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Green Business development through Industrial Symbiosis. The GAIA model

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Grøn Forretningsudvikling
gennem Industriel Symbiose
'GAIA modellen'

Green Business Development
through Industrial Symbiosis
'The GAIA model'



DCEA
THE DANISH CENTRE FOR
ENVIRONMENTAL ASSESSMENT

DEN EUROPÆISKE UNION

Den Europæiske Fond
for Regionaludvikling



Vi investerer i din fremtid

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GAIA og Industriel Symbiose

GAIA and Industrial Symbiosis

Denne brochure fokuserer på udvikling og miljøvurdering af bæredygtige forretningsmodeller for Industriel Symbiose. En forretningsmodel for industriel symbiose beskriver, hvordan en virksomhed skaber værdi ved at udveksle overskudsressourcer som f.eks. restprodukter og energi med en eller flere andre virksomheder. Den præsenterede GAIA model er et værktøj til at arbejde med udvikling og bæredygtighedstjek af en forretningsmodel. GAIA kan gennem sit fokus på miljøhensyn komplementere andre og eksisterende forretningsmodeller, som f.eks. Business Model Canvas.

Det anbefales, at læseren allerede er bekendt med konceptet industriel symbiose. Ikke desto mindre gives en kort beskrivelse nedenfor.

This brochure focuses on the development and environmental assessment of sustainable business models for Industrial Symbiosis. An industrial symbiosis business model describes how a business creates value by exchanging surplus resources such as residual products and energy with one or more other companies. The GAIA model is a tool for working with the development and sustainability check of a business model. Through its focus on environmental concerns, GAIA can complement other and existing business model tools, such as Business Model Canvas.

It is recommended that the reader is already familiar with the concept of industrial symbiosis. Nevertheless, a brief description is given below

Baggrund

Background

Begrebet grønne eller bæredygtige forretningsmodeller er blevet buzz words, og der udvikles mange modeller i disse år. Grønne forretningsmodeller har til formål at genere indtægter og samtidig reducere den samlede miljøpåvirkning.

The terms green and sustainable business model has become buzz word and many models are being developed these years. Green business models aim to generate revenue while reducing overall environmental impact.

En vigtig udfordring er at besvare spørgsmålene: **Er forretningsmodellen grøn, og hvor grøn er den?**

Da en forretningsmodel ofte er rettet mod en begrænset del af værdikæden eller endda kun én virksomhed, mens bæredygtigheden bestemmes af, hvad der sker i hele værdikæden, er det afgørende at anvende et systemisk livscyklusperspektiv, når vi besvarer disse spørgsmål. Det er, hvad GAIA modellen hjælper med.

An important challenge is to answer the questions: **Is the business model green and how green is it?**

As a business model is often aimed at a limited part of the value chain or even just one business, while sustainability is determined by what happens throughout the value chain, it is crucial to apply a systemic life-cycle perspective when answering these questions. That's what the GAIA model helps with.



Mange virksomheder kan få mere ud af deres affald eller overskudsenergi ved at give/sælge dem til andre virksomheder i en industriel symbiose. For de modtagende virksomheder, er spildprodukter også ofte et billigere alternativ til nye ressourcer i egen produktion.

Many companies can get more out of their waste or surplus energy by giving / selling them to other companies in an industrial symbiosis. For the receiving companies, waste products are also often a cheaper alternative to new resources in their own production.

Fra industriel til bæredygtig symbiose

From industrial to sustainable symbiosis

Industrielle symbioser er deling af overskudsressourcer mellem to eller flere virksomheder, såsom materialer, energi, biprodukter og vand. Det kan også være fællesløsninger i logistik, faciliteter og ekspertise. Virksomheder kan være placeret tæt ved hinanden eller langt fra hinanden og de kan være i samme virksomhedskategori eller vidt forskellige.

