Estela Regos Casas

Building a Sustainable Future:

The Interplay of Collaboration and Innovation in Circular Construction

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Introduction

PROBLEM STATEMENT

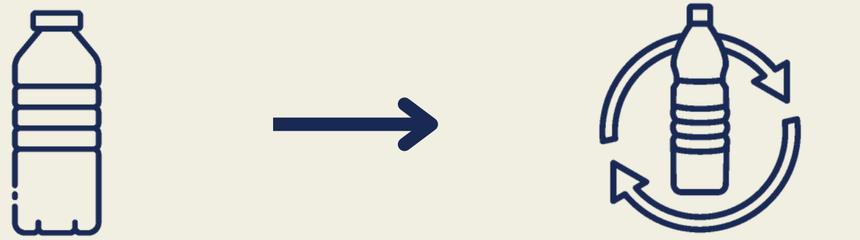
Problem Statement

27 million kilos

Problem Statement

27 million kilos

Problem Statement



27 million kilos

24,3 million kilos

Problem Statement

27 million kilos

24,3 million kilos

25 000 million kilos

Problem Statement

27 million kilos

24,3 million kilos

25 000 million kilos

Problem Statement

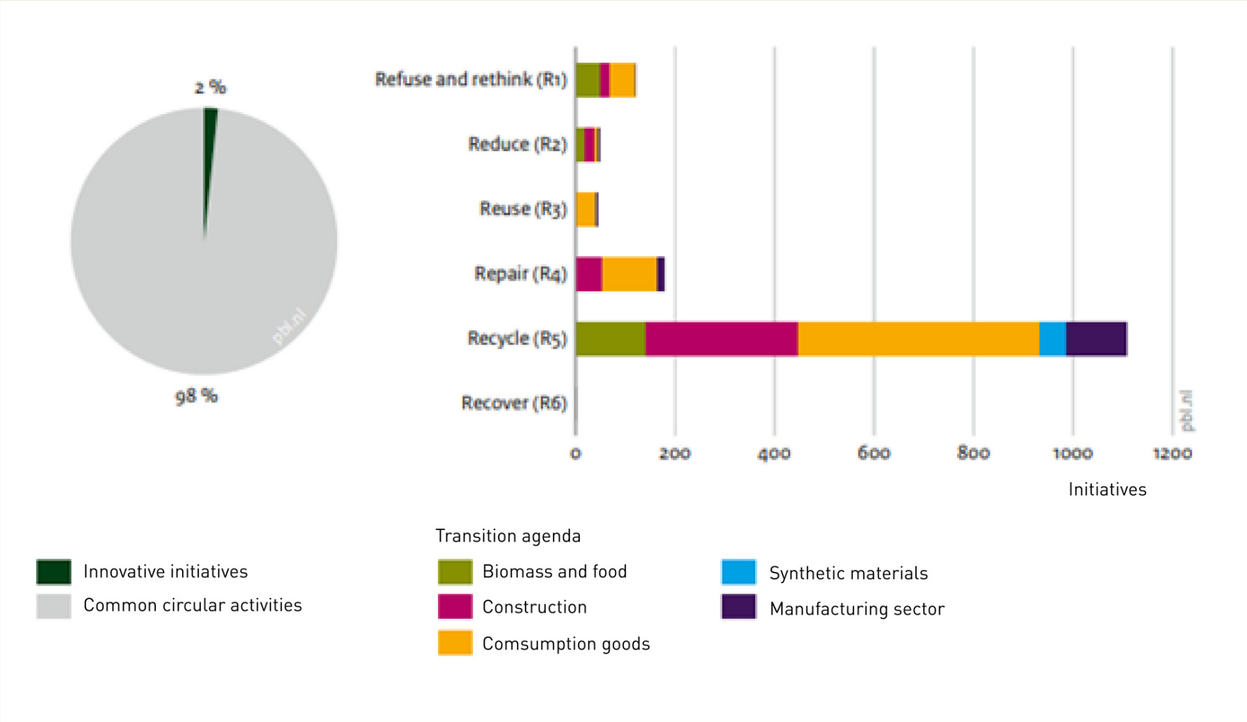
27 million kilos

24,3 million kilos

25 000 million kilos

?

Problem Statement



(Planbureau voor Leefomgeving, 2019)

Problem Statement

Collaborations

Problem Statement

Collaborations

No collaborations

Research questions

Main question

- What is the relationship between collaboration and innovation in the circular construction sector?

Sub-questions

- RQ1: What kind of innovations are there in the circular construction sector?
- RQ2: What are the different elements of collaboration in the circular construction sector?
- RQ3: Wat are the factors that drive and prevent collaborations and innovation in the circular construction sector?
- RQ4: Who are the parties between whom collaboration should be established in order to facilitate innovation in the circular construction sector?

Methods

Methods

INPUT

Literature study

INPUT

Document analyses

INPUT

In-depth interviews

OUTPUT

Theories on the subjects of the research

OUTPUT

Case study information

OUTPUT

Conclusions and recommendations

Methods

INPUT

Literature study

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Document analyses

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In-depth interviews

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Theories on the subjects of the research

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Case study information

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Conclusions and recommendations

Methods

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Literature study

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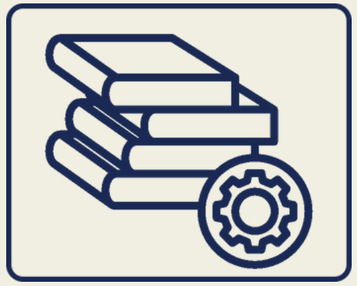

Document analyses

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In-depth interviews

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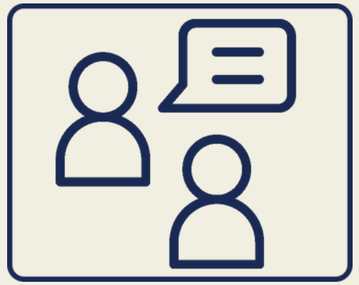

In-depth interviews

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Theories on the subjects of the research

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Case study information

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Conclusions and recommendations

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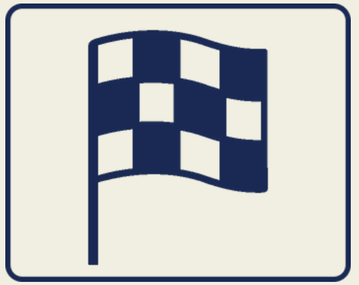


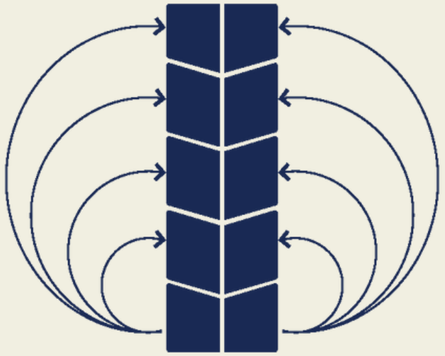
Conclusions and recommendations

Literature review

Literature review

What is the circular economy ?

- A world without waste
- Careful consideration of the next life of a product
- Keep products at their highest utility and value at all times



Literature review

Innovation

- Innovation occurs when different types of knowledge are converted into value.
- Product innovation is when a new good or quality of goods is introduced which an external user or market is not yet familiar with.
- Process innovation involves the implementation of new elements that have not been previously tried within a specific industry to manufacture a product or deliver a service.

Literature review

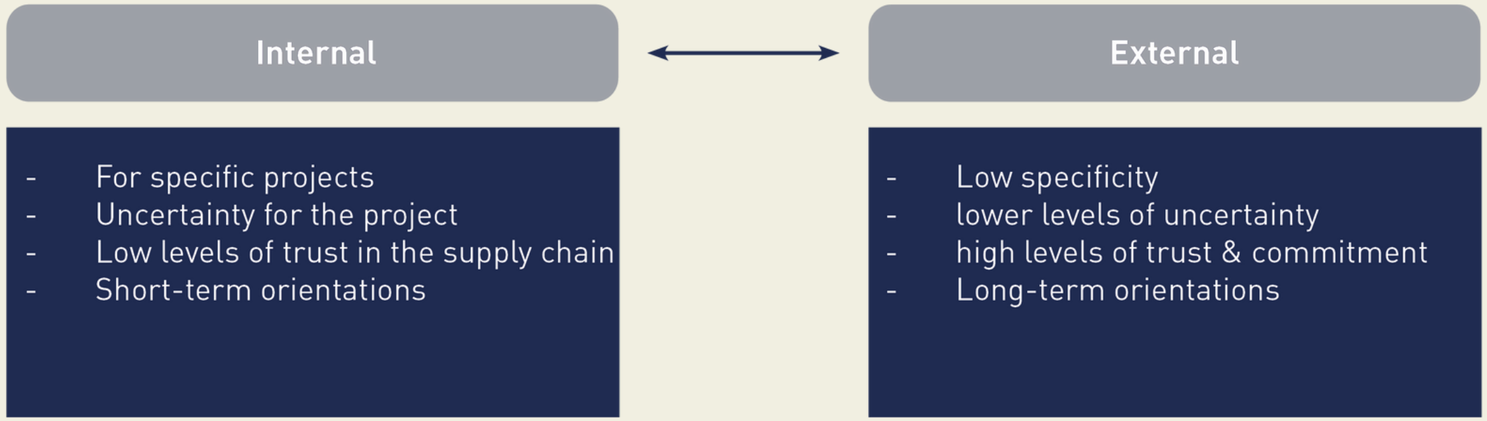
Collaboration

- Collaboration occurs when two or more stakeholders have a relationship together where they interact with shared rules, norms and structures. Stakeholders can include individuals, groups, organisations or entire societies.

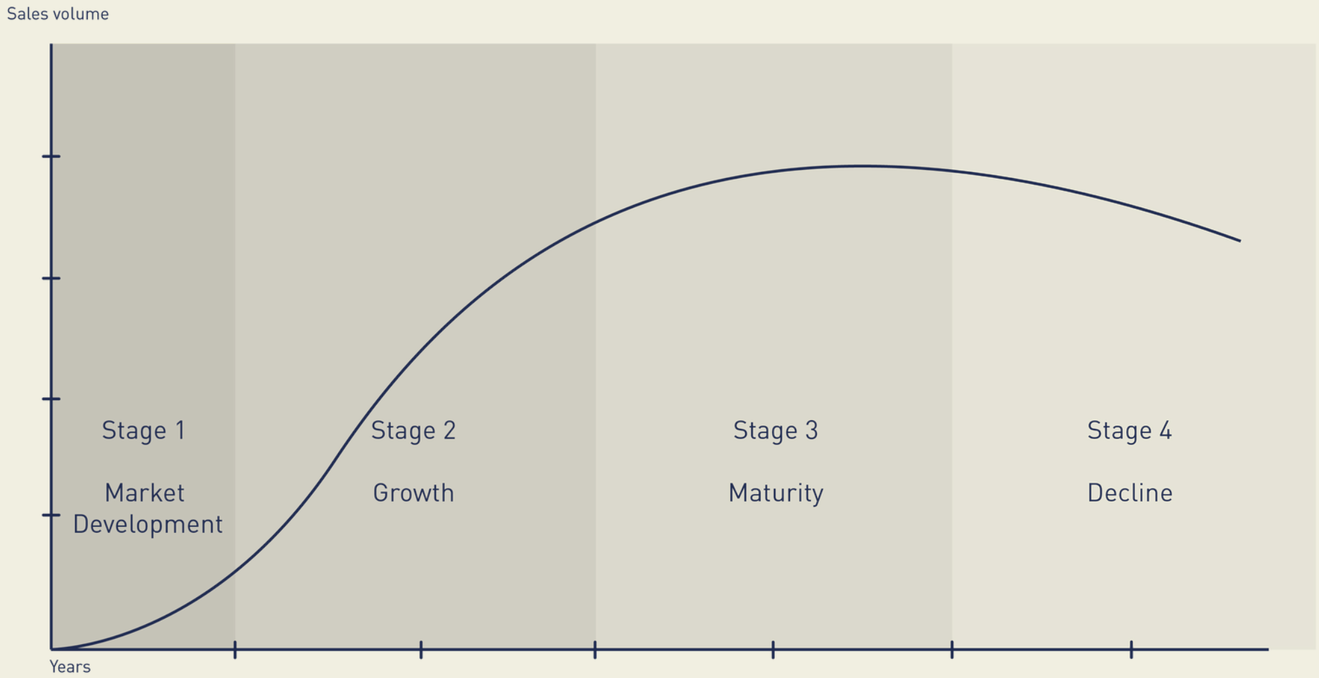
- Inter-organisational collaborations arises when there are collaborations between different organisations.

