Partnerships for Successful Enterprise Transformation of Forest Industry Companies Implementing the Forest Biorefinery

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Abstract: Increasingly, forest product companies are seeking to diversify their revenues, and improve their profitability via implementation of the forest biorefinery. This paper considers the overall approach that forestry companies might consider for the implementation of the forest biorefinery, the enterprise transformations implicated, and, most importantly, the partnerships that must be created in order to mitigate risk and enhance the potential for success of biorefinery implementation. Forestry companies that limit their consideration of the biorefinery as an investment in projects that yield interesting returns in the short term, such as pellet mills or biofuels, may or may not be successful at transforming the business models of their companies in the longer term. The recommended approach is to identify new added-value biorefinery products to be manufactured over the longer term, the new supply chain mechanisms needed for their efficient delivery, and importantly, the quality partners needed to be successful in this objective.

The forest biorefinery (FBR) is increasingly being considered by forest products companies as a viable business option to diversify and grow revenues – while at the same time potentially resulting in significant reductions of greenhouse gas emissions. In practice there are many possible biorefinery routes, i.e. product and process combinations that might be feasible for a company, but only a few options will bring sustainable competitive advantages. The forestry industry, at the same time struggling with its economic stalemate situation [1], must capture the intrinsic value of its existing activities while identifying these viable new product/process opportunities. Critically, the company’s enhanced product portfolio after biorefinery implementation, i.e. traditional pulp and paper products plus new biorefinery products, must be systematically identified in order to maximize the likelihood for successful transformation. At the same time as assessing the enhanced product portfolio, the technical, techno-economic, and commercial risks associated with each strategy must be identified and mitigated.

The development and the integration of a slate of new products into an existing product portfolio requires the selection of viable biorefinery processes permitting the manufacture of the products at a competitive price (key to the technology strategy), and the identification of promising products for the market including their penetration via efficient delivery systems (key to the business strategy). The forest industry, vested in a commodity and manufacturing-centric core business, must be prepared to transform in order to compete in new competitive markets such as the biofuels and added-value biochemicals markets. In this context, forestry companies must recognize their competitive weaknesses and maximize their existing competitive strengths in order to establish successful biorefinery strategies.

One of the immediate priorities of forestry companies is thus establishing ‘quality’ biorefinery strategic alliances with other companies that enable risk mitigation/sharing, and value creation via assets sharing. One type of strategic alliance referred to in this paper is that of the value-chain partnership, which can be defined as “companies in different industries with different but complementary skills which link their capabilities to create value for ultimate users.” [2]

There are several partner and partnership model scenarios that potentially offer competitive advantages over the longer term. The strategic compatibility of business models and visions, the long-term capital investments required, and the potential revenue diversification are critical elements in partnership creation. However, how to identify the best partner and partnership model enabling the creation of sustainable competitive advantages is not obvious.

One strategy is to implement the biorefinery via a phased approach that supports a targeted new product portfolio [3]. According to this strategy, forest companies gradually implement the biorefinery by lowering manufacturing costs, diversifying the product slate, and finally optimizing existing delivery systems and supply chains. Most importantly, these phases must be supported by the selection of appropriate partners and partner-
ship models. Depending on the business model targeted by a forestry company, different technological, commercial, and financial partnership strategies could be considered [4].

The phased implementation of the biorefinery implies Enterprise Transformation (ET). ET is a core strategy of leading companies for enhancing organizational performance to stimulate attractive profits that are sustainable over the longer term. In this manner, ET should become the recognized target for forestry companies embarking on the FBR. The value capture subsequent to FBR implementation is expressed through ET and should significantly help the forest sector focus on achieving a new competitive position in the market by becoming margin-centric, for example. The overall benefit of the FBR must not be limited to revenue increase or product diversification in the short-term, but rather should target an improved business strategy over the intermediate term [2].

In implementing the FBR, forest product companies must understand the linkage of markets/products/processes and partnership selection with business models and ET in order to create and secure value over the long term.

OBJECTIVE
In order for forestry companies to successfully implement the FBR, it is critical that competitive disadvantages such as access to capital and other factors be addressed through strategic partnerships and partnership models. The objective of this paper is to demonstrate the importance of developing a long-term, sustainable biorefinery vision, as opposed to considering only short-term cash flow objectives, and the linkage of this with partnership selection.

SOME PARTNERSHIP EXAMPLES FOR FOREST BIOREFINERY DEVELOPMENT
As market interest increases for carbon-neutral alternatives to petrochemical products, including biofuels and added-value biochemicals, strategic R&D partnerships for technology development and/or market access are being announced, mainly in the chemical and petrochemical industries (Fig. 1). The strategy of building such non-traditional partnerships is gaining the interest of forestry companies that are considering FBR implementation and company transformation.

