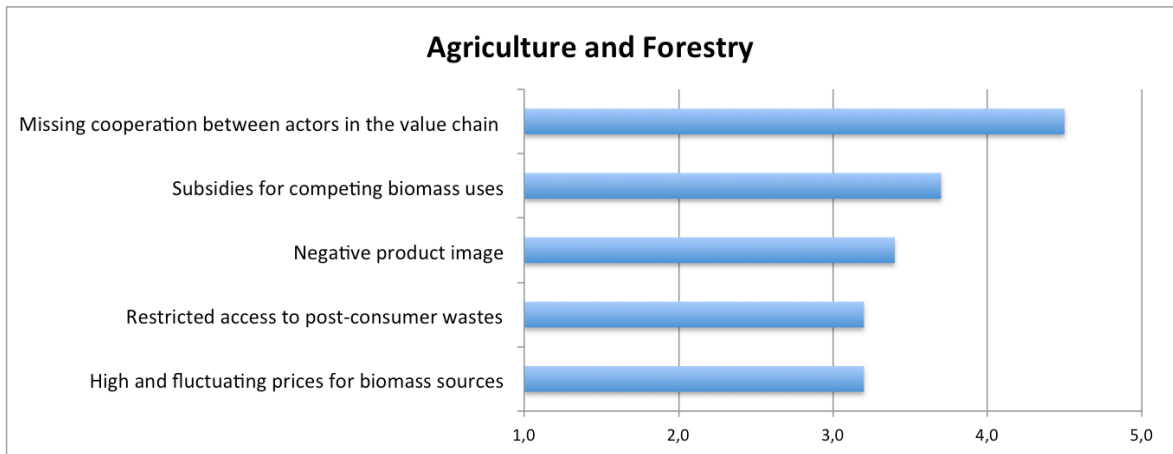
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fore, cascading use is a strategy that is communicated more between processing companies (B2B) than between companies and end users (B2C).

The next figures (source: Essel et al. 2014) show the ranking sorted by respondents from different economic sectors. While the industrial players (chemicals and plastic, pulp and paper, waste management) rate “subsidies for competing biomass uses” as the main barrier, the respondents from agriculture and forestry as well as those from the bioenergy sector rate “missing cooperation between actors in the value chain” as the biggest hurdle.



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