Literature review

Inter-organisational collaborations



Literature review



Product life cycle (Levitt, 1965)

Analytical Framework

Characteristics Collaborations / Stages Life Cycle		Level of Specificity		Level of Uncertainty		Level of Trust & Commitment		Time Frame	
		Product	Process	Product	Process	Product	Process	Product	Process
Market Development	Internal								
	External								
Growth	Internal								
	External								
Maturity	Internal								
	External								
Decline	Internal								
	External								

Very much
Many
Normal
Few
Very few

Case studies

Case studies

Seawood
Sustainable alternative for panel material

Case studies

The flow of timber from Beelen Next
Harvesting and preparing wood for reuse

Case studies

Hoogstraat 168-172
Re-used donor steel for load-bearing structure

Case studies

The Hof van Cartesius
Upcycled materials

Results

Seawood

Characteristics / Collaborations / Stages / Life Cycle		Level of Specificity		Level of Uncertainty		Level of Trust & Commitment		Time Frame	
		Product	Process	Product	Process	Product	Process	Product	Process
Market Development	Internal	Architecture and Copyright rules that are needed to build and maintain an extra house in the Netherlands. Other Construction materials? Or does it not matter, specific, and clear rules? For us to experience the the material fourth if we want to build with it. Because we have to know specific rules. You need to look at the rules and regulations. Because if you don't know, and you have to make basic stoichiometry knowledge (MR)	And in the end I tried to make it look as much as possible like a normal house. Because I did not I brought it to the first house groups and they said that they would not buy it because it was made out of wood and they all liked it. (Bruno 2nd time different client)	Ok, so that I have 2 clients and still 2 plots to go. Which are not. I sign (MR)	And one of the biggest challenges is now the architect's problem that is the building industry. Because they are not used to the idea of a product by itself is really hard to enter the market. Because they are not used to that. Like with a product. It will be built in one day. So you have to be very precise with all of the structure and materials. there's a so very, we are less than 10 meters. sheet (MR)	We make sure that we contribute to a circular economy because that is a big issue and that's our main mission to transform systems. And we do that by, for example, we have the ambition that our new houses in Kavelrom systems will be 100% circular. And we do that by the architecture and materials. there's a so very, we are less than 10 meters. sheet (MR)		Ugent paper in the 3d printing and different ways of printing and printing by the Ugent and that's what I tried to make it look as much as possible like a normal house. And I also had brought it to my first house groups and they all were hate.	Yeah, the interior offers with gothic arches will be there, so there will be already quite different products and wood pressed shapes. I'm Ugent and I'm not sure if I'm, I'm not sure if I'm not sure yet whether that. So we really keep the 3d printer (MR)
	External	OK, depends a bit on the role the used of the technical expertise that is needed. I would of course, I would also like to have a client that is from a normal, if you're already an existing client, that you have a relationship with and that is it. It looks. A year and a half that I would have a client that is from a normal, if you're already an course that good thing is other people want. But I would also like to have a client that is from a normal, if you're already an existing client, that you have a relationship with and that is it. It looks. Kind that's from a normal, if you're already an existing client, that you have a relationship with and that is it. It looks. A year and a half that I would have a client that is

Results

Seawood

Characteristics / Collaborations / Stages Life Cycle		Level of Specificity		Level of Uncertainty		Level of Trust & Commitment		Time Frame	
		Product	Process	Product	Process	Product	Process	Product	Process
Market Development	Internal	Apart from Lisa who did not hesitate to work with somebody on same level (Lisa: Construction - Interior)? Or does it so work - some - specific - and - more - skilled	And in the end I tried to make it look as much as possible as the working materials and so the look and I brought it to my first house groups and the all were really impressed by the result and I got so much confirmation of them to throw it on a different level.	Ok, so that's Vista Express and still Listed (?) Module and - sign - right?		We make sure that we contribute to a similar working environment as the building industry. But it's our main mission to transform systems. We want to do that by creating awareness for the necessity as we can understand with - non-profit - organizations - and - by - showing - them - an - action that are at the moment unused. We - are - trying - to - make - a - change - in - the - way - we - do - things - before - that - but - in - future - proof - that - we - are - not - only - creating - a - product - but - also - experience - in - the - world. - So - it - has - proven - itself - that - we - are - more - successful - when - we - are - more - than - a - product - but - we - can - be - the - one - for - the - client.		Again just a bit to trying out different ways of working and getting to know each other and what I mean to make it look as much as possible as the working materials and so the look and I brought it to my first house groups and the all were really	
	External	Ok, depends a bit on the - on the - level of the - technical expertise that is needed. I would of - course - not - go - to - a - client - that - is - not - from - in - startup. If you're already an existing - company - and - you're - working - with - us - and - not - a - it - is - more - of - a - - but - it - is - more - of - a - you - start - from - scratch - and - you - have - to - - close - the - good - thing - is - other - people - learn - But - you - also - have - to - have - the - budget - and - the - - afford - to - have - a - your - team - on - a - time - gives - you - the - opportunity - to - learn - and - to - grow - and - - know - that - think - along - with - you - and - different - - but - also - for - themselves - it - works - both - ways - I - think - 2000.	Add on the market side, in some case because - we - are - working - with - companies - that - are - in - - by - - the - - -

Results

Seawood

Stages Life Cycle / Characteristics Collaborations		Level of Specificity		Level of Uncertainty		Level of Trust & Commitment		Time Frame	
		Product	Process	Product	Process	Product	Process	Product	Process
Market Development	Internal	And then aren't specific skills that are needed to work with seaweed, or can you treat it as other Construction material? Or does it require some specific and new skills? For us to manufacture the the material itself. If you know a lot about materials then you don't need new or specific skills. You need to look at the organism and the organism or plant in this case, and you have to have basic biochemistry knowledge (SW).	And in the end I tried to make it look as much as possible as the existing materials and in the end I brought it to my first focus groups and then I also had some examples that I wasn't too happy about myself and they all liked it. Because it was different (SW).	OK, so that's I hope it works, yet still a pilot. It's always a risk right (SW).	And one of the biggest challenges is now that we have a product, but in the building industry, before you are working in the building industry, a product by itself is really hard to to enter the market with. So that's why we now collaborate with a project. It will be built in July. It's a complete facade with other people that do the structure and isolation, there's an interior and we are then the interior sheet (SW).	We make sure that we contribute to a circular economy and we have future proof solutions. So that's our main mission to transform systems in that way. So we use as much as regenerative materials as possible and residual flows or dust streams or waste from other industries or sectors that are at the moment unused. We focused on seaweed as feedstock because we strongly believe that that's a future proof feedstock. It's the fastest growing one of the most ergonomic in the world. So it has proven itself as adaptive organism throughout the centuries and we think that might also be the case for the future (SW).		I spent a year in the lab trying out different ways and methods and recipes to do things and in the end I tried to make it look as much as possible as the existing materials and in the end I brought it to my first focus groups and they all were (SW).	Yeah, the interior offers still quite some options for us to to develop new and different products and each product requires it to 5 years R&D before you have all the certifications set and your production line. So we totally busy for a while (SW)
	External	OK, depends a bit on the on the Level of the technical expertise that is needed. I would always say education. Especially when you start, you have to have a team that's complementary, had company there you have resources. You have your Sol R & D team. If you start small, then my advice would be to start with education, because the good thing is other people learn. But then you have to have a team that you can also afford to have in your team yet, so it also gives access to knowledge and a good set of extra brains that think along with you and different parts of the of innovation. It works both ways I think (SW).	And on the market side, it came later because then I already had the concept and then I quickly started having focus groups trying to find partners who would be interested in the actual material. And then I found a couple of them and then yeah, yeah, the whole exercise is bound to Fail. So I knew I had to connect with the market as soon as possible, yeah (SW).	What's Difficult sometimes is that we also had. This system developed with another small company start up and then they disappeared. So we did all kinds of tests and pilots supervised by them and then they were gone. I don't mind. But then years, we had half of the of the system. So yeah then that's a set back, so that's difficult and it's hard to. Yeah, there are quite some options right to collaborate, to know or to have a network to collaborate in a direction to go and it will form the beginning. So that that is a difficult sometimes, yeah (SW).	Yeah, because there you actually need to hold value chain yes. And one of the biggest challenges is now that we have a product, but in the building industry, before you are working in the building industry, a product by itself is really hard to to enter the market with. So that's why we now. Collaborate that starts in. It will be built in July. It's a complete facade with other people that do the structure and isolation, there's an exterior and we are then the interior sheet (SW).	If the material fails in 10 years and the risk and the suing and the claims are for the contractor. How things are now right range, so yeah, well, why should this person take the risk if there's no real big advantage (SW)?	Yeah, because there you actually need to hold value chain yes. And one of the biggest challenges is now that we have a product, but in the building industry, before you are working in the building industry, a product by itself is really hard to enter the market with. So that's why we now have a collaboration that starts in July. It's a complete facade with other people that do the structure and isolation, there's an exterior and we are then the interior sheet. And then you can make something for the sector, because otherwise it's small parts and the Forces are huge and strong, and the networks in the build Environment and the Regulations are huge. So if you if you're or of any significance later on, you need to formpartnerships as soon as possible (SW).	Good point. I started in house in Blue City in the Lab, but since my former profession was partly also being a tutor at the Industrial design Academy, I had a lot of contacts with strong connexion with education, so I worked with programmes, process and food technology for the chemical procedures, but also because the industrialization was the aim from the beginning. So I wanted to make a material that that means also volume in our case, but then in a good way so we'll talk about the new industrial revolution producing in mass but then not harmful. So first food technology and chemical procedures, but also because I studied to nicotinus farmers, which is an organisation I know because I studied in Delft, the founder of the seaweed company. So we connected quite early (SW).	
Growth	Internal	We actually hope to be able to deliver something that's ready to use. So we've been a while because now I have you look at the chips and board. For example, you drill holes in it and you take it, plaster it, strokers and that's a lot of material waste and it's hard to reuse it, right. And then you have to have a material that's already finished and you don't have to damage it to install it. That's what we're going to test in Amsterdam as well. So you can actually take it out as a whole without if having any holes. So that's the ideal situation and then it can also a tool at the green village. I don't know if you're familiar with it. But then in small size, so the thickness of 40 by 40 cm and then you can have holes in it and you've found the wall and and should it concurrence mine so that is in the and for the circular economy better then that we take it back and we grind it and make new material. So that's the ideal case. But at the moment is if people drill holes for televisions or paintings or electricity. Can we repair that so it can be actually reused and you don't have to throw it away (SW).		So for all the applications, there are typical challenges. So the challenges are not the same. It depends add on how you apply it? A ceiling panel has different needs and criteria than a load bearing structure, so to speak. And depends also where you put it. If it's a public building, so the rules and the regulations and the certifications are different. How we work with it, we focus now first on the applications that require the least amount of certifications to just also be able to enter the market and to overcome that. So that's why we choose for ceilings to overcome that our costs are high and we're not on the market yet. So we want to enter the market with the ceiling, and then it's not a load bearing structure, and it's not in the, it's construction of the of the building, so the the the building or house has already been built and it's applied later as interior right. So they are not the same challenges and depends on the nails, those kinds of things and then it depends on. How public the building is and what the setting is (SW).					
	External		I think it's the only way, especially in in complex sectors like this, OK. If you do not have a plug in product that's easy for the market to understand that it's a direct replacement. Then you have to educate the market and that's what that's also how we do it. We developed it up to a certain point and then together with the end users. So in this case, because there's a process, how do they fit, how they're they're it with their with kind of machines they use, what kind of context they want to use it in and what that means for the technical properties that they require. And then we develop that and then offer it to the client, but you can also pick your. We do now different plots in different situations. So we do a kitchen and a wall and furniture all different applications, and then we monitor how they how they how people respond and how they interact with the material after it leaves our company and that's where the actual market learning and refines. And I, I do believe that that's where the success or failure in the end will happen (SW).		Yeah, because there you actually need to hold value chain yes. And one of the biggest challenges is now that we have a product, but in the building industry, before you are working in the building industry, a product by itself is really hard to to enter the market with. So that's why we now. Collaborate that starts in. It will be built in July. It's a complete facade with other people that do the structure and isolation, there's an exterior and we are then the interior sheet (SW).		And then you can mean something for the sector, because otherwise it's small parts. The Forces are huge and strong, and the networks in the build Environment and the Regulations are huge. So if you if you're or of any significance later on, you need to form partnerships as soon as possible.	And in the end I tried to make it look as much as possible as the existing materials and in the end I brought it to my first focus groups and then I also had some examples that I wasn't too happy about myself and they all liked it. Because it was different.	Yeah, but also if we talk about the build industry, they talk about a lot of square metres, because otherwise there's no sense for building industries or constructors to work with you if you're not in that scale, right? And in the end, that's nothing. And so therefore you need to be attractive enough to actually get attention and investment in time to get to know you how it works? What is this new material?
Maturity	Internal								
	External								
Decline	Internal								
	External								