Working on the extension of its product portfolio, UPM-Kymmene has developed a strategic partnership with Andritz-Carbona in order to cooperate on the development of a technology for biomass gasification and biodiesel production. Biodiesel has been recognized by UPM-Kymmene as a "natural extension for companies whose core business is now newly defined as adding value to wood raw material." [5]

In North America, the forestry company Weyerhaeuser, in collaboration with Chevron, has created a joint-venture called Catchlight Energy LLC. Each company contributes to the JV, whose goal is to develop economical, low-carbon biofuels while maximizing each company's competitive advantages. Catchlight Energy LLC offers a strategic, low-risk diversification opportunity to both participating companies. Other partnerships with universities, laboratories, and technology-based companies support the development of second generation biofuels.

Another interesting example is that of StoraEnso, which signed an agreement with Neste Oil to develop technology for the production of biofuels, e.g. biodiesel from wood residues [6]. In this case, each company defined its contribution to the joint venture, such as biomass supply in the case of StoraEnso, and refining and marketing of the end-product in the case of Neste Oil. More recently, StoraEnso has announced that they are seeking to manufacture beyond biofuels production, and develop for added-value chemicals production.

These forestry companies have embarked on partnership development with specific implications to the supply chain, and may partner with other stakeholders who offer complementary skills across the supply chain to maximize the partnership outcomes [7]. Different kinds of partnership models can be established, depending on the company's business model, and vision and mission for the company over the longer term. As per the above examples, efforts must identify the right partner and partnership model in order to implement the biorefinery successfully using less-risky approaches.

PARTNERSHIPS FOR THE FOREST BIOREFINERY
If the FBR is considered by forestry companies as another capital spending project seeking an interesting internal rate of return (IRR) in the short term, then the likelihood of company failure may well increase in the longer term [8]. The FBR represents a unique opportunity to gradually diversify revenues and transform the core business of forestry companies. The FBR thus implies the determination of an evolving product portfolio including traditional pulp and paper products as well...
as new biorefinery products [2]. Then a suitable technology strategy should be developed that serves the business strategy associated with the new product portfolio, as well as the modes of product delivery and associated enterprise transformation.

Successful large product diversification for a company is a strong function of its strategic alliances [9]. Partnerships can facilitate critical issues such as accessing complementary assets and know-how, reducing time to market, mitigating risks, sharing investment costs; hence partnerships can increase the probability of capturing (and sustaining) first-mover advantages [10]. This is especially true for the financially distressed forest industry which must gather the capital required for FBR transformation.

Fig. 3: Strategic phased implementation of the FBR

Fig. 4: Example of evolved product portfolio for a forestry company implementing the biorefinery

Partnerships for the FBR are critical in order to (1) meet profitability targets by milestone dates, (2) reduce transformation risks associated with the manufacture of new products intended for new markets, (3) ensure rapid and efficient business development of the biorefinery ahead of potential competitors, (4) secure competitive advantages in the short term, (5) enter an existing value chain to mitigate market risk, and (6) efficiently set up new and ideally unique supply chains.

Partner selection

Benefits of partnering may well decrease as the number of partners increases [5], if a strategic approach is not well-defined. In fact, not all strategic alliances bring a competitive advantage nor will they necessarily ensure a sustainable business model over the long term. The selection of the “best” partner(s) is thus necessary, but not obvious.

Many possible partnerships can be identified from a forestry company perspective for enhancing the potential for successful FBR implementation (Fig. 2). At the operational level, feedstock partners could increase feedstock supply and lower overall feedstock costs secured for the long-term. Commercial partners, for example chemical companies and/or logistics partners, could better enable product development and its efficient delivery to the market. Outside the operational level, technology partners could bring a short-term competitive advantage providing the opportunity to be first-to-market for targeted green biorefinery products. Finally, financial partners, such as equity partners, can help address the complex issues associated with the required large project investment, which must be invested over the long term in order to transform the company.

Opportunistic or strategic partner selection should be made in order to identify “quality” partners [11]. Among the possible selection criteria, some are essential, such as (a) the perspective of each potential stakeholder(s) and (b) the identification of key drivers for partnering. The partnership should enable the creation of unique competitive advantages via, for example, (a) the development of a slate of products that will be part of the new product portfolio of the forestry company, and (b) the delivery of products to the market via the exploitation of existing value chains coupled with the design of a unique and efficient new supply chain.

Through a panel discussion that included (1) a major chemicals company, (2) a major forestry company, and (3) a leading biorefinery technology provider, the following elements were identified as among the most critical for establishing the long term business alliances essential for the success of the FBR [3].