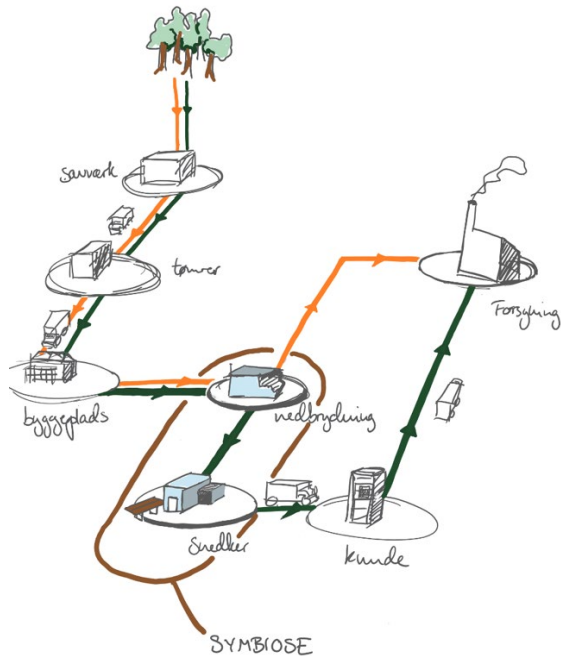
Industriel symbiose (IS) er i stigende grad set som et middel til at realisere en cirkulær økonomi og som et strategisk redskab til grøn vækst. IS er en innovativ måde at øge ressourceeffektiviteten på.

Bæredygtige Synergier er symbioser, hvor alle deltagere får fordele ved deling af ressourcer og hvor delingen skaber mere bæredygtige løsninger. Mange industrielle symbioser har potentialer for at skabe bæredygtige forbedringer, men nogle synergier har større effekter end andre. For at kalde en symbiose bæredygtig skal effekterne vurderes og dokumenteres. Bæredygtige Synergier skal være både miljømæssigt og økonomisk attraktive. Forretningsmodellerne skal derfor ikke tænkes snævert på økonomi, men i en bredere og systemisk sammenhæng.

Industrial symbiosis is the sharing of surplus resources between two or more companies, such as materials, energy, by-products, and water. It can also be common solutions in logistics, facilities, and expertise. Companies can be located close to each other or far from each other and they can be in the same industry or widely different.

Industrial symbiosis (IS) is increasingly seen as a means of realizing a circular economy and as a strategic tool for green growth. IS is an innovative way to increase resource efficiency.

Sustainable Synergies are symbioses, in which all participants benefit from sharing resources and where sharing creates more sustainable solutions. Many industrial symbioses have the potential to create sustainable improvements, but some synergies have greater effects than others. To call a symbiosis sustainable, the effects must be assessed and documented. Sustainable Synergies must be both environmentally and economically attractive. Therefore, the business models should not be focused narrowly on economics, but considered in a broader and systemic context.



*Industriel symbiose mellem nedbrydningsfirma og snedkeri.
Industrial symbiosis between demolition company and carpentry.*

Nedbrydningsfirma/Demolition company	Snedkeri/Carpentry
(Leverer genbrugstræ supplies used wood)	(Modtager genbrugstræ til bord – receives wood for furniture)
Reduceret omkostning til affaldsbortskaffelse Reduced waste disposal costs	Reduceret omkostning til indkøb af nyt træ og mindre stål Reduced costs of purchasing new wood and less steel.
Bedre image Better image	Øget adgang til marked for bæredygtigt design Increased market access for sustainable design.

Virksomhedernes forretningsmodeller / The companies' business models

At tænke systemisk

To think systemic

Virksomheder er systemer i sig selv, og er del af større systemer. Udtrykket 'systemtænkning' refererer til en tilgang, hvor en enkelt virksomheds forretningsmodel analyseres ud fra de systematiske konsekvenser, de har – både internt og eksternt i forhold til virksomheden.

Eksemplet med symbiosen mellem nedbrydningsfirmaet og snedkeriet viser også, at der er konsekvenser uden for selve virksomhederne:

- Nedbrydningsfirmaet leverer nu mindre affald til forbrænding. Forsyningen må nu erstatte med det som er marginal energi, hvilket i dette tilfælde er kul.
- Snedkeriet aftager nu mindre nyt træ til produktion af borde. Konsekvensen er, at der i princippet fældes, forarbejdes og transporteres mindre nyt træ.
- Stellet kan simplificeres grundet bedre planker.
- Snedkeriet indfører en ny proces, da genbrugstræet skal rengøres før brug.