Very much
Many
Normal
Few
Very few

Results

Seawood

Stages Life Cycle / Characteristics Collaborations		Level of Specificity		Level of Uncertainty		Level of Trust & Commitment		Time Frame	
		Product	Process	Product	Process	Product	Process	Product	Process
Market Development	Internal	And then aren't specific skills that are needed to work with seaweed, or can you treat it as other Construction material? Or does it require some specific and new skills? For us to manufacture the the material itself. If you know a lot about materials then you don't need new or specific skills. You need to look at the composition of the organism or plant in this case, and you have to have basic biochemistry knowledge (SW).	And in the end I tried to make it look as much as possible as the existing materials and in the end, I brought it to my first focus groups and then I also had some examples that I wasn't too happy about myself and they all liked it. Because it was different (SW).	OK, so that's I hope it works, yet still a pilot. It's always a risk right (SW).	And one of the biggest challenges is now that we have a product, but in the building industry, before you are working in the market with, to a product by itself is really hard to to enter the market with. So that's why we now collaborate with a project. It will be built in July. It's a complete facade with other people that do the structure and isolation, there's an interior and we are then the interior sheet (SW).	We make sure that we contribute to a circular economy and we have future proof solutions. So that's our main mission to transform systems in that way. So we use as much as regenerative materials as possible and residual flows or dust streams or waste from other industries or sectors that are at the moment unused. We focused on seaweed as feedstock because we strongly believe that that's a future proof feedstock. It's the fastest growing one of the marine organisms in the world. So it has proven itself as adaptive organism throughout the centuries and we think that might also be the case for the future (SW).		I spent a year in the lab trying out different ways and methods and recipes to do things and in the end I tried to make it look as much as possible as the existing materials and in the end I brought it to my first focus groups and they all were (SW).	Yeah, the interior offers still quite some options for us to develop and to test different products and each product requires 2 to 3 years R&D before you have all the certifications set and your production line. So we totally busy for a while (SW)
	External	OK, depends a bit on the on the Level of the technical expertise that is needed. I would always say education. Especially when you start, you need to have a good knowledge base and a had company there you have resources. You have your Sol R & D team. If you start small then my advice would be to start with education, because the good thing is other people learn. But you don't have to have the resources that you afford to have in your team yet, so it also gives access to knowledge and a good set of extra brains that think along with you and different parts of the of innovation. It works both ways I think (SW).	And on the market side, it came later because then I already had the concept and then I quickly started having focus groups trying to find partners who would be interested in the actual the material and then also the product that we then yeah, yeah, the whole exercise is bound to fail. So I knew I had to connect with the market as soon as possible, yeah (SW).	What's Difficult sometimes is that we also had. This system developed with another small company start up and then they disappeared. So we did all kinds of tests and pilots supervised by them and then they were gone and we stood. But then years, we had half of the of the system. So yeah then that's a set back, so that's difficult and it's hard to. Yeah, there are quite some options right to collaborate, to know or to have a good network and to have a direction to go and it will form the beginning. So that that is a difficult sometimes, yeah (SW).	Yeah, because there you actually need to hold value chain yes. And one of the biggest challenges is now that we have a product, but in the building industry, before you are working in the market with, to a product by itself is really hard to to enter the market with. So that's why we now. Collaborate that starts in. It will be built in July. It's a complete facade with other people that do the structure and isolation, there's an exterior and we are then the interior sheet (SW).	If the material fails in 10 years and the risk and the suing and the claims are for the contractor. How things are now right range, so yeah, well, why should this person take the risk if there's no real big advantage (SW)?	Yeah, because there you actually need to hold value chain yes. And one of the biggest challenges is now that we have a product, but in the building industry, before you are working in the market with, to a product by itself is really hard to to enter the market with. So that's why we now have a collaboration that starts in July. It's a complete facade with other people that do the structure and isolation, there's an exterior and we are then the interior sheet. And then you can make something for the sector, because otherwise it's small parts and the Forces are huge and strong, and the networks in the build Environment and the Regulations are huge as well. So if you're at any significance later on, you need to formpartnerships as soon as possible (SW).	Good point. I started in house in Blue City in the Lab, but since my former profession was partly also being a tutor at the Industrial design Academy in Delft, I was already very strong connexion with education, so I worked with programmes, process and food technology for the chemical procedures, but also because the industrialization was the aim from the beginning. So I started with a small scale lab, but that means also volume in our case, but then is a good way so we'll talk about the new industrial revolution producing in mass but then not harmful. So first food technology and chemical procedures, but also because I started as a nicotinus farmers, which is an organisation I know because I studied in Delft, the founder of the seaweed company. So we connected quite early (SW).	
Growth	Internal	We actually hope to be able to deliver something that's ready to install. So we're not the whole because now I have you look at the chips and board. For example, you drill holes in it and you take it, plaster it, strokers and that's a lot of material waste and it's hard to reuse it, right. So we hope to be able to deliver something that's already finished and you don't have to damage it to install it. That's what we're going to test in Amsterdam as well. So you can actually take it out as a whole without if having any holes. So that's the ambition because that can be also a tool at the green village. I don't know if you're familiar with it. But then in small size, in the in the form of 40 by 40 cm tiles, so that's a tile system. So you can also mound the wall tiles and rebuild it somewhere else so that is in the and for the circular economy better then that we take it back and we grind it and make new material. So that's the ambition. But at the moment is if people drill holes for televisions or paintings or electricity. Can we repair that so it can be actually reused and you don't have to throw it away (SW).		So for all the applications, there are typical challenges that we encounter and that is that it depends alot on how you apply it? A ceiling panel has different needs and criteria than a load bearing structure, so to speak. And depends also where you put it. If it's a public building, the rules and the regulations around public tattoos are different. How we work with it, we focus now first on the applications that require the least amount of certifications to just also be able to enter the market and to overcome that. So that's why we choose for those that our costs are high and we're not on the market yet. So we want to enter the market with the product and with the first applications that are not in the, so it's not in the, it's construction of the of the building, so the the the building or house has already been built and it's applied later as interior right. So they are not in the load bearing structure and the walls, those kinds of things and then it depends on. How public the building is and what the setting is (SW).					
	External		I think it's the only way, especially in in complex sectors like this, OK. If you do not have a plug in product that's easy for the market to understand that it's a direct replacement. Then you have to connect with the market early on. And that's also how we do it. We developed it up to a certain point and then together with the end users. So in this case, because it's process, it's know-how in the in the in the factories, it with their with kind of machines they use, what kind of context they want to use it in and what that means for the technical properties that they require. So we develop it together with that and then offer it to the client, but you can also pick your. We do now different pilots in different situations. So we do a kitchen and a wall and furniture all different applications, and then together with them we look at how do people respond and how they interact with the material after it leaves our company and that's where the actual market learning and refines. And I, I do believe that that's where the success or failure in the end will happen (SW).	Yeah, because there you actually need to hold value chain yes. And one of the biggest challenges is now that we have a product, but in the building industry, before you are working in the market with, to a product by itself is really hard to to enter the market with. So that's why we now. Collaborate that starts in. It will be built in July. It's a complete facade with other people that do the structure and isolation, there's an exterior and we are then the interior sheet (SW).		And then you can mean something for the sector, because otherwise it's small parts. The Forces are huge and strong, and the networks in the build Environment and the Regulations are huge as well. So if you're at any significance later on, you need to form partnerships as soon as possible.	And in the end I tried to make it look as much as possible as the existing materials and in the end I brought it to my first focus groups and then I also had some examples that I wasn't too happy about myself and they all liked it. Because it was different	Yeah, but also if we talk about the build industry, they talk about a lot of square metres, because otherwise there's no sense for building industries or constructors to work with you if you don't have a big volume. And in the lab, that's nothing. And so therefore you need to be attractive enough to actually get attention and investment in time to get to know you how it works? What is this new material?
Maturity	Internal								
	External								
Decline	Internal								
	External								

Very much
Many
Normal
Few
Very few

Results

Seawood

'If you start small then my advice would be to start with education, because the good thing is other people learn, but you also have access to disciplines which you cannot afford to have in your team yet, so it also gives access to knowledge and a good set of extra brains that think along with you and different parts of the of innovation.'

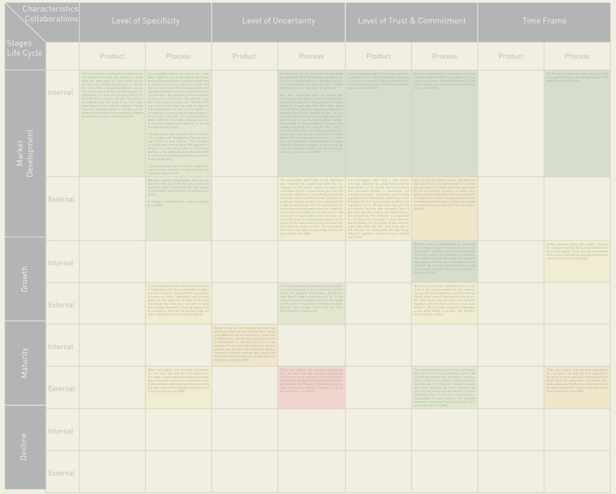
Results

Seawood

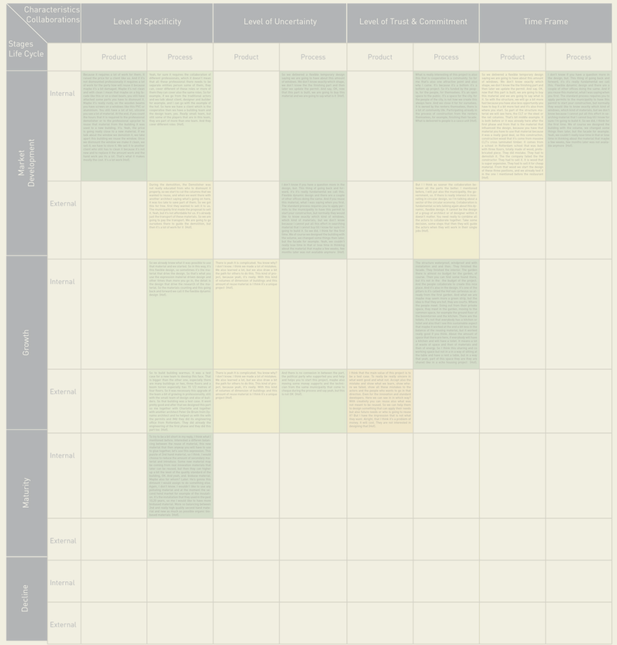
Beelen Next

Characteristics / Collaborations / Stages Life Cycle		Level of Specificity		Level of Uncertainty		Level of Trust & Commitment		Time Frame	
		Product	Process	Product	Process	Product	Process	Product	Process
Market Development	Internal	We actually went through it step by step, and I'm pretty sure we've tried it more or less with all parties and when it's smarter to just call that party and say, hey, we've got a question, can we do a thing there with you. In that way we've actually also kept the relationship with the contractor and engaged in discussions with them. We have also had a number of meetings with them before finishing, where they've put the doors on the table and we've looked at them and said, right? Or if it has one extra point of dye, indeed, we've also had that. So in that way we've also tried to work well that's when we've been making good moves on.		We actually went through it step by step, and I'm pretty sure we've tried it more or less with all parties and when it's smarter to just call that party and say, hey, we've got a question, can we do a thing there with you. In that way we've also kept the relationship with the contractor and engaged in discussions with them. We have also had a number of meetings with them before finishing, where they've put the doors on the table and we've looked at them and said, right? Or if it has one extra point of dye, indeed, we've also had that. So in that way we've also tried to work well that's when we've been making good moves on.		So, just as I said, Gladdeling Tegen Kleine, the architect, he is really a visionary person, he is really thinking that works. We also had a lot of talks in the beginning, also with the client, with Beelen, about, you've given extraordinary tasks. You're really pushing the boundaries. And he was very closed to much time and energy in it that way. So		We, we still have those concept maps, which we made in the beginning, and we're still using it almost. You can see that the people working there are 100% connected. We		When that was up and running, three shipping containers quickly became too small, so we added a fourth container. And then we've had to add another one.
	External								
Growth	Internal	And eventually, it grew in such a way that I now have a fully enclosed residential wing on a plot that I bought from the municipality, and which produces high-quality interior goods from long history. We		And eventually, it grew in such a way that I now have a fully enclosed residential wing on a plot that I bought from the municipality, and which produces high-quality interior goods from long history. We		You're, using wood while competing with large materials in Scandinavia and Poland, but the quality of the wood is also very good. So, we're		But production process is quality improvements. And the level of how timely we're able to, we're also getting to come up with on the own. I really need to say that, in comparison to the other, the shipping, no, comparison is very important here.		When that was running, three shipping containers quickly became too small, so we added a fourth container. And then we've had to add another one.
	External								
Maturity	Internal				We handle the entire process in-house, but then				
	External						Well, it mostly depends on the product. It doesn't		
Decline	Internal								
	External								

Hoogstraat 168-172



The Hof van Cartesius



Results

Beelen Next

Stages Life Cycle / Characteristics Collaborations		Level of Specificity		Level of Uncertainty		Level of Trust & Commitment		Time Frame	
		Product	Process	Product	Process	Product	Process	Product	Process
Market Development	Internal	We actually went through it step by step, calculating how much time it takes to pull those nails and, in that way, we kind of, bit by piece of wood out. Or to painstakingly remove those three nails and, in that way, we kind of, bit by bit by bit, pull out each piece. We never engaged in discussions with them. We ended up with the idea of making picket fences, thinking, well, there can't be much wrong with it if it's a fraction of an inch thicker or thinner, because it's not like it's a precision thing that really cares. So that might be a nice place to start, and that's when we began making picket fences (B).	We actually went through it step by step, calculating how much time it takes to pull those nails and, in that way, we kind of, bit by bit by bit, pull out each piece of wood out. Or to painstakingly remove those three nails and, in that way, we kind of, bit by bit by bit, pull out each piece. We never engaged in discussions with them. We ended up with the idea of making picket fences, thinking, well, there can't be much wrong with it if it's a fraction of an inch thicker or thinner, because it's not like it's a precision thing that really cares. So that might be a nice place to start, and that's when we began making picket fences (B).		So, just as I said, stumbling three times, but continuing to try, and eventually arriving at something that works. And I'm very, very proud of that regard, because in the beginning, everyone said, 'Axel, you've gone completely nuts. You'd be better off finding a hobby. You're not going to invest so much time and energy in it that way (B).		So, we still have those circular hubs, which are really the places where circularity is at its highest level. And I'm very proud people working there are 100% convinced (B).		When that was up and running, three shipping containers quickly became too small, so we added two more shipping containers (B).
	External		We closely examined with them what kind of products we should make, what quality standards to adhere to, when to reject something, and when to approve it. So in the end, we've arrived at this, but processing these panels is done, that it works, and that it's now running smoothly. They are one of our customers, but not much more than that (B).				For the first six months, I searched for someone who owned a sawmill and was willing to do this with us. So, I really learned from that. That we're very much dependent on having a sawmill, and so we've done it, but processing these panels is done, that it works, and that it's now running smooth. Often requires you to do it yourself (B).		We worked closely with them to determine what kind of products to make, what quality standards to adhere to, when to reject something, and when to approve it. So in the end, we've arrived at this, but processing these panels is done, that it works, and that it's now running smoothly. They are one of our customers, but not much more than that (B).
Growth	Internal	And eventually, it grew in such a way that I now have a fully serious woodworking shop in Utrecht, where we handle substantial volumes and produce high-quality interior-grade finishing timber (B).	And eventually, it grew in such a way that I now have a fully serious woodworking shop in Utrecht, where we handle substantial volumes and produce high-quality interior-grade finishing timber (B).		You're using wood while competing with large sawmills in Scandinavia and Poland, but the wood prices have, of course, skyrocketed. So, we've been really lucky in that regard (B).				When that was running, three shipping containers quickly became too small, so we added two more shipping containers. And eventually, it grew in such a way that I now have a fully serious woodworking shop in Utrecht, where we handle substantial volumes and produce high-quality interior-grade finishing timber (B).
	External						But also when it comes to quality requirements, it's at the level of how many nail holes are allowed in a linear meter. These are things I'm not going to come up with on my own. I really need a party that knows a lot about wood for those kinds of considerations is very important there. So, despite the fact that we now ultimately do it ourselves (B).		
Maturity	Internal				We handle the entire process in-house, but Ontwikkelbedrijf Beelen is actually responsible for almost all the construction materials we produce. That's very convenient for us because it means we don't have to maintain any inventory. I'm a bit allergic to holding inventory, so they come to pick up our products every week (B).				
	External						Well, it really depends on the product. In essence, I don't need and don't want to have my own production facility. That's not in line with what my core business, and it's distracting. Of course, it's a lot of fun, and I enjoy receiving people, and I was there the whole morning today. It's just nice to be there, and we create beautiful things. But I don't want to have that responsibility on my head, and I can't set up our own production location for all 10 of those material streams. Even if I could, I wouldn't want to(B). I established that sawmill more to prove that it's possible, and I hope that someone will eventually pick it up and say, 'Hey, bring your logs here, and we'll saw them for you and we'll do it more efficiently than you.' That way, I can finally be rid of it (B).		
Decline	Internal								
	External								