The executives of partnering companies must have an expressed company strategy that embraces the biorefinery in order to justify the long-term commitment needed for its implementation. Equally important, the partnering companies must come to agreement regarding partnership control and management in order to enhance business success [12]. Thereafter, biorefinery partnerships should bring value to stakeholders relative to the risk taken by each of the partners. For example, the partial and/or complete integration of a corporation’s core business into the partnership business model should be determined in order to best serve the long-term returns sought by the partnership, while preserving interim cash flow and other requirements. For the case of forestry companies that may have difficulty obtaining the necessary capital to invest over the longer-term, this may, for example, involve sacrificing some of their best assets to the partnership.

The existing strategic business model of each company must embrace the biorefinery concept.

The biorefinery product portfolio vision should be well-defined, but flexible in its definition for the longer term.

The value offered by an expanded product portfolio resulting from biorefinery implementation should be recognized by the partners. For example, the potential to mitigate the risk due to uncontrollable factors, such as price volatility, via the development of an appropriate product portfolio will greatly enhance the long-term viability of a partnership. In the case of forest product companies, for example, it is critical that existing assets be considered for incorporation into the partnership so that a unique supply chain can be exploited. In contrast, the model
where forestry companies supply biomass to a joint venture that processes this into primary chemicals for sale to a chemical or energy company may not result in a company transformation to a profitable business model in the longer term.

Biorefinery process technologies are emerging and future market conditions are difficult to predict due to ever-lower oil reserves and emerging carbon policy. The partnership model should thus allow for flexibility in the terms and conditions needed to change and thus sustain the partnership under changing market conditions.

Financial risk mitigation for each partner: “One project, one site at a time.”

Financial risk identification and mitigation is a critical concern for any partnership, and is perhaps particularly complex in the case of the biorefinery where substantial outlays of capital are required over a period of years. Further, in the context of a company-to-company partnership, financial risk is difficult to recognize in the partnership model. A careful product portfolio expansion is required where, for example, targeted added-value bioproducts are to be made and a market segment dominated by the new joint venture company. This should be implemented in a number of implementation phases, each of which must be financially attractive. The approach of creating a long-term partnership vision, implemented one project, one site at a time, and incorporating contractual flexibility is crucial to mitigating financial risk associated with the partnership.

FOREST BIOREFINERY IMPLEMENTATION STRATEGY

As forest companies pursue different FBR strategies, various approaches will emerge, including (a) deferring an investment in biorefinery processes until they are well-proven and relatively risk-free, (b) focusing on cost reduction strategies related to FBR opportunities and implementing projects to replace fossil fuel use or produce commodity biofuels, (c) moving beyond cost enhancement to produce new added-value bioproducts resulting in revenue growth and some improvement in business model profitability, and (d) moving to a new business model where the ultimate goal is sustainable margin enhancement for the long term [2].

For companies seeking to transform their business into profitable enterprises, the final option is undoubtedly the vision to be embraced. To achieve this, companies must implement a series of technologies and produce a portfolio of new products.

The successful implementation of the FBR at an existing pulp and paper mill might be achieved using a strategic phased approach, taking into account short, mid- and long-term goals expressed in Fig. 3.

Biorefinery Phase I – Lowering operating costs

Lowering mill operating costs by replacing fossil fuel use at the mill via the production of biofuels represents an interesting alternative to address in part the current economic stalemate situation of forestry companies. This first biorefinery product could be consumed by the mill itself to replace fossil fuels in the short term, or could entail the manufacture of biofuels for the market. It should be considered as a “building block” process for the production of added-value chemicals at a later point in the biorefinery development. The viability of these projects is based in the emergence of policy and regulations related to global warming, as well as the volatile and increasing price of petroleum. This preliminary phase of the biorefinery should also ensure a long-term viable price of a large volume of biomass for the forestry company core business at the same time. Alone, this biorefinery implementation phase will assist to lower costs, but does not result in company transformation nor render the forestry operations competitive for the longer term.

Biorefinery Phase II – Value creation

The goal of this biorefinery implementation phase is to increase revenues through the production of added-value biochemicals and diversification of the existing product portfolio. The new revenue streams may be from the development of a biorefinery product family based on the chemical “building block” produced in Phase I, or companies may wish to invest directly in process technology for bioproducts that diversify revenues. At this stage, strategic definitions of process/product combinations, product delivery to the market, competitive position of product on the market, and flexibility of the product family are essential in order to successfully determine the evolving business model. The modified product portfolio might be implemented gradually one project at a time, at several mills, and support the creation of value over the long term. Partnerships are thus essential in order to minimize technical, commercial, economic, and financial risks.