Companies are systems in themselves, and are part of larger systems. The term 'system thinking' refers to an approach where an individual company's business model is analyzed based on the systematic consequences they have - both internally and externally in relation to the company.

The example of the symbiosis between the demolition company and the carpentry company also shows that there are consequences outside the companies themselves:

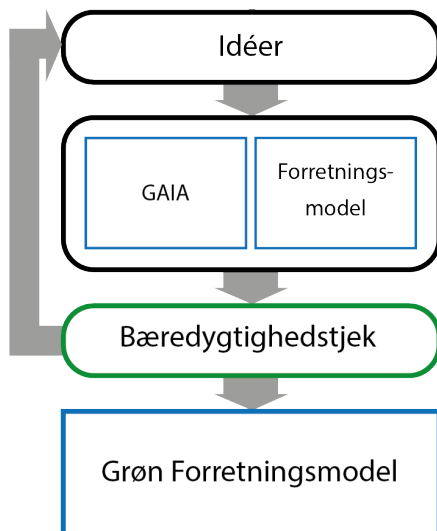
- The demolition company now supplies less waste for incineration. The supply must now be replaced by what is marginal energy, which in this case is coal.
- The carpentry company now purchases less new wood for the production of tables. The consequence is that, in principle, less new wood is felled, processed, and transported.
- The frame can be simplified due to better planks.
- The carpentry is introducing a new process, as the recycled tree must be cleaned before use.

En systemisk tilgang er nødvendig, når man som virksomhed overvejer at etablere grønne tiltag. GAIA hjælper med vi får øje for og beskriver de ændringer, som f.eks. genanvendelse vil kunne forårsage på forskellige relaterede systemer. Når felterne i GAIA er udfyldt, er det muligt at vurdere den samlede konsekvens af tiltaget: Er det overordnet set en god eller en dårlig idé miljømæssigt set?

A systemic approach is necessary when considering the establishment of green initiatives as a company. GAIA helps us spot and describe the changes, which for example recycling can cause on various related systems. When the fields in GAIA are filled in, it is possible to assess the overall consequence of the measure: Is it in general a good or a bad idea environmentally?

Grøn forretningsudvikling med GAIA

Green business development with GAIA



For det første identificeres ideer for forretningsmuligheder for industriel symbiose. Bagefter udvikler virksomheden sin **forretningsmodel** samtidig med, at ideer til symbiosen konkretiseres og tænkes systemisk i forhold til miljø ved hjælp af **GAIA** modellen. GAIA kan anvendes komplementært til eksisterende værktøjer til udvikling af forretningsmodeller – som f.eks. Osterwalder's Business Model Canvas, der bl.a. ser på økonomi, kundeværdi, kundesegmenter og afsætning.

First, ideas for business opportunities for industrial symbiosis are identified. Afterwards, the company develops its business model while concretising ideas for the symbiosis and thinking systematically in relation to the environment using the GAIA model. GAIA can be used complementary to existing tools for developing business models - such as Osterwalder's Business Model Canvas, which looks at building blocks such as finance, customer value, customer segments, and sales.

Efter denne iterative proces, skal den nye grønne, nye forretningsmodel valideres; *Er den nu grøn? Og hvor grøn?* Dette sker gennem et **Bæredygtigheds-tjek**, hvor ændringerne i miljøpåvirkninger bliver evalueret. En dokumentet **grøn forretningsmodel** er resultatet.

Following this iterative process, the new green, new business model must be validated; *Is it green? And how green?* This is done through a Sustainability Check, where the changes in environmental impacts are evaluated. A documented green business model is the result.

Hvordan bruges GAIA?

How is GAIA used?

Efter en første idégenereringsproces, hvor der bestemmes, hvilken ny anvendelse, en overskudsressource skal have, kan GAIA bruges af virksomheder som et vurderingsværktøj i udviklingsprocessen. Modellen er udformet, så den kan bruges på tværs af organisationen eller endda værdikæden.