Very much
Many
Normal
Few
Very few

Results

Beelen Next

Stages Life Cycle / Characteristics Collaborations		Level of Specificity		Level of Uncertainty		Level of Trust & Commitment		Time Frame	
		Product	Process	Product	Process	Product	Process	Product	Process
Market Development	Internal	We actually went through it step by step, calculating how much time it takes to pull those nails and, in that way, we kind of, bit by piece of wood out. Or to painstakingly remove those three nails and, in that way, we kind of, bit by bit by bit, pull out the entire fence. We tried and engaged in discussions with them. We ended up with the idea of making picket fences, thinking, well, there can't be much wrong with it if it's a fraction of an inch thicker or thinner, nobody really cares. So that might be a nice place to start, and that's when we began making picket fences (B).	We actually went through it step by step, calculating how much time it takes to pull those nails and, in that way, we kind of, bit by bit by bit, pull out the entire fence. We tried and engaged in discussions with them. We ended up with the idea of making picket fences, thinking, well, there can't be much wrong with it if it's a fraction of an inch thicker or thinner, nobody really cares. So that might be a nice place to start, and that's when we began making picket fences (B).		So, just as I said, stumbling three times, but continuing to try, and eventually arriving at something that works. And I'm very proud of that regard, because in the beginning, everyone said, 'Axel, you've gone completely nuts. You'd be better off finding a hobby. You're not going to invest so much time and energy in it that way (B).		So, we still have those circular hubs, which are really the places where circularity is at its highest. And I'm very proud that people working there are 100% convinced (B).		When that was up and running, three shipping containers quickly became too small, so we added two more shipping containers (B).
	External		We closely examined with them what kind of products we should make, what quality standards to adhere to, when to reject something, and when to approve it. So that we have a shared understanding of how we do business, and you can see that it's now running smoothly. They are one of our customers, but not much more than that (B).				At the first six months, I searched for someone who served a sawmill and was willing to do it with us. So, I really learned from that. The first one is the most important thing, even if it is only to do it, but preferably with a partner, that it works, and that it's also a partnership found, often requires you to do it yourself (B).		We worked closely with them to determine what kind of products to make, what quality standards to adhere to, when to reject something, and when to approve it. So that we have a shared understanding of how we do business (B), and you can see that it's now running smoothly. They are one of our customers, but not much more than that (B).
Growth	Internal	And eventually, it grew in such a way that I now have a fully serious woodworking shop in Utrecht, where we handle substantial volumes and produce high-quality interior-grade finishing timber (B).	And eventually, it grew in such a way that I now have a fully serious woodworking shop in Utrecht, where we handle substantial volumes and produce high-quality interior-grade finishing timber (B).		You're using wood while competing with large sawmills in Scandinavia and Poland, but the wood prices have, of course, skyrocketed. So, we've been really lucky in that regard (B).				When that was running, three shipping containers quickly became too small, so we added two more shipping containers. And eventually, it grew in such a way that I now have a fully serious woodworking shop in Utrecht, where we handle substantial volumes and produce high-quality interior-grade finishing timber (B).
	External						But also when it comes to quality requirements, it's at the level of how many nail holes are allowed in a linear meter. These are things I'm not going to come up with on my own. I really need a party that knows a lot about wood for those kinds of considerations is very important there. So, despite the fact that we now ultimately do it ourselves (B).		
Maturity	Internal				We handle the entire process in-house, but Ontwikkelbedrijf Beelen is actually a supplier for almost all the construction materials we produce. That's very convenient for us because it means we don't have to maintain any inventory. I'm a bit allergic to holding inventory, so they come to pick up our products every week (B).				
	External						Well, it really depends on the product. In essence, I don't need and don't want to have my own production facility. That's not in line with what my core business, and it's distracting. Of course, it's a lot of fun, and I enjoy receiving people, and I was there the whole morning today. It's just nice to be there, and we create beautiful things. But I don't want to have that responsibility on my head, and I can't set up our own production location for all 10 of those material streams. Even if I could, I wouldn't want to(B). I established that sawmill more to prove that it's possible, and I hope that someone will eventually pick it up and say, 'Hey, bring your logs here, and we'll saw them for you and we'll do it more efficiently than you.' That way, I can finally be rid of it (B).		
Decline	Internal								
	External								

Very much
Many
Normal
Few
Very few

Results

Beelen Next

‘I spent the first six months looking for someone who had a sawmill and would be willing to do this with us. So, I really learned from that experience. That once you've demonstrated something, everyone is willing to do it, but proving that it's possible, that it works, and that it's not entirely absurd, you often have to do it yourself first.’

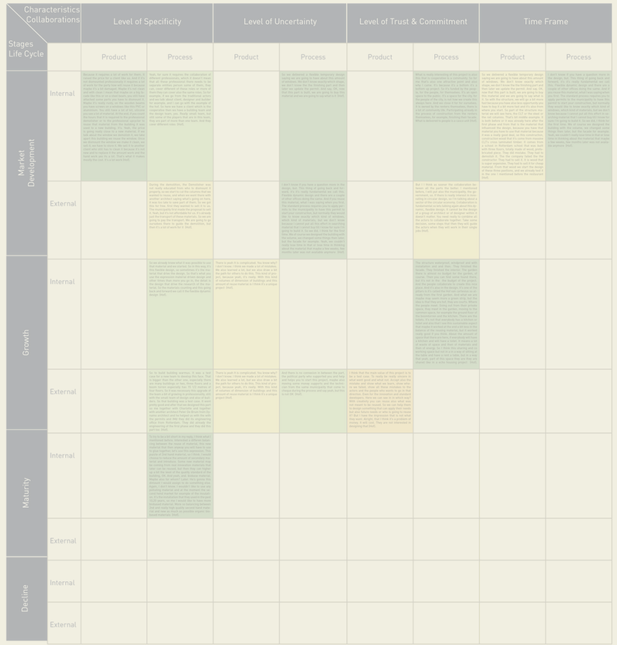
Results

Seawood

Beelen Next

Hoogstraat 168-172

The Hof van Cartesius



Results

Hoogstraat 168-172

Stages Life Cycle / Characteristics Collaborations		Level of Specificity		Level of Uncertainty		Level of Trust & Commitment		Time Frame	
		Product	Process	Product	Process	Product	Process	Product	Process
Market Development	Internal	The first commercial step of ours where a donor skeleton was used, and, of course, reused. We had to figure out the best way, so it did not take time and effort (IM4).	So, completely routed, you name it. So, I said, 'Well, maybe we can do something with these.' Can you find these materials because you do a lot of profiles more there, how much length they had. So, we revisited the shopping list we initially gave to Breiten and went to the construction site ourselves. We found about 80% of what we had on the shopping list. Which was very good. So the client on board, so we said, 'We have 80%, ago or so, 8 years ago. They didn't think about it at all. Now, they have actually established a company specifically focused on this. So, you can buy it from them. It's not free anymore, and it's nice to see. No, the demolition company searched for these profiles for two years but couldn't find them. So, I thought, 'Well, that's a shame.' That's when we started searching ourselves. We found a demolition company where the materials were just lying in a field. Now, it's common for various parties, including the first demolition company, to call us and say, 'Hey, we have this and that, and we're going to remove it. Can you use it (IM4)?'		At one point, we 'sat down with a demolition company and told them we have a shopping list. Can you find these materials because you do a lot of demolitions, and they also had a history with that client. So they said, 'No problem.' But, like I mentioned when we started with Hoogstraat, we had to find the materials and the stock at all back then. That was about 10 years ago or so, 8 years ago. They didn't think about it at all. Now, they have actually established a company specifically focused on this. So, you can buy it from them. It's not free anymore, and it's nice to see. No, the demolition company searched for these profiles for two years but couldn't find them. So, I thought, 'Well, that's a shame.' That's when we started searching ourselves. We found a demolition company where the materials were just lying in a field. Now, it's common for various parties, including the first demolition company, to call us and say, 'Hey, we have this and that, and we're going to remove it. Can you use it (IM4)?'	Yes, the breakthrough of the project came because we took the initiative ourselves. So, when it comes to innovations, the party that wants it, that has the passion for it, really has to take the lead and go all in (IM4).	Yes, the breakthrough of the project came because we took the initiative ourselves. So, in the case of innovations, the party that wants it, that has the passion for it, really has to take the lead and go all in (IM4).		No, for each project we were running at that time, we had to figure out the best way, so it did take time and effort (IM4).
	External		We had a material investigation done in consultation with the client. We also created an inspection table to determine the steel quality, rust formation, delamination, and various other factors. A company conducted this material analysis for us (IM4).		The municipality didn't play a very significant role. However, we collaborated with the municipality on the quality control procedure and calculation system. In innovations, you naturally encounter regulations, and building regulations are particularly important in projects like this. But when it's existing or reused, we didn't have regulations for it. We discussed this with the municipality because they ultimately have to get their approval, and we are responsible for the calculations. The municipality is responsible for supervising it's done correctly, and ultimately, for the quality of the steel because they took that over from us through the contract. The municipality then has to say, 'Okay, it's approved, and you will get a permit later (IM4).'	The municipality didn't play a very significant role. However, we collaborated with the municipality on the quality control procedure and calculation system. In innovations, you naturally encounter regulations, and building regulations are particularly important in projects like this. But when it's existing or reused, we didn't have regulations for it. We discussed this with the municipality because they ultimately have to get their approval, and we are responsible for the calculations. The municipality is responsible for the execution, ensuring it's done correctly, and ultimately, for the quality of the steel because they took that over from us through the contract. The municipality then has to say, 'Okay, it's approved, and you will get a permit later (IM4).'	You can see that clients want it, but they also feel like it has to be determined in a certain way, perhaps from above, like a decision made by the municipality, province, or some other party. However, sometimes the ones who have the initiative are also the ones who are highly motivated about the topic, and that does affect the motivation for cooperation from the client's side (N).'		
Growth	Internal	'Because with that number of parties, you're never going to be able to focus on anything. Because everyone has their own capabilities and potential opportunities, risks and if you start putting them together, then opportunities get lost. Because I was like, 'Hey, I can do this in IFC 23 because I was like yes, I am a structural engineer, I want to deal with construction and I shouldn't deal with window frames and that's a waste for me because I don't know anything about that.'					When it comes to collaboration on circularity in the projects where, for example, we incorporate donor skeletons, we find that all parties must fully support and embrace the principle. This means that both the client, the architect, suppliers, and the main contractor must stand on board. We, of course, stand behind it, so we often initiate it as well. But everyone needs to embrace it (IM4).		Similar projects during this project, because it's a project that has had a long duration. But during the project, we've already encountered other works where we've used donor skeletons and reused constructions (IM4).
	External		To create profiles for the construction and then to be able to reuse them, we still have to figure out how to make it compliant with regulations. Because, of course, regulations are primarily based on new materials, at least at that time and largely even now. So, if you want to make it possible to reuse, you must ensure that you can be included in, let's say, the building code and other regulations. How to address that (N)		Yes, it's about more sustainable concrete, right? That's why we've been working on the Rijkswaterstaat dossier pilot projects. Nevertheless, Rijkswaterstaat hasn't made it mandatory yet. So, it may still need some innovation, but I see this mainly on the side of structuring contracts and prioritizing the right circular criteria that can make such a project a success (N).		When you look at the collaboration for circularity in the projects where, for example, we incorporate donor skeletons, we notice that all parties must support and embrace the principle. This means that the client, the architect, suppliers, and the main contractor must stand on board. We, of course, stand behind it, so we often initiate it as well. But everyone must embrace it (IM4).		
Maturity	Internal			Based on our current projects, we have now found a workflow for how to do it, how it can be done. The advantage is that when you're working on a building that's already there and you're going to disassemble it, and then use it for a new building, it has a very high chance of success because you already know everything about it. You've already done the research, and you've done the design twice because you already have the basis for your design (IM4).					
	External		That's one aspect, and ensuring regulations. So, I am also. This year, the first standard for the reuse of steel elements is being launched. It's been a long process, and it was also kind of held between the Ministry of the Interior and the steel construction industry, and they are set to be launched in June (IM4).		That's one aspect, and ensuring regulations. So, I am also. This year, the first standard for the reuse of steel elements is being launched. It's been a long process, and it was also kind of held between the Ministry of the Interior and the steel construction industry, and they are set to be launched in June (IM4).		The interesting thing is that almost all the parties have started doing something with it. We initially approached the demolition company, but they were also very open and very much enthusiastic about it. They even started a circular demolition company. We asked 'Nedvest' to do this, and they also got excited about it. They are now taking steps to make more reused materials available. So, it's not only us, but also the other companies are doing this because they see a business model in it (IM4).		
Decline	Internal								
	External								