Biorefinery Phase III – Value maximization

The goal of this phase is to maximize the operating margins from the transformed company, and improve bottom line results through the re-engineering of supply chains, systems that exploit manufacturing flexibility, new delivery mechanisms, etc. Partnerships are critical also at this stage in order to optimize the results of the new delivery systems [13].

Linkages of Strategy with Enterprise Transformation

Enterprise transformation is a core strategy of some leading companies to increase profits sustainably over the longer term. In the case of so-called “inside-out enterprise transformation”, the current mission/vision of the company is maintained, but the company is made-over from bottom to top in terms of their processes. On the other hand, “outside-in transformation” is when the core vision/mission changes. In this case, the targeted service or product is changed for a company as well as the way it is delivered. Naturally, this must be done in a manner synergistic with the core business and competency of the pre-transformed company, e.g. UPS has become “Big Brown” and focuses on delivering supply chain services in and around their basic courier service. The forest industry transformation to the biorefinery requires achieving both of these transformations.

In addressing Phase II of this transformation, the company must see itself as ultimately committing to the manufacture of new biorefinery products in the context of a change in the core business, and not simply as a revenue increase. If the context of the biorefinery investment is in a separate JV, then the forestry company will have achieved inside-out transformation but not outside-in transformation. The manifestation of both transformations is complete only after the execution of Phase III, where the new product portfolio is delivered using new business processes.
Building Strategic and Sustainable Partnerships

Employing the phased approach described above will lead forestry companies towards the identification and formation of partnerships during the early stages of FBR implementation. This is because whereas a systematic product and market analysis may lead to a number of potentially successful business plans, there will be a smaller number of “quality” partners available to forestry companies for the biorefinery, and it will be essential to negotiate and partner with these before other companies who are potentially competing in bioproduct markets.

Financial partners could be considered at each phase of the strategy in order to bring sufficient financial capacity to the FBR project. The financial partners could be limited to the role of investment, or could at the same time be the operating partner for the enhanced product portfolio.

Below, some examples are presented in order to illustrate partnership opportunity during this phased approach. Issues of interest for partnerships are presented in the context of a forest company’s overall vision, i.e. the approach to partnership will change depending on the perceived endpoint. In many cases today, a company’s endpoint might well be Phase I, i.e. lowering operating cost.

Biorefinery Strategy End-Point: Lowering Operating Costs

During the implementation of Phase I, a mill’s product portfolio is extended via the production of bioenergy products and/or a chemical building block, such as bioethanol or biodiesel. Several outcomes could emerge from this strategy as an end-point, including the following for examples:

- Lowering of delivered biomass costs due to the implementation of new and efficient biomass harvesting technologies that transport increased quantities of biomass to mill site;
- Reduction of the carbon footprint of forestry companies due to the elimination of fossil fuels, and benefits from trading the carbon credits;
- Reduction of mill operating costs via the replacement of fossil fuel at the mill, or marginal increase of revenues via the sale of commodity bioethanol into a fuel blend tank. However, except in unusual cases, finite bioethanol volumes will be produced (limited by biomass availability) at a given site and will be sold at commodity prices.

Associated with this as an end-point biorefinery strategy, two kinds of partners might be considered:

Feedstock partner – enabling economies of scale
Securing low-cost, sustainable access to additional quality biomass, i.e. forest and other biomass such as agricultural biomass, residues, and energy crops, could secure low costs for secure production of both pulp and paper as well as biorefining products.

Technology partner – enabling a short-term competitive advantage
Identifying partners whose technology would enable the cost-competitive manufacture of biofuels and at the same time would be prepared to commit to a single forestry company for a period of time, is not obvious. The technology partner, whose general goal is to accelerate the commercialization of the biorefinery technology, should be able to provide a competitive position to the forestry company in terms of low product manufacturing costs. Nevertheless, the speed of competing technology development on the market will likely only provide a short-term cost competitive advantage.

Biorefinery Strategy End-Point: Increase Revenues

Figure 4 illustrates an example of product portfolio development, which begins with the introduction of a product family based on the Phase I production of bioethanol followed by the implementation of ethylene and polyethylene in Phase II. Manufacturing flexibility enables stable revenue diversification by mitigating the effect of product price volatility [14]. Reducing product volumes along the biorefinery process chain is accompanied by increased process and market complexity, nevertheless, even accounting for yield loses from ethanol to polyethylene, overall revenues should increase [15].