After an initial idea generation process, which determines what new use a surplus resource should have, GAIA can be used by companies as an assessment tool in the development process. The model is designed so that it can be used across the organization or even the value chain.

Værktøjet er bygget op på en måde, som hjælper virksomheden og dens rådgivere med at tænke systemisk og vurdere potentielle miljøkonsekvenser på alle relevante parametre.

The tool is designed in a way that helps the company and its advisors think systematically and assess potential environmental impacts on all relevant parameters.

Med GAIA kommer man gennem to trin.

SYMBIOSEMODEL: Efter en beskrivelse af, hvilken overskudsressource virksomheden modtager og/eller afgiver, er første trin at beskrive, hvad der erstattes, eventuel ekstra bearbejdning af det som modtages, eventuelle designændringer som følge af ændret materiale, og endelig den tidligere anvendelse af det, som modtages.

MILJØKONSEKVENSER: Det andet trin er fokuseret på de potentielle miljøkonsekvenser som følge af det, som er beskrevet under første trin. Miljøkonsekvenserne kan være såvel positive som negative.

Efter GAIA kan man gå videre og vurdere og eventuelt sætte tal på miljøkonsekvenserne.

BÆREDYGTIGHEDSTJEK: Bæredygtighedstjekket kan foregå på flere niveauer, fra det simple som giver en indikation, til mere sofistikeret, som vurderer bredere og med større sikkerhed. Et simpelt værktøj, som man selv kan arbejde med, er 'Bæredygtig Bundlinje', mens man i den anden ende af skalaen finder den professionelt udførte livscyklusanalyse.

GAIA guides you through two steps.

SYMBIOSIS MODEL: Following a description of what surplus resource the company receives and/or delivers, the first step is to describe what resource is replaced, any additional processing or design changes that are required, and, finally, the previous use of the received resource.

ENVIRONMENTAL IMPACT: The second step is focused on the potential environmental impacts resulting from what is described in the first step. The environmental consequences can be both positive and negative.

After GAIA, it is possible to go ahead and assess and possibly quantify the environmental impacts.

SUSTAINABILITY CHECK: The sustainability check can take place on several levels, from the simple indication, to the more sophisticated analysis, which assesses wider and with greater certainty. A simple tool that you can work on yourself is the 'Sustainable Bottom Line', while at the other end of the scale you will find the professionally performed life cycle analysis.

SYMBIOSEMODEL

SYMBIOSIS MODEL

Første trin ser på følgende dele og spørgsmål:

Genbrugsressource: Beskriv hvilken overskudsressource, der modtages/ afleveres, og hvorfra den potentielt kan leveres. Uddybninger er mulige senere i processen, og på dette tidspunkt er det nok at have overslag på mængder.

Erstattet ressource/proces: Med overskudsressourcen søges at erstatte en anden og måske jomfruelig ressource i virksomheden, som dermed ikke behøver at blive produceret, transporteret m.v. Hvilken ressource er der tale om, og hvor meget vil kunne erstattes af en genbrugsressource?

Bearbejdning: Genbrugsressourcen skal muligvis gøres klar til at kunne blive anvendt i stedet for den nye/jomfruelige ressource. Er der eventuelt brug for sortering, oparbejdning og/eller rensning?

Designændringer: Brugen af overskudsressourcen kan have betydning for designet af virksomhedens produkt og/eller service. Vil der f.eks. være brug for at ændre nogle andre dele, materialer eller produktionsprocesser?

The first step looks at the following parts and questions:

Recycled resource: Describe which surplus resource is received/delivered and from which source it can potentially be delivered. Elaborations are possible later in the process, and at this point it is enough to estimate quantities.

Replaced resource / process: The surplus resource seeks to replace another and perhaps virgin resource in the company, which thus does not need to be produced, transported, etc. What resource is involved and how much can be replaced by a recycled or reused resource?

Processing: The used resource may need to be made ready to be reused instead of the new/virgin resource. Is there any need for sorting, reprocessing, and/or cleaning?

Design changes: The use of the surplus resource can have a bearing on the design of the company's product and/or service. For example, will some other parts, materials or production processes need to be changed?