Very much
Many
Normal
Few
Very few

Results

Hoogstraat 168-172

Stages Life Cycle / Characteristics Collaborations		Level of Specificity		Level of Uncertainty		Level of Trust & Commitment		Time Frame	
		Product	Process	Product	Process	Product	Process	Product	Process
Market Development	Internal	The first commercial step of ours where a donor skeleton was used, and, of course, reused. We had done a few small projects before, but this is on a large scale and also a material that came from a completely different source. You see the same thing in smaller projects or renovations. You have steel lying around in the yard, and you say, 'Let's see what we can do somewhere else and reuse it.' So that might have happened, but truly the concept of having structural elements lying or standing somewhere and using them in a completely different building, that's new in this project (IM4).	So, completely rusted, you name it. So, I said, 'Well, maybe we can do something with these.' Can you find these materials because you do a lot of profiles more there, how much length they had. So, we revisited the shopping list we initially gave to Bretten and went to the construction site ourselves. We found about 80% of what we had initially listed. The rest was not there, or the client on board, so we said, 'We have 80%, ago or so, 8 years ago. They didn't think about it at all. Now, they have actually established a company specifically focused on this. So, you can't buy it from them, but you can buy it, and it's nice to see. No, the demolition company searched for these profiles for two years but couldn't find them. So, I thought, 'Well, that's a shame.' That's when we started searching ourselves. We found a demolition company where the materials were just lying in a field. Now, it's common for various parties, including the first demolition company, to call us and say, 'Hey, we have this and that, and we're going to remove it. Can you use it (IM4)?'		At one point, we 'sat down with a demolition company and told them we have a shopping list. Can you find these materials because you do a lot of demolitions, and they also had a history with that client. So they said, 'No problem.' But, like I mentioned when we started with this project, the idea of reusing steel was not an aspect at all back then. That was about 10 years ago or so, 8 years ago. They didn't think about it at all. Now, they have actually established a company specifically focused on this. So, you can't buy it from them, but you can buy it, and it's nice to see. No, the demolition company searched for these profiles for two years but couldn't find them. So, I thought, 'Well, that's a shame.' That's when we started searching ourselves. We found a demolition company where the materials were just lying in a field. Now, it's common for various parties, including the first demolition company, to call us and say, 'Hey, we have this and that, and we're going to remove it. Can you use it (IM4)?'	Yes, the breakthrough of the project came because we took the initiative ourselves. So, when it comes to innovations, the party that wants it, that has the passion for it, really has to take the lead and go all in (IM4).	Yes, the breakthrough of the project came because we took the initiative ourselves. So, in the case of innovations, the party that wants it, that has the passion for it, really has to take the lead and go all in (IM4).		No, for each project we were running at that time, we had to figure out the best way, so it did take time and effort (IM4).
	External		We had a material investigation done in consultation with the client. We also created an inspection table to determine the steel quality, rust formation, delamination, and various other factors. A company conducted this material analysis for us (IM4).		The municipality didn't play a very significant role. However, we collaborated with the municipality on the quality control procedure and calculation system. In innovations, you naturally encounter regulations, and building regulations are particularly important in this case. But when it's existing or reused, we didn't have regulations for it. We discussed this with the municipality because they ultimately have to give their approval, and we are responsible for the calculations. The municipality is responsible for the execution, ensuring it's done correctly, and ultimately, for the quality of the steel because they took that over from us through the contract. The municipality then has to say, 'Okay, it's approved, and you will get a permit later (IM4).'	The municipality didn't play a very significant role. However, we collaborated with the municipality on the quality control procedure and calculation system. In innovations, you naturally encounter regulations, and building regulations are particularly important in this case. But when it's existing or reused, we didn't have regulations for it. We discussed this with the municipality because they ultimately have to give their approval, and we are responsible for the calculations. The municipality is responsible for the execution, ensuring it's done correctly, and ultimately, for the quality of the steel because they took that over from us through the contract. The municipality then has to say, 'Okay, it's approved, and you will get a permit later (IM4).'	You can see that clients want it, but they also feel like it has to be determined in a certain way, perhaps from above, like a decision made by the municipality, province, or some other party. However, sometimes the ones who have the ambition are the ones who are genuinely motivated about the topic, and that does affect the motivation for cooperation from the client's side (IN).		
	Internal		Because with that number of parties, you'll never going to be able to focus on anything. Everyone has their own capabilities and potential opportunities, risks and if you start putting them together, then opportunities are lost. Because I'm not going to do that (IM1). (IM 23 because I was like yes, I am a structural engineer, I want to deal with construction and I shouldn't deal with window frames and that's a reason for me because I don't know anything about that.)					When it comes to collaboration on circularity in the projects where, for example, we incorporate donor skeletons, we find that all parties must fully support and embrace the principle. This means that both the client, the architect, suppliers, and the main contractor must stand on board. We, of course, stand behind it, so we often initiate it as well. But everyone needs to embrace it (IM4).		Similar projects during this project, because it's a project that has had a long duration. But during the project, we've already encountered other works where we've used donor skeletons and reused constructions (IM4).
	External		To create policies for the construction and built environment, we first need to figure out how to make it compliant with regulations. Because, of course, regulations are primarily based on new materials, at least at that time and largely even now. So, if you want to make policies for the use of existing materials, you'll be included in, let's say, the building code and other regulations. How to address that (N)		Yes, it's about more sustainable concrete, right? That's why we've been involved in the Rijkswaterstaat dossier pilot projects. Nevertheless, Rijkswaterstaat hasn't made it mandatory yet. So, it may still need some innovation, but I see this mainly on the side of structuring contracts and prioritizing the right circular criteria that can make such a project a success (N).		When you look at the collaboration for circularity in the projects where, for example, we incorporate donor skeletons, we notice that all parties must support and embrace the principle. This means that the client, the architect, suppliers, and the main contractor must stand on board. We, of course, stand behind it, so we often initiate it as well. But everyone must embrace it (IM4).		
Maturity	Internal			Based on our current projects, we have now found a workflow for how to do it, how it can be done. The biggest challenge is when you're given a building that's already there and you're going to disassemble it, and then use it for a new building, it has a very high chance of success because you already know everything about it. You've already done the calculations, and you've the design twice because you already have the basis for your design (IM4).					
	External		That's one aspect, and ensuring regulations. So, I am also. This year, the first standard for the reuse of steel elements is being launched. It's been in development for a long time and was held between the Ministry of the Interior and the steel construction industry, and they are set to be launched in June (IM4).		That's one aspect, and ensuring regulations. So, I am also. This year, the first standard for the reuse of steel elements is being launched. It's been in development for a long time and was held between the Ministry of the Interior and the steel construction industry, and they are set to be launched in June (IM4).		The interesting thing is that almost all the parties have started doing something with it. We initially approached the demolition company, Bedaned, because they were the most enthusiastic about it. They even started a circular demolition company. We asked 'Bedaned: to do this, and they also got excited about it. They are now taking steps to make more reused materials available. We've noticed that all the other companies are doing this because they see a business model in it (IM4).		
Decline	Internal								
	External								

Very much
Many
Normal
Few
Very few

Results

Hoogstraat 168-172

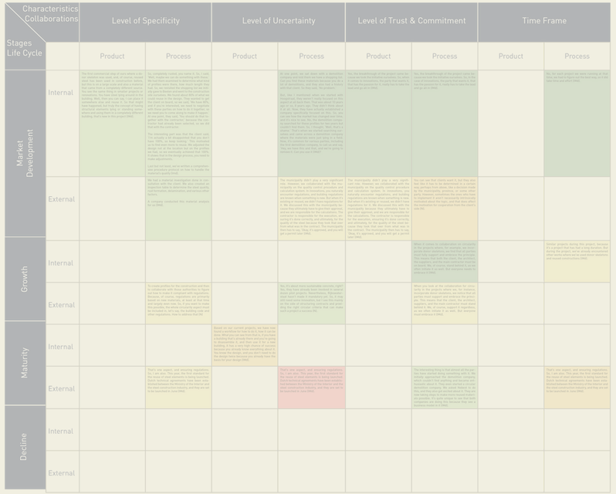
‘Because with that number of parties, you're never going to be able to focus on anything. Because everyone has their own capabilities and potential opportunities and risks and if you start putting them together, then opportunities get smaller and risks get bigger. I also didn't join CB 23 because I was like yes, I am a structural engineer, I want to deal with construction and I shouldn't deal with window frames and that's a waste for me because I don't know anything about that.’

Results

Seawood

Beelen Next

Hoogstraat 168-172



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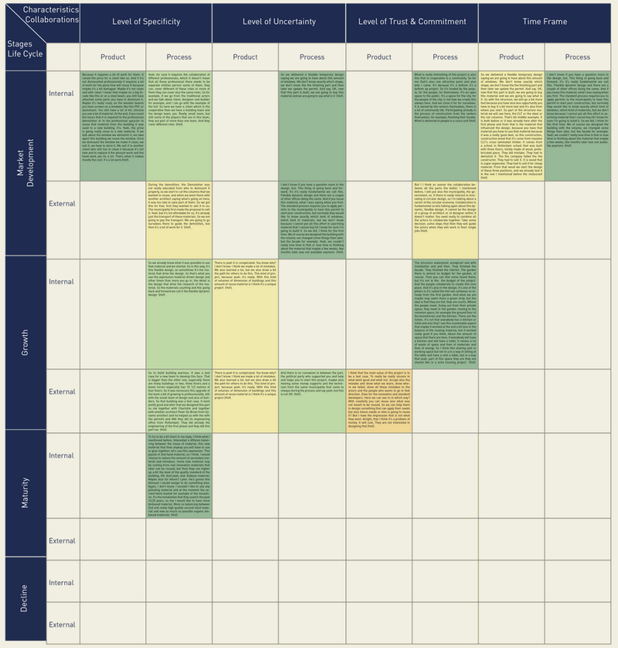


Results

The Hof van Cartesius

Stages Life Cycle / Characteristics Collaborations		Level of Specificity		Level of Uncertainty		Level of Trust & Commitment		Time Frame	
		Product	Process	Product	Process	Product	Process	Product	Process
Market Development	Internal	Because it requires a lot of work for them. It raised the price for a client like us. And if it's not dismounted professionally it requires a lot of work to make it reusable. For example, maybe it's a bit damaged. Maybe it's not clean and with clean I mean that maybe on a big facade like this, there's a lot of screws and other attached some parts you have to dismount it. Maybe it's really rusty, on the wooden beams you have screws on a windows like this PVC or aluminium. You still have a lot of kit, silicone and all that kind of stuff. And that takes a lot of the hours that it is required by the professional demolisher or by the professional upcycler to make it reusable. And that is the reason why it is used to a new building. It's. Yeah, the price is going really close to a new material. If we talk about the window we demolish it, we take apart this building we reuse the window, those windows are probably not going to be reused. We sell it, we have to store it. We sell it to another client who still has to clean it because it's not going to be perfect. It's going to be used. On the hand work you it's a lot. That's what it makes mostly the cost. It's a lot work (Hof).			So we delivered a flexible temporary design saying we are going to have about this amount of windows. We don't know exactly which shape, which size. We don't know exactly what we will do later we update the permit. And say, OK, now that this part is built, we are going to buy this material and we are going to say what is it (Hof).		What is really interesting of this project is also this that is cooperative is a community. So for me that's also one attractive point and also that's also one challenge because it's also a bottom up project. So it's funded by the people, for the people, for themselves. It's an open building. So that's also the idea that the part of the people of the city is not knew we create this always here. And we close it for for ourselves. It is served by the renters themselves, there is a lot of community life. Participating already in the design process and also in the build process themselves, for example, finishing their facades. What is delivered to people is a casco unit (Hof).	So we delivered a flexible temporary design saying we are going to have about this amount of windows. We don't know exactly which shape, which size. We don't know exactly what we will do later we update the permit. And say, OK, now that this part is built, we are going to buy this material and we are going to say what is it. So with the structure, we will go a bit more fast because you have also less opportunity you have to buy it a bit more fast and it's also from where you start. So part of the structure maybe you have to use that. So if you have already the rod columns. That's bit middle examples. It is both before or it was already here after the demolition. And that also has a bit of how it influenced the design, because you have that material you have to use that material because it was a really good deal, so this construction, connection wood that it's came from museum in. The Netherlands, which was a museum, was a school in Rotterdam school that was built with three floors, totally made of wood, prefabricated wood. And that was also ready for demolish it. The the company failed. He the constructor. They had to sell it. It is wood that was already there. So it was a really cheap material. From that would we start the design of these three pavilions, and we already test it in the one I mentioned before the restaurant (Hof).	I don't know if you have a question more in the design, but. This thing of going back and forward. It's it's really fundamental we can say. Because we cannot go to the city and say a couple of other offices doing the same. And if you reuse this material, what I was saying when you first. You need to have exactly which kind of windows, which kind of materials, but we don't know exactly permits to the municipality to take this permit to start your construction, but normally they would like to know exactly which kind of windows, which kind of materials, but we don't know exactly what we will do later. So we are using arching material that I cannot buy till I know for sure I'm going to build it. So we did, I think for the first time. We of course we designed the building with the facade, but the facade for example. Yeah, we couldn't really lose time in that or lose time in thinking about the material that maybe two months later was not available anymore (Hof).
	External		During the demolition, the Demolisher was not really educated from who to dismount it because it was not really clear what they were wanted to reuse, and when we went there with another architect saying what's going on here, it was too late to save part of them. So we got this for free, first they wanted to sell it to us. We were thinking about it, but we were not ready for it. Yeah, but's not affordable for us. It's already just the transport of these materials. So we are like, OK, we will not do it now, we are going to get ourselves. Rens to guide. Per demolition, but then it's a lot of work for it (Hof).		I don't know if you have a question more in the design, but. This thing of going back and forward. It's it's really fundamental we can say. Flexible dynamic design and Rens are a couple of other offices doing the same. And if you reuse this material, what I was saying when you first. The standard process requires you to apply permits to the municipality to take this permit to start your construction, but normally they would like to know exactly which kind of windows, which kind of materials, but we don't know because I cannot put all this effort in searching material that I cannot buy till I know for sure I'm going to build it. So we did, I think for the first time. We of course we designed the building with the facade, but the facade for example. Yeah, we couldn't really lose time in that or lose time in thinking about the material that maybe two months later was not available anymore (Hof).		But I I think as sooner the collaboration between all the parts the better. I mentioned before that I'm also involved in circularity in the rainforest, so. If there is really interest in integrating in circular design, so I'm talking about a sector of the circular economy. Collaboration is fundamental so lets talking again about this dynamic design. So we are not going to start as part of a group of architect or of designer within it doesn't matter. You need really to combine all the parties, the stakeholders, the decision, the decision, some steps that then they will guide the actors when they will work in their single jobs (Hof).		
Growth	Internal		So we already knew what it was possible to use that material, and we started. So in this way, it's this flexible design, so sometimes it's the material that drive the design. So that's what you mean with that material that drive the design or in other times than where you go in, the detail is the design that drive the research of the material. So the materials counting and this going back and forward we call it the flexible dynamic design. (Hof).	There is yeah it is complicated. You know why? I don't know. I think we made a lot of mistakes. We also learned a lot, but we also draw a bit the path for others to do this. This kind of project, because yeah, it's really. With this kind of volumes of dimension of buildings and this amount of reuse material is I think it's a unique project. (Hof).			The structure waterproof, windproof and also installations and and then. They finished the facade. They finished the interior. The garden there is almost no budget for the garden, of course. There is a budget for the garden, but but it's not in the. For the budget of the project. And the people collaborate to create this nice place. And it's also the reason why, in size of the units. And it's also the first project. It's not really ready from the first garden. And what we are maybe may seem more a green strip, but the idea is that they are hot, they are courts. Where the people can. Yeah, they can use the shared spaces, they meet in the garden, moving to the common space, for example the ground floor of the restaurant, because in the units, there are no kitchen, it's not that everybody has a kitchen or toilet and also that I see this sustainable aspect that maybe it worked at the end a bit less in the balance of the reusing material, but it worked really well in the fact that in the common space that there are here, if everybody will have a kitchen and will have a toilet. It means a lot of material. And that means a lot of resources and of energy. So I think this sharing and co working space but not in a in a way of sitting at the table and have a rest a table, but in a way that yeah, part of this space they are they are shared like in a echo housing project. (Hof).		
	External		So to build building warmoo. It was a test case for a new team to develop this face. That is bigger than the other one, especially there are many buildings or two, three floors and a boom torres especially has 75 1/2 metres at the top. So it was a challenge for us, because also the team a bit of growing in professionality, still with the small team of design and also of building. So it was a challenge for us, but we are pretty good and after that we designed this part so me together with Charlotte and together with another colleague of Petra De Bruijn from Ubbink, we developed this facade from the. Uh, the permits and VAT they did as engineering office from Rotterdam. They did already the engineering of the first phase and they did this part too (Hof).	There is yeah it is complicated. You know why? I don't know. I think we made a lot of mistakes. We also learned a lot, but we also draw a bit the path for others to do this. This kind of project, because yeah, it's really. With this kind of volumes of dimension of buildings and this amount of reuse material is I think it's a unique project (Hof).	And there is no connexion in between the part, the political party who supported you and help you to start this project, maybe also moving some money supports and the technician from the same municipality that come to the end of the process and say yeah, but this is not OK (Hof).	I think that the main value of this project is to be a test case. To really be really sincere in what went good and what not. Accept also the mistake and show what we learn, show when we failed, show all these mistakes to the people that are starting now and to go in the right direction. Even for the innovation and standard developers. Here we can see in in which way? Which direction? Is it is it a way that we would not meant to be reused. So we can help them to design something that can apply their needs but also future needs or who is going to reuse it? And I think that's the value of this project that they want. Allright, that I think it's a problem of money. It will cost. They are not interested in designing that (Hof).		
Maturity	Internal		To try to be a bit short in my reply, I think what I mentioned before, the balance that we found existing between the reuse of materials, this new material that then anyway you will have to use to glue together, let's use this expression. This popole of 2nd hand material, so I think. I would not change anything because we found a good material and introduce. Some new material may be coming from real innovation materials that are not there yet. Maybe they will be able to make up a bit the level of the quality standard of the building. OK. And yeah, and, biobase material. Maybe also for whom? Later. He's gonna this dimoulit I would assign to do something else. Maybe it's not the best way to do it. It's a bit polluting material and at the moment the second hand market for example of the insulation. Is. Is developing. Maybe in the next 5 or 10,20 years, so me I would like to have more biobased material. More so balancing between 2nd and really high quality second hand material and new as much as possible organic biobased materials. (Hof).							
	External								
Decline	Internal								
	External								