The outcomes that could emerge from this strategy as an end-point include the following:

- Increased opportunity for process integration between the biorefinery and existing mill operations, resulting in lower unit production costs for pulp and paper products (depending on the site-specific processes and conditions) due to shared facilities and overheads;
- Increased opportunity for sales revenue from new products;
- Increased potential for synergies in product delivery logistics.

In addition to the partners associated with the biorefinery end-point strategy targeting cost reduction, partners could be considered for revenue diversification through new products delivery, based on enabling the efficient delivery and sale of products. The competitive advantage resides in the definition of an efficient and competitive supply chain via the selection of the right delivery product partner.

For example, this step might involve a commercial partnership between a forestry company and a large multi-national chemicals producer, who seeks access to lignocellulosic biomass needed to produce green products that replace or substitute existing fossil-based products. A robust business model, implying an outside-in transformation, is required in order to maximize the value of creating a new product portfolio, and in the case of the example shown in Fig. 4, the potential for selling flexible quantities of ethanol, ethylene and/or polyethylene depending on market conditions.

Biorefinery Strategy End-Point: Improve Profit Margins

Phase III is about value maximization via the optimization of product delivery systems, and other transformative changes that might take place such as outsourcing or off-shoring. The company should evolve the supply chain policy from being manufacturing-centric to margins-centric in order to deliver the new product portfolio [7]. Whereas the business model was essentially defined in Phase II of the biorefinery strategy, it is only with the Phase III end-point that significantly improved margins will be achieved via implementation of the biorefinery. In Phase II, the company would have identified the partners and products providing an interesting market. In Phase III, systems would be implemented to deliver the product portfolio including wood, pulp, paper, energy, and bioproducts in a supply chain that is unique to the newly-formed biorefinery company.

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For example, how can forestry companies address the issues that must still be addressed once poor-conceived strategy for its implementation and those who will proactively and strategically make decisions suitable for transforming their company into a unique new biomass-processing company making profits sustainable into the long-term.

The phased approach proposed here recommends the incremental implementation of the FBR over the long term, through (a) the identification of a long-term business model, and (b) the proactive creation of quality partnerships in the short term. Phase III of the overall strategy implies the definition of clear and achievable targets, as well as changing the mission and vision of the company over the long term. In this context, partnerships are essential for consolidating and securing value creation, as well as enabling the company’s transformation by addressing the company’s competitive disadvantages.

There are a number of key partnership issues that must still be addressed once the strategic approach has been fixed. For example, how can forestry companies quantitatively identify and recognize the benefits of implementing the FBR in terms of value creation, enterprise transformation, and associated risk identification and mitigation? What are the appropriate partnership models in order to best ensure the development of a viable product portfolio that is flexible with market conditions over the long term?

In implementing the FBR, forest product companies must therefore understand the linkage of markets, products, and processes with partnerships and business models. Different biorefinery strategies will lead to different levels of FBR implementation, different partnership strategies, and different degrees of enterprise transformation.

DISCUSSION AND CONCLUSIONS

Different forestry companies have their own vision regarding the forest biorefinery. Certainly, there will be forestry companies who will not implement the biorefinery. There will be those who will employ a poorly-conceived strategy for its implementation and those who will proactively and strategically make decisions suitable for transforming their company into a unique new biomass-processing company making profits sustainable into the long-term.

The importance of partnering in order to implement the FBR shouldn’t bring additional complexity to the business model, but rather it should enable a better focus on core competencies, and allow biorefinery companies to optimize existing assets.

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Résumé: Les entreprises de produits forestières cherchent de plus en plus à diversifier leurs revenus et à améliorer leur rentabilité en implantant des activités de bioraffinage forestier. Ce papier considère les stratégies que ces entreprises pourraient adopter en matière de bioraffinage forestier, sur les transformations à apporter, et aussi sur les partenariats qui devraient être établis afin de réduire les risques et d’accroître le potentiel de réussite des bioraffineries. Les entreprises forestières qui considèrent le bioraffinage seulement comme un investissement classique dans des projets offrant des rendements intéressants à court terme, comme la fabrication de billes de bois (wood pellets) ou de biocombustibles, pourraient ne pas réussir à transformer leurs modèles d’entreprises à plus long terme. L’approche présentée souligne la nécessité de déterminer quels sont les nouveaux produits de bioraffinage à valeur ajoutée à fabriquer à plus long terme, les nouveaux mécanismes de la chaîne d’approvisionnement nécessaires afin de pouvoir les livrer plus efficacement, et plus important les partenaires stratégiques requis pour atteindre ces objectifs.


Keywords: FOREST BIOREFINERY, ENTERPRISE TRANSFORMATION, PARTNERSHIP, PRODUCT PORTFOLIO.