Tidligere anvendelse: Den ressource, som virksomheden modtager, har haft en alternativ brug tidligere. Det kan eksempelvis være, at ressourcen tidligere indgik i affaldsforbrænding og bidrog til energiproduktion, og nu måske skal erstattes af anden energikilde som f.eks. kul. Vigtige spørgsmål er, hvad den alternative brug af ressourcen er? Og hvem eller hvilken produktion/proces, der nu ikke kan anvende ressourcen.

Previous use: The resource received by the company has had an alternative use in the past. For example, it may be that the resource was previously included in waste incineration and contributed to energy production, and may now have to be replaced by another energy source such as coal. An important question is: What is the alternative use of the resource? And who or which production/process can now not use the resource anymore?

MILJØKONSEKVENSER ENVIRONMENTAL IMPACTS

Andet trin er en beskrivelse af potentielle miljøkonsekvenser som følge af forretningsmodellen med udveksling og brug af overskudsressourcer. Her handler det om at beskrive de miljømæssigt relevante konsekvenser af den foreslåede symbiose. For at sikre at man ikke glemmer noget, udfyldes disse under de samme overskrifter som i symbiosemodelen.

The second step is a description of potential environmental consequences arising from the business model of exchange and use of surplus resources. Here it is about describing the environmentally relevant consequences of the proposed symbiosis. To ensure that you do not forget anything, these are filled in under the same headings as in the symbiosis model.

Erstattet ressource/proces: Mængden og kvaliteten af de erstattede ressourcer er essentiel at kende for at kunne vurdere bæredygtighed. Herudover kan det også være relevant at tænke over, hvordan den oprindelige ressource blev bearbejdet, samt den transport som nu kan undgås.

Bearbejdning: Kemikalier, nye maskiner, energi og spild fra sortering, oparbejdning og/eller rensning opgøres, da genbrugte ressourcer kan kræve mere bearbejdning.

Designændringer: Ved at bruge et andet materiale kan produktets egenskaber ændres, dette kan have indflydelse på livstid, vedligehold, transport, forbrug under brugsfasen samt, hvordan produktet behandles, når det kasseres.

Tidligere anvendelse: Miljøpåvirkninger i denne kategori kan f.eks. stamme fra forbruget af andre energiressourcer, herunder kul der erstatter træ i energiforsyningen.

Replaced resource/process: It is essential to know the amount and quality of the replaced resource to assess the sustainability of the symbiosis. In addition, it may also be relevant to think about how the original resource was processed and the transport that can now be avoided.

Processing: Chemicals, new machines, energy and waste from sorting, reprocessing, and/or purification are calculated as recycled resources may require more processing.

Design changes: By using a different material, the properties of the product can be changed. This can affect the lifespan, maintenance, transport, consumption during the use phase, as well as how the product is treated when discarded.

Previous use: Environmental impacts in this category may e.g. arise from the consumption of other energy resources, such as coal replacing wood in the energy supply.

BÆREDYGTIGHEDSTJEK SUSTAINABILITY CHECK

Når modellen er udfyldt, og den samlede miljøpåvirkning ser ud til at være formindsket ved hjælp af de nye tiltag, er man klar til næste trin. Miljøvurderingen for bæredygtighedstjekket findes på forskellige detaljeringsniveauer:

1. Kvalitativt overblik over mulige konsekvenser, herunder eventuelle faldgruber, ved hjælp af **GAIA**.
2. Simple livscyklusberegning af konsekvenser. Eventuel brug af **Bæredygtig Bundlinje**¹, som dog alene beregner drivhusgasemissioner, energiforbrug og materialeforbrug. Kan også suppleres med beregninger af andre miljøpåvirkninger.
3. Fuld livscyklusanalyse. Gennemført efter **ISO standard 14040**, og som kan bruges i en eventuel videre certificeringsproces.