Very much
Many
Normal
Few
Very few

Results

The Hof van Cartesius

Stages Life Cycle		Level of Specificity		Level of Uncertainty		Level of Trust & Commitment		Time Frame	
		Product	Process	Product	Process	Product	Process	Product	Process
Market Development	Internal	Because it requires a lot of work for them. It raised the price for a client like us. And if it's not dismounted professionally it requires a lot of work to make it reusable. For example, maybe it's a bit damaged. Maybe it's not clean and with clean I mean that maybe on a big facade like this, there's a lot of screws and other attached some parts you have to dismount it. Maybe it's really rusty, on the wooden beams you have screws on a windows like this PVC or aluminium. You still have a lot of kit, silicone and all that kind of stuff. And that takes a lot of the hours that it is required to the professional demolisher or to the professional upcycler to make it reusable. And that is the reason why it is used to a new building. It's. Yeah, the price is going really close to a new material. If we talk about the window we dismount it, we take apart this building we reuse the window. Since we have the connection with the client that we sell it, we have to store it. We sell it to another client who still has to clean it because it's not clean. And then we have to store it and then we hand work you to a lot. That's what it makes mostly the cost. It's a lot work (Hoff).	Yeah, for sure it requires the collaboration of different professionals, which it doesn't mean that all those professional there needs to be involved in every project, but there are a lot that can, cover different of these roles or more of them they can cover also the same roles. So for example, we have a client which is the cooperative and we talk about client, designer and builder for example, and I can go with the example of the hof. So here we have a client which is the cooperative then we have a building team and then we have us as the designer. And there are still some of the players that are in this team, they are part of more than one team. And they cover different roles. (Hoff).		So we delivered a flexible temporary design saying we are going to have about this amount of windows. We don't know exactly which shape, but that's also one attractive point and also that's also one attractive point and also bottom up project. So it's funded by the people, for the people, for themselves. It's an open building. So the idea is that the people, so the people of the city, is not knew we create this always here. And we close it for for ourselves. It is served by the renters themselves, there is a lot of community life. Participating already in the design process and also in the build, so even themselves, for example, finishing their facades. What is delivered to people is a casco unit (Hoff).		What is really interesting of this project is also this that is cooperative is a community. So for me that's also one attractive point and also that's also one attractive point and also bottom up project. So it's funded by the people, for the people, for themselves. It's an open building. So the idea is that the people, so the people of the city, is not knew we create this always here. And we close it for for ourselves. It is served by the renters themselves, there is a lot of community life. Participating already in the design process and also in the build, so even themselves, for example, finishing their facades. What is delivered to people is a casco unit (Hoff).	So we delivered a flexible temporary design saying we are going to have about this amount of windows. We don't know exactly which shape, but that's also one attractive point and also then later we update the permit. And say, OK, now that this part is built, we are going to buy this material and we are going to say what is it (Hoff).	I don't know if you have a question more in the design, but. This thing of going back and forward. It's it's really fundamental we can say. I'm talking about a sector of the circular economy. Collaboration is fundamental so lets talking again about this dynamic design and there are a couple of other offices doing the same. And if you reuse this material, what I was saying when you first. The standard process requires you to apply permit, so you have to apply permit, you have to start your construction, but normally they would like to know exactly which kind of windows, which kind of materials, but we don't know it because I cannot put all this effort in searching material that I cannot buy till I know for sure I'm going to build it. So we did, I think for the first time. We of course we designed the building with the material that maybe a few weeks later, but the facade for example. Yeah, we couldn't really lose time in that or lose time in thinking about the material that maybe a few weeks later was not available anymore (Hoff).
	External		During the demolition, the Demolisher was not really educated from who to dismount it because we were there and we were there, we wanted to reuse, and when we went there with another architect saying what's going on here, it was too late to save part of them. So we got this for free, first they wanted to sell it to us. We didn't know exactly what we were going to do it. Yeah, but it's not affordable for us. It's already just the transport of these materials. So we are like, OK, this is not for us, we are going to get somewhere. There to guide. The demolition, but then it's a lot of work for it (Hoff).		I don't know if you have a question more in the design, but. This thing of going back and forward. It's it's really fundamental we can say. Flexible dynamic design and there are a couple of other offices doing the same. And if you reuse this material, what I was saying when you first. The standard process requires you to apply permit, so you have to apply permit, you have to start your construction, but normally they would like to know exactly which kind of windows, which kind of materials, but we don't know it because I cannot put all this effort in searching material that I cannot buy till I know for sure I'm going to build it. So we did, I think for the first time. We of course we designed the building with the material that maybe a few weeks later, but the facade for example. Yeah, we couldn't really lose time in that or lose time in thinking about the material that maybe a few weeks later was not available anymore (Hoff).		But I I think as sooner the collaboration between all the parts the better. I mentioned before the, the cooperative between the, the, the,

Results

The Hof van Cartesius

‘And there is no connection in between the political party who supported you and helped you to start this project, maybe also moving some money supports and the technician from the same municipality that come to check during the process and say yeah, but this is not OK.’

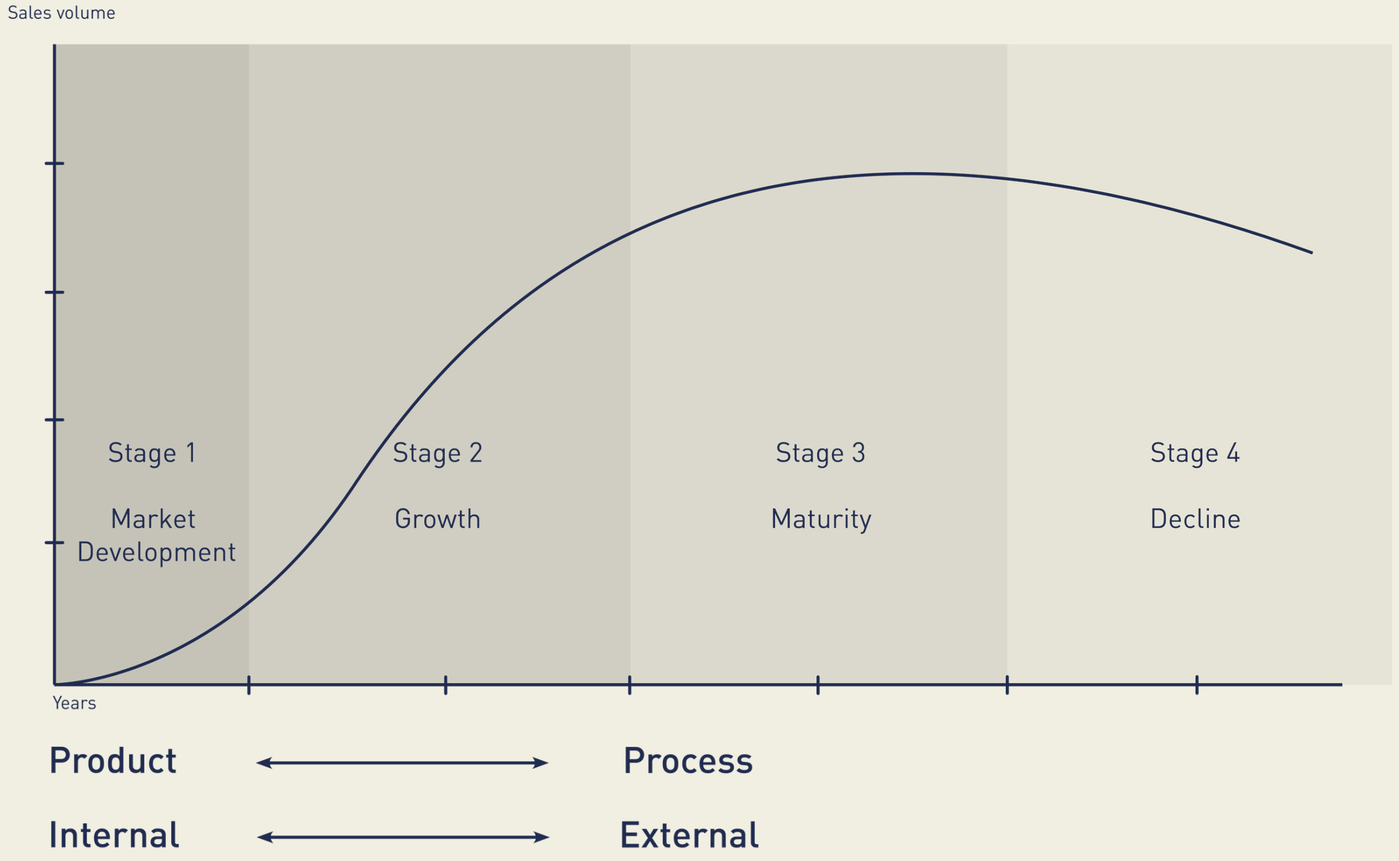
Discussion

Discussion

Seawood

Characteristics / Collaborations / Stages / Life Cycle		Level of Specificity		Level of Uncertainty		Level of Trust & Commitment		Time Frame	
		Product	Process	Product	Process	Product	Process	Product	Process
Market Development	Internal	Adolf Kurz and Lisa Ma: only final pre-tenders in which all consortia in one round have to offer. Construction - material? Or does it not matter - specific - can mean various	But up to everyone like the material that's it [illegible] and then you can't say that you have had to see in specific ratios. You have to look at the whole project and see what's the best in the case, and you have to have basic biochemistry knowledge [MB]	But in the end I tried to make a book as much as possible about the process and the result and I brought it to the first focus groups and they were very positive about it and I also got a lot of feedback from them. Because I think it's a very different [MM]	Ask one of the biggest challenges is now the architects present them to the building industry and the building industry is not used to this kind of product by itself is really hard to enter the market. So that's why we have to work together with other people to get it. It will be hard to [illegible] to the building industry that they have to do the structure and materials, there's a lot more cost and, and, does this [illegible] sheet [MM]	We make sure that we contribute to a circular economy and that's also a reason why we have so much [illegible] in our project. So we have chosen that it's more [illegible] and that's why we have chosen for [illegible] [MM]				
	External	OK, depends a bit on the role of the client of the technical expertise that is needed. I would of course say that it's important that you have a client from a business. If you're already an installer, or you're already a producer, then you can say that it is a business client that is not directly the client that's going to offer people work. But if you're a client that's more from a user point of view, then you're more from a user point of view and you're more from a business point of view. I think that's along with you and different [illegible] in themselves. It works both ways I think [MM]	And on the market side, in some later because I think that's also important that you have to do the market thereby focus groups more or less [illegible] and then you can see what's the best approaches, because if there's no interest there, then you can't do anything with it. So you have to have the chance to connect with the market of course as possible, yeah [MM]	What's [illegible] sometimes is that an circular economy is not always cheaper. So that's a big challenge when you do that. But sometimes you can also see that it's cheaper because you can reuse and then actually the material was already [illegible] and then you don't have to buy it anymore. So yeah that that's a [illegible] to think about. But sometimes you have to connect with some options right to collaborate, to know that you can actually [illegible] and that you can get a good and have the business [illegible] [MM]	Yeah, because there you actually need to have a lot of knowledge. So I think that's also a big challenge is now that we have a product, but in order to get it on the market, we have to [illegible] to the building industry that they have to do the structure and materials, there's a lot more cost and, and, does this [illegible] sheet [MM]				
Growth	Internal	We actually hope to be able to deliver some- thing that [illegible] is a bit different. So that steps and [illegible] then more than you'd think of the [illegible] and [illegible] and [illegible] and

Discussion


Sales volume
Stage 1
Market Development
Stage 2
Growth
Stage 3
Maturity
Stage 4
Decline
Years
Product
Process
Internal
External

Discussion

Key Takeaways

Discussion

Key Takeaways

1. Product innovation is linked to process innovation.

Discussion

Key Takeaways

1. Product innovation is linked to process innovation.
2. Focus more on process innovation.

Discussion

Key Takeaways

1. Product innovation is linked to process innovation.
2. Focus more on process innovation
3. You don't always have to collaborate, but it is good to collaborate at the beginning of every innovation.