¹ Bæredygtig Bundlinje-måleværktøjet, udviklet af DTU som en del af Bæredygtig Bundlinje-projektet, er et livscyklusbaseret værktøj, som også kan medtage effekter i virksomhedernes værdikæder. Tidligere har værktøjet Klimakompasset været anvendt som indrapportering af effekter jævnfør Erhvervsstyrelsens krav til effektmåling. Ved årsskiftet 2018/2019 var Klimakompasset nedlagt og i stedet skal alle regional-fondsfinansierede prioritetsakse 3-projekter bruge Bæredygtig Bundlinje-måleværktøjet (Gate21, 2019).

When the model is completed and the overall environmental impact seems to have been reduced by the new measures, you are ready for the next step. The sustainability check is available at various levels of detail:

1. Qualitative overview of possible impacts, including possible pitfalls, using **GAIA**.
2. Simple life cycle calculation of consequences. Possible use of the Sustainable Bottom Line, which, however, only calculates greenhouse gas emissions, energy consumption, and material consumption. This can also be supplemented with calculations of other environmental impacts.
3. Full life cycle analysis. Implemented according to ISO standard 14040, which can be used in any further certification process.

The Sustainable Bottom Line Measurement Tool, developed by DTU as part of the Sustainable Bottom Line Project, is a life-cycle-based tool that can also include effects in corporate value chains. Previously, the Climate Compass tool has been used as a reporting of effects, cf. the Danish Business Authority's requirements for effect measurement. By the end of the year 2018/2019, the Climate Compass was closed and instead all regional fund-financed priority axis 3 projects must use the Sustainable Bottom Line Measurement Tool (Gate21, 2019).

Eksempel: Erstatning af nyt træ i møbelproduktion med genbrugstræ fra nedbrydning
Example: Replacing virgin wood in furniture production with waste wood from building demolition

Symbiosemodel/ Symbiosis model		Miljøkonsekvenser/Environmental impacts	
<p>Genbrugsressource/ Reused or recycled resource</p> <p>Hvilken ressource modtager virksomheden? Mængder, bearbejdelse, bearbejdning, transport.</p> <p>Which resource does the company receive? Amounts, extraction, processing, transport.</p> <p>Affaldstræ fra nedbrydning af bygninger, søvætræ.</p> <p>Dimensions 100x100mm, assorteret længde, over 2m, 20 ton årligt.</p> <p>Waste wood from building demolition, barred trees.</p> <p>Dimensions 100x100mm, assorted length, over 2m, 20 tons a year.</p>	<p>Erstattet ressource/Substituted resource</p> <p>Hvad blev brugt indtil nu? Eller, hvad ville blive indkøbt hvis genbrugsressourcen ikke længere var tilgængelig? What was bought until now? Or, what would be bought if the reused resource was no longer available?</p> <p>Nye svenske douglas planker. 25mm tykkelse. New Swedish douglas planks. 25 mm thickness.</p>	<p>Er energi- og bearbejdning af den optimale ressource? How is the recycled resource extracted/processed compared to the former material?</p> <p>Formybar ressource. Træ er fra norden, dvs. minimal bearbejdning selv uden FSC. Renewable resource. Wood is from the north, meaning minimal impact even without FSC.</p>	<p>Vurdering/ Assessment</p> <p>Samlert set, hvilke miljø-mæssige fordele har den nye anvendelse af genbrugsressourcen? Which effects are caused by the change altogether?</p> <p>Positivt. Materialets levetid forlænges med ca. 30 år. Mindre stål. Positive: The materials lifetime is prolonged by ca. 30 years. Less steel use.</p> <p>Negativt: Gas afbrændes frem for træ. Negative: Gas is burned instead of wood.</p> <p>SUM: Overvejende miljømæssigt forbedring. SUM: Predominantly environmental improvement.</p>
<p>Bearbejdning/Processing</p> <p>Er ekstra processer eller behandlinger nødvendige for at klarere materialet til at indgå i produktionen? Is extra processing or treatment necessary to prepare the material for reproduction?</p> <p>Høvles inden brug i produktion. Stort slid på høvl, skal ofte slibes. Has to be planned before use in production. Wood plane is abraded more quickly.</p>	<p>Designændringer/Design changes</p> <p>Skal materialeforbrug, proces eller andet i produkt-designet ændres grundet brugen af genbrugsressourcen? Do material use, processing, or design require changes?</p> <p>Stel kan forsimples grundet stærkere planker. Kunne evt. optimeres i forhold til materialeforbrug. Frame can be simplified because of stronger planks. Material use could maybe be reduced.</p>	<p>Energiforbrug, type af energi, skadelige stoffer, transport osv. Energy consumption and -type, toxic substances, transport etc.</p> <p>Ekstra bearbejdning indstøbes, dvs. øget energi-forbrug. Evt. indkøb af ny høvl. Extra processing is needed, meaning higher energy use. Evt. purchase of new wood plane.</p>	<p>Positive og negative ved f.eks. mere eller mindre materialeforbrug. Positive and negative caused by e.g. using more or less material.</p> <p>Mindre stål. Less steel.</p>
<p>Tidligere anvendelse/Former use</p> <p>Hvad blev genbrugsressourcen brugt til/behandlet, hvis ikke den indgår i denne produktion/process? What was the use of the resource before it was used in this production/process?</p> <p>Forbrænding - dvs. energiindvinding. Incineration, meaning energy generation.</p>	<p>Hvad vil blive brugt i stedet for træ i den tidligere anvendelse/process? Hvilke effekter har det? What will be used now, when the material is diverted? Which effects does it have?</p> <p>Udvæksling forgår i Aalborg Kommune, dvs. gas afbrændes i stedet for træ for at dække energibehovet. The exchanges takes place in Aalborg Kommune, meaning gas will be used to generate the energy.</p>		

Bæredygtighedscheck/ Sustainability check

Gode grønne principper

Good green principles

Når vi udvikler IS forretningsideer er der en række generelle principper, som hjælper os med at opnå størst mulig bæredygtighed af symbioseinitiativer.

As we develop IS business ideas, there are a number of general principles that help us achieve the greatest sustainability of symbiosis initiatives.

Sikre rene strømme

Ressourcer er langt mere værd, hvis de er let tilgængelige. Det opnår vi ved ikke at blande affaldsfraktioner.

Bevare højeste værdi af ressourcen

Den højeste kvalitet af ressourcen skal sikres længst muligt. F.eks. plastfolie til plastfolie.

Søge 'opad' i affaldshierarkiet

For eksempel er det at reducere brug af ressourcer bedre end at genanvende.

Design for genbrug og genanvendelse

Udover sikre lang levetid, kan der f.eks. bruges rene materialer fremfor sammen-satte, samt sikres at produkter let kan adskilles for genbrug.

Øge sporsparhed

Det gælder om at holde hus med, hvor ens egne ressourcer kommer fra og stille krav til, hvad der sker efterfølgende med egne restressourcer.

Tænke og vurdere systemisk

Nye symbioser vil påvirke eksisterende systemer – udenfor virksomheden. Det skal der være øje for og vurderes.

Gennemføre bæredygtighedstjek

Beregninger af positive og negative konsekvenser skal laves under udviklingen af symbioser og dokumenteres i grøn forretningsmodel.

Genbesøge grøn forretningsmodel

Ændringer, f.eks. internt i virksomheden og i den delte restressource, kan have betydning for hvor grøn forretningsmodellen er.

Ensure pure flows

Resources are worth far more if they are easily accessible. We achieve this by not mixing waste fractions.

Preserve the highest value of the resource

The highest quality of the resource must be ensured as long as possible when recycling resources. For example, plastic foil should be turned into plastic foil.

Aim high in the waste hierarchy

For example, reducing resource use is better than recycling waste.

Design for recycling and reuse

In addition to ensuring a long lifespan through clever product design, the use of pure materials rather than composites can pave the way to recycling. Moreover, designing modular can allow for the re-use of materials through easy product disassembly.

Increase traceability

It is important to keep track of where one's own resources come from and to make demands on what happens next with own residual resources.

Think and evaluate systemic

New symbioses will affect existing systems – also outside the company. This must be considered and assessed.