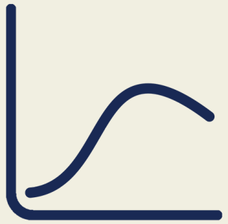
Conclusion

Conclusion

What is the relationship between collaboration and innovation in the circular construction sector?

Conclusion

What is the relationship between collaboration and innovation in the circular construction sector?



Product life cycle

Conclusion

What is the relationship between collaboration and innovation in the circular construction sector?

Product life cycle

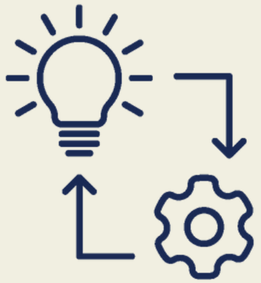
Product innovation

Conclusion

What is the relationship between collaboration and innovation in the circular construction sector?

Product life cycle

Product innovation



Process innovation

Conclusion

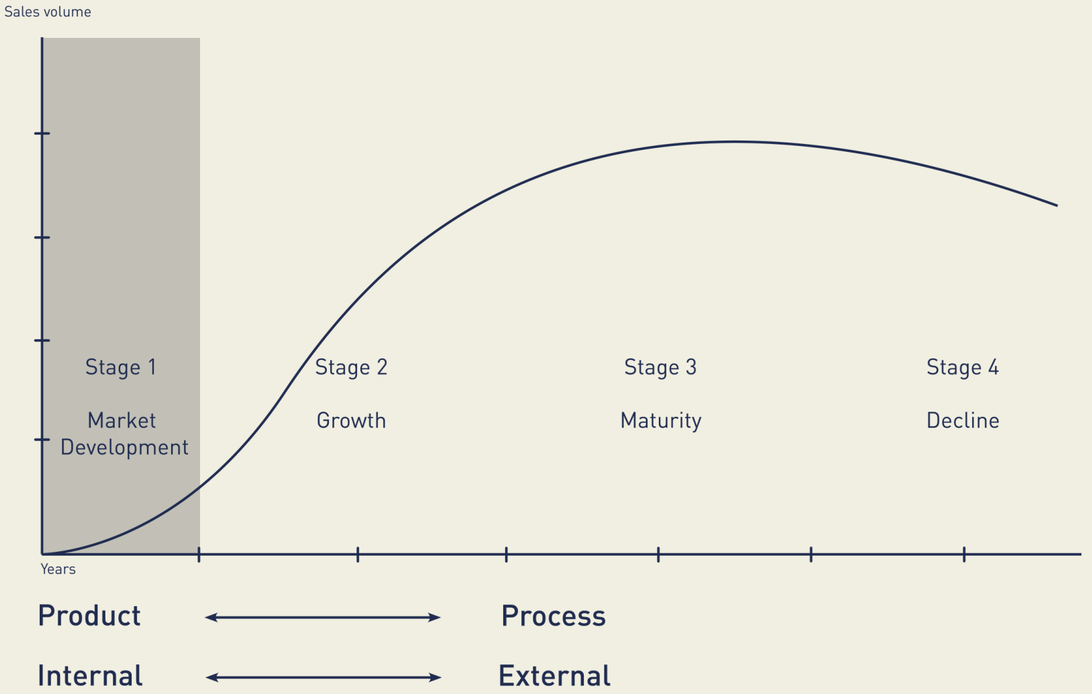
If we want to achieve the circular economy, it would be advisable for governments to examine the three takeaways and provide more targeted subsidies.

Thank you for your attention

Results

Stages Life Cycle / Characteristics Collaborations		Level of Specificity		Level of Uncertainty		Level of Trust & Commitment		Time Frame	
		Product	Process	Product	Process	Product	Process	Product	Process
Market Development	Internal	The first commercial step of ours where a door solution was used, and, of course, moved to the next project. The challenge was to find this in a large scale and also a material that came from a completely different source. Reclaimed wood is not always available in renewables. You have steel lying around in the building. Well, then you can say, I can place it somewhere else. And that's also what we have done. We have had lying around in the building, structural elements lying or standing somewhere, that's where this comes from. Recycled building, that's new in this project (INA).	So, completely rooted, you name it. So, I said, 'Well, maybe we can do something with these.' And then we started calculating what the amount of profiles were there, how much length they had. So, we revisited the shopping list we initially had and then we started calculating with the old variables. We found about 80% of what we could reuse in the design. They wanted to get rid of the profiles, so we took it off their hands and if you're interested, we need to negotiate with these parties on how to do it together, so that's also something we have done in this project. At one point, they said, 'You should do that together with the contractor,' because the contractor had already been selected, so we did that with the contractor. The interesting part was that the client said, 'I'm actually a bit disappointed that you don't have 100%, so keep looking.' This motivated us to find even more in reuse. We adjusted the design not at the location but on the profiles. So, we changed the dimensions of the profiles. It shows that in the design process, you need to make adjustments. Last but not least, we've written a comprehensive procedure protocol on how to handle the material's quality (Ind).		All side point, we sat down with a demolition company and told them we have a shopping list. They said, 'Interesting because we have a lot of demolitions, and they also had a history with that client. So they said, 'No problem.' But, like I mentioned when we started with Hoogstraat, they weren't really focused on this circularity thing. They were focused on what we did 10 years ago, it's 5 years ago. They didn't think about it at all. Now, they have actually established a department for circularity, and it's nice to see. We can see how the market has changed over time, and it's nice to see. So, the demolition company that we initially wanted to work with, they couldn't find them. So, I thought, 'Well, that's a shame.' That's when we started searching ourselves and came across a demolition company where it's relatively more just lying in a barn. Now, it's relatively more just lying in a barn. We found the demolition company, to cut a long story short. They, we have this and that, and we're going to remove it. Can you use it (Ind)?	Yes, the breakthrough of the project came because we took the initiative ourselves. So, in the beginning, nobody asked for circularity. We had the passion for it, really has to take the lead and go all in (Ind).	Yes, the breakthrough of the project came because we took the initiative ourselves. So, in the beginning, nobody asked for circularity. We had the passion for it, really has to take the lead and go all in (Ind).		No. So each project we were running at that time, we had to figure out the best way, so it cost here time and effort (Ind).
	External		We had a material investigation done in consultation with the client. We had a certified inspection body to determine the most quality, rust formation, delamination, and various other factors. A company conducted this material analysis for us (Ind).		The municipality didn't play a very significant role in the projects where, for example, we incorporate the quality control procedure and calculation system. In innovations, you actually see that municipalities are very much there when something is new. But when it's existing or reused, we didn't have regulations for it, municipality because they ultimately have to give their approval, and we are responsible for the calculations. The municipality then has to say, 'Okay, it's approved, and you will get a permit later (Ind).	The municipality didn't play a very significant role in the projects where, for example, we incorporate the quality control procedure and calculation system. In innovations, you actually see that municipalities are very much there when something is new. But when it's existing or reused, we didn't have regulations for it, municipality because they ultimately have to give their approval, and we are responsible for the calculations. The municipality then has to say, 'Okay, it's approved, and you will get a permit later (Ind).	You can see that clients want it, but they also that it's not the most obvious thing in the way, perhaps from above, like a decision made by the municipality, province, or some other party. Municipalities sometimes find it difficult to implement it aren't necessarily technically motivated about the topic, and that does affect the motivation for cooperation from the client's side (In).		Similar projects during this project, because it's a project that has had a long duration. But during the project, we've already encountered more projects with reclaimed steel skeletons and reused constructions (Ind).
Growth	Internal						When it comes to collaboration on circularity in the projects where, for example, we incorporate donor skeletons, we find that all parties have to be willing to go along with the process. This means that both the client, the architect, the suppliers, and the main contractor must be willing to go along with it, and one party often initiates it as well. But everyone needs to embrace it (Ind).		
	External		To create profiles for the constructions and then to collaborate with those authorities to figure out how to make it compliant with regulations, and that is also a challenge because we've been based on new materials, at least at that time and largely even now. So, if you want to make a building that's already there and you're going to be included in, let's say, the building code and other regulations. How to address that (In).		Yes, it's about more sustainable concrete, right? Yes, they have already been involved in several dozen pilot projects. Nevertheless, Rijkswaterstaat is also a party that wants to and has to still invest some innovation, but I see this mainly on the side of structuring contracts and providing the right circular criteria that can make such a project a success (In).		When you look at the collaboration for circularity in the projects where we, for instance, incorporate donor skeletons, we notice that all parties have to be willing to go along with the process. This means that the client, the architect, suppliers, and the main contractor must stand behind it, or at least support it regardless, as we often initiate it as well. But everyone must embrace it (Ind).		
Maturity	Internal			Based on our current projects, we have now found a workflow for how to do it, how it can be done. What you can see from that is, if you have a building that's already there and you're going to disassemble it, and then use it for a new building, then you can already say in advance because you already know everything about it. You know the design, and you don't need to do the whole design process anymore; you already have the basis for your design (Ind).					
	External		That's one aspect, and ensuring regulations. So, I am also. This year, the first standard for CE marking for concrete products was published. Dutch technical agreements have been established between the Ministry of the Interior and the Rijkswaterstaat, municipality, and they are set to be launched in June (Ind).		That's one aspect, and ensuring regulations. So, I am also. This year, the first standard for CE marking for concrete products was published. Dutch technical agreements have been established between the Ministry of the Interior and the Rijkswaterstaat, municipality, and they are set to be launched in June (Ind).		The interesting thing is that almost all the parties have started doing something with it. We have also had parties in the consortium with whom we which couldn't find anything and become enthusiastic about it. They even started a circular construction company. They saw the potential in this, and they also got excited about it. They are now taking steps to make more reused materials available. That is also nice to see that the companies are doing this because they see a business model in it (Ind).		That's one aspect, and ensuring regulations. So, I am also. This year, the first standard for CE marking for concrete products was published. Dutch technical agreements have been established between the Ministry of the Interior and the Rijkswaterstaat, municipality, and they are set to be launched in June (Ind).
Decline	Internal								
	External								