Conduct a sustainability check

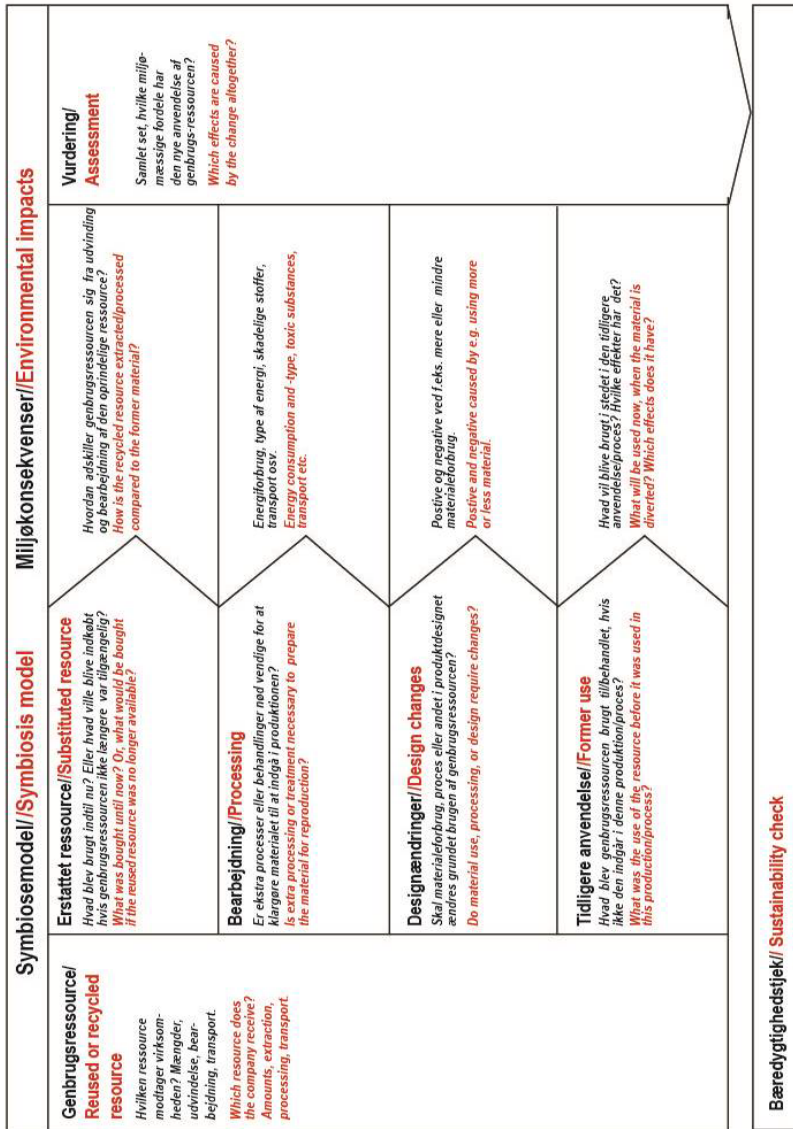
Calculations of positive and negative consequences must be made during the development of symbioses and documented in the green business model.

Re-visit the green business model

Changes, e.g. internally in the company and in the shared residual resource, can have an impact on how green the business model is.

GAIA modellen

The GAIA template



Bæredygtigheidsjek// Sustainability check

Kilder

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'Bæredygtige Synergier'.

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Grønne forretningsmodeller og industrielle symbioser er kodeordene i projektet, der er et samarbejde mellem Aalborg Havn, Aalborg Universitet og House of Energy. Her bliver små og mellemstore virksomheder i postnummer 9220 ført sammen om initiativer, der kan gøre deres forretning mere bæredygtig og skabe vækst. Virksomheder i Aalborg Øst samarbejdede i forbindelse med dette projekt for at skabe jobs og grøn forretning gennem bedre brug af områdets ressourcer.

Green business models and industrial symbiosis are the keywords in the project, which is a collaboration between Port of Aalborg, Aalborg University, and House of Energy. Here, small and medium-sized companies in ZIP code 9220 were brought together for initiatives that can make their businesses more sustainable and create growth. Companies in Aalborg East were collaborating on this project to create jobs and green business opportunities through better use of the area's resources.



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