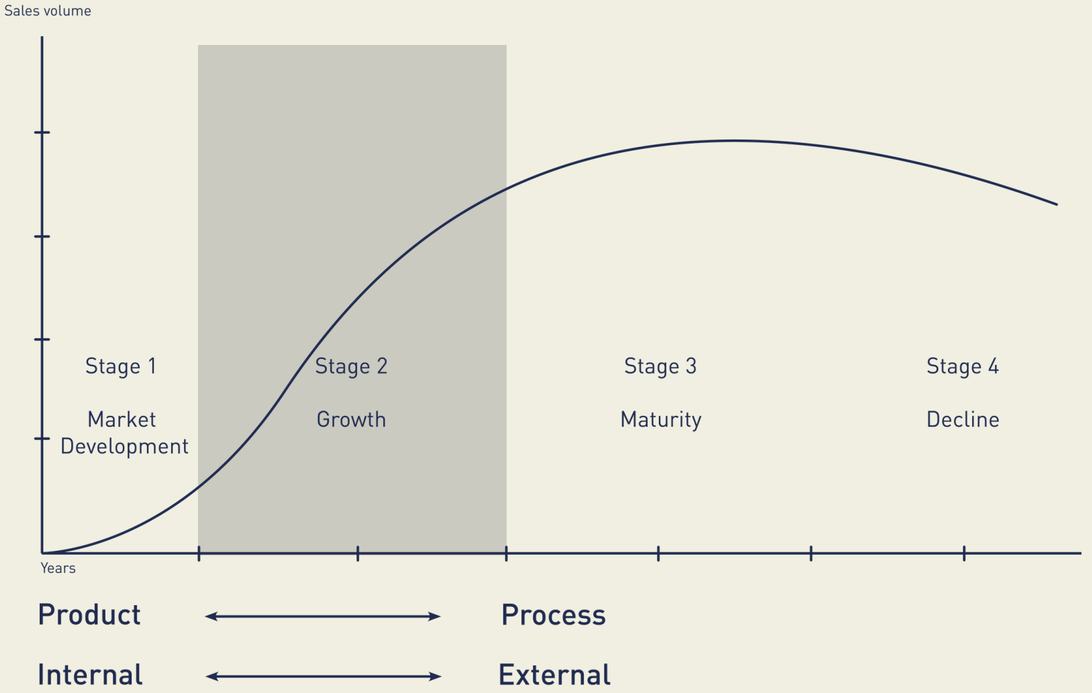
Very much
Many
Normal
Few
Very few



Results

Characteristics Collaborations / Stages Life Cycle		Level of Specificity		Level of Uncertainty		Level of Trust & Commitment		Time Frame	
		Product	Process	Product	Process	Product	Process	Product	Process
Market Development	Internal	The first commercial step of ours where a donor skeleton was used, and, of course, moved to the next project. We've been very pleased to put this in on a large scale and also a material that came from a completely different source. We've been able to make a lot of savings and innovations. You have steel lying around in the building. Well, then you can say, I can place it somewhere else. And that's also what we have done here, but truly the concept of having structural elements lying or standing somewhere and using them in a completely different building, that's new in this project [Mol].	So, completely rusted, you name it. So, I said, 'Well, maybe we can do something with these.' We've been investigating the economic and ecological profiles were there, how much length they had. So, we revisited the shopping list we initially had for the project and adapted it based on site ourselves. We found about 80% of what we could reuse in the design. They wanted to get rid of the material, and we said, 'Well, we can, and if you're interested, we need to negotiate with these parties on how to do it together, so that we can also benefit from that.' And they were at one point, they said, 'You should do that together with the contractor,' because the contractor had already been selected, so we did that with the contractor. The interesting part was that the client said, 'I'm actually a bit disappointed that you don't have 100%, so keep looking.' This motivated us to find even more to reuse. We adjusted the design not at the location but on the profiles that we had in our warehouse, and in the end, it shows that in the design process, you need to make adjustments. Last but not least, we've written a comprehensive procedure protocol on how to handle the material's quality [Ind].		At one point, we sat down with a demolition company and told them we have a shopping list. And they said, 'Interesting because we have a lot of demolitions, and they also had a history with that client. So they said, 'No problem.' But, like I mentioned when we started with Hoogstraat, they weren't really focused on this circular aspect. They did this project maybe 10 years ago or so, 8 years ago. They didn't think about it at all. Now, they have actually established a department for circularity [Ind]. So, in this case, we can see how the market has changed over time, and it's nice to see. So, the demolition company that we initially wanted to work with, they couldn't find them. So, I thought, 'Well, that's a shame.' That's when we started searching ourselves and came across a demolition company that's innovative more or less in the region. Now, it's interesting to see that we're working the first demolition company, to call us and say, 'Hey, we have this and that, and we're going to remove it. Can you use it [Mol]?	Yes, the breakthrough of the project came because we took the initiative ourselves. So, in the end, the contractor was also willing to go along, has the passion for it, really has to take the lead and go all in [Mol].	Yes, the breakthrough of the project came because we took the initiative ourselves. So, in the end, the contractor was also willing to go along, has the passion for it, really has to take the lead and go all in [Mol].		Yes, for each project we were running at that time, we had to figure out the best way, so it did take time and effort [Mol].
	External		We had a material investigation done in consultation with the client. We had a certified inspection labs to determine the steel quality, rust formation, delamination, and various other factors. A company conducted this material analysis for us [Mol].		The municipality didn't play a very significant role in the projects where we, for instance, incorporate donor skeletons, we notice that all parties involved in general dislike uncertainty. This means that both, for client, the architect, the suppliers, and the main contractor must be willing to go along with the project, as we often initiate it as well. But everyone needs to embrace it [Mol].	The municipality didn't play a very significant role in the projects where we, for instance, incorporate donor skeletons, we notice that municipality on the quality control procedure and calculation system. In innovations, you naturally run into uncertainties because the rules and regulations are known when something is new. But when it's existing or reused, we didn't have regulations for it. Therefore, it's also very important to discuss they ultimately have to give their approval, and we are responsible for the calculations. The municipality then has to say, 'Okay, it's approved, and you will get a permit later [Mol].	You can see that clients want it, but they also don't want it. They're motivated in a certain way, perhaps from above, like a decision made by the municipality, province, or some other authority. Sometimes, clients are also motivated to implement it aren't necessarily intrinsically motivated about the topic, and that does affect the motivation for cooperation from the client's side [Vic].		
Growth	Internal						When it comes to collaboration on circularity in the projects where, for example, we incorporate donor skeletons, we find that all parties involved in general dislike uncertainty. This means that both, for client, the architect, the suppliers, and the main contractor must be willing to go along with the project, as we often initiate it as well. But everyone needs to embrace it [Mol].		Similar projects during this project, because it's a project that has had a long duration. But during the project, we've already encountered some circularity, and we've had some skeletons and reused constructions [Mol].
	External		To create profiles for the constructies and then to collaborate with those authorities to figure out how to make it compliant with regulations, and that's, of course, a challenge because they're based on new materials, at least at that time and largely even now. So, if you want to make it circular, there are a lot of aspects that need to be included in, let's say, the building code and other regulations. How to address that [Ni]		Yes, it's about more sustainable concrete, right? Yes, they have already been involved in several dozen pilot projects. Nevertheless, Rijkswaterstaat is also a very conservative party. They're still a bit timid some innovation, but I see this mainly on the side of structuring contracts and providing the right circular criteria that can make such a project a success [Ni].		When you look at the collaboration for circularity in the projects where we, for instance, incorporate donor skeletons, we notice that all parties involved in general dislike uncertainty. This means that the client, the architect, suppliers, and the main contractor must stand behind it. The client needs to support it regardless, as we often initiate it as well. But everyone must embrace it [Mol].		
Maturity	Internal			Based on our current projects, we have now found a workflow for how to do it, how it can be done. What you can see from that is, if you have a building that's already there and you're going to disassemble it, and then use it for a new building, that's the most ideal scenario for us because you already know everything about it. You know the design, and you don't need to do much research because everything already have the basis for your design [Mol].					
	External		That's one aspect, and ensuring regulations. So, I am also. This year, the first standard for steel reuse in structural elements was published. Dutch technical agreements have been established between the Ministry of the Interior and the Rijkswaterstaat, namely, and they are set to be launched in June [Mol].		That's one aspect, and ensuring regulations. So, I am also. This year, the first standard for steel reuse in structural elements was published. Dutch technical agreements have been established between the Ministry of the Interior and the Rijkswaterstaat, namely, and they are set to be launched in June [Mol].		The interesting thing is that almost all the parties have started doing something with it. We have also been in touch with companies and parties which couldn't find anything and become enthusiastic about it. They even started a circular demolition company. They didn't have that for this, and they also got excited about it. They are now taking steps to make more reused materials available [Mol]. So, to be honest, that's what companies are doing this because they see a business model in it [Mol].		That's one aspect, and ensuring regulations. So, I am also. This year, the first standard for steel reuse in structural elements was published. Dutch technical agreements have been established between the Ministry of the Interior and the Rijkswaterstaat, namely, and they are set to be launched in June [Mol].
Decline	Internal								
	External								

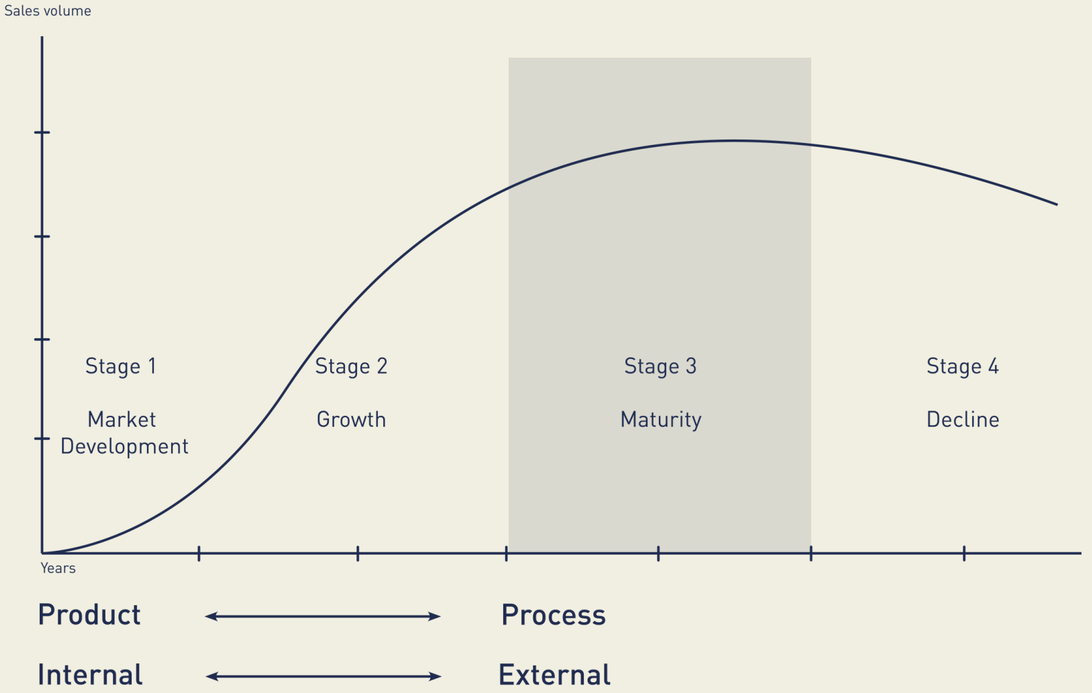
Very much
Many
Normal
Few
Very few



Results

Characteristics / Collaborations / Stages Life Cycle		Level of Specificity		Level of Uncertainty		Level of Trust & Commitment		Time Frame	
		Product	Process	Product	Process	Product	Process	Product	Process
Market Development	Internal	The first commercial step of ours where a donor skeleton was used, and, of course, moved to the next project. We had never done anything but this in on a large scale and also a material that came from a completely different source. We had to work out a lot of practical and logistic necessities. You have steel lying around in the building. Well, then you can say, I can place it somewhere else, but you have to be sure that you have happened, but truly the concept of having structural elements lying or standing somewhere and using them this completely different building, that's new in this project (Mo).	So, completely rusted, you name it. So, I said, 'Well, maybe we can do something with these.' We had a discussion with the demolition company, of profiles were there, how much length they had. So, we revisited the shopping list we initially had, and we made a selection of profiles that we ourselves. We found about 80% of what we could reuse in the design. They wanted to get rid of the profiles, and we said, 'Well, if that's the case and if you're interested, we need to negotiate with these parties on how to do it together, so that we can guarantee the quality of the profiles.' At one point, they said, 'You should do that together with the contractor,' because the contractor had already been selected, so we did that with the contractor. The interesting part was that the client said, 'I'm actually a bit disappointed that you don't have 100%, so keep looking.' This motivated us to find even more to reuse. We adjusted the design not at the location but on the profiles that we had available and that we could reuse. So it shows that in the design process, you need to make adjustments. Last but not least, we've written a comprehensive procedure protocol on how to handle the material's quality (Ind).		All side point, we sat down with a demolition company and told them we have a shopping list. We had a discussion with them because they had a lot of demolitions, and they also had a history with that client. So they said, 'No problem.' But, like I mentioned when we started with Hoogstraat, they weren't really focused on this circularity thing. They were focused on what we did ages or so, 8 years ago. They didn't think about it at all. Now, they have actually established a circularity department within their firm. So, you can see how the market has changed over time, and it's nice to see. So, the demolition company, they were very interested, and they said, 'We couldn't find them. So, I thought, 'Well, that's a shame.' That's when we started searching ourselves and came across a demolition company that's very innovative and very willing to learn. Now, it's interesting to work with them. I'm calling the first demolition company, to call us and say, 'Hey, we have this and that, and we're going to remove it. Can you use it (Mea)?	Yes, the breakthrough of the project came because we took the initiative ourselves. So, in the beginning, nobody asked us to do this. We had the passion for it, really has to take the lead and go all in (Mo).	Yes, the breakthrough of the project came because we took the initiative ourselves. So, in the beginning, nobody asked us to do this. We had the passion for it, really has to take the lead and go all in (Mo).		Yes, for each project we were running at that time, we had to figure out the best way, so it did take time and effort (Mo).
	External		We had a material investigation done in consultation with the client. We had a certified inspection lab to determine the steel quality, rust formation, delamination, and various other factors. A company conducted this material analysis for us (Mo).		The municipality didn't play a very significant role in the projects where we, for instance, incorporate donor skeletons, we notice that all parties involved in general are known when something is new. But when it's existing or reused, we didn't have regulations for it. Because they ultimately have to give their approval, and we are responsible for the calculations. The municipality then has to say, 'Okay, it's approved, and you will get a permit later (Mo).	The municipality didn't play a very significant role in the projects where we, for instance, incorporate donor skeletons, we notice that all parties involved in general are known when something is new. But when it's existing or reused, we didn't have regulations for it. Because they ultimately have to give their approval, and we are responsible for the calculations. The municipality then has to say, 'Okay, it's approved, and you will get a permit later (Mo). You can see that clients want it, but they also don't. They're not really pushing it in a certain way, perhaps from above, like a decision made by the municipality, province, or some other authority. Sometimes, clients are also forced to implement it aren't necessarily intrinsically motivated about the topic, and that does affect the motivation for cooperation from the client's side (Ve).		
Growth	Internal						When it comes to collaboration on circularity in the projects where, for example, we incorporate donor skeletons, we find that all parties involved in general are known when something is new. This means that both the client, the architect, the suppliers, and the main contractor must be willing to go for it. But everyone needs to be the other initiate it as well. But everyone needs to embrace it (Mo).		Similar projects during this project, because it's a project that has had a long duration. But during the project, we've already encountered some projects with similar donor skeletons and reused constructions (Mo).
	External		To create profiles for the constructions and then to collaborate with those authorities to figure out how to make it compliant with regulations, and that's, of course, something that's currently based on new materials, at least at that time and largely even now. So, if you want to make sure that reused steel can be used, it needs to be included in, let's say, the building code and other regulations. How to address that (Ni)		Yes, it's about more sustainable concrete, right? Yes, they have already been involved in several dozen pilot projects. Nevertheless, Rijkswaterstaat is still a very traditional party. They're still a bit timid some innovation, but I see this making on the side of structuring contracts and governing the right circular criteria that can make such a project a success (Ni).		When you look at the collaboration for circularity in the projects where we, for instance, incorporate donor skeletons, we notice that all parties involved in general are known when something is. This means that the client, the architect, suppliers, and the main contractor must stand behind it. They must want to support it regardless, as we often initiate it as well. But everyone must embrace it (Mo).	
Maturity	Internal			Based on our current projects, we have now found a workflow for how to do it, how it can be done. What you can see from that is, if you have a building that's already there and you're going to disassemble it, and then use it in a new building, that's very much the case for this project because you already know everything about it. You know the design, and you don't need to do that much research because you already have the basis for your design (Mo).					
	External		That's one aspect, and ensuring regulations. So, I am also. This year, the first standard for steel has been established, and several dozen Dutch technical agreements have been established between the Ministry of the Interior and the Rijkswaterstaat, and they are set to be launched in June (Mo).		That's one aspect, and ensuring regulations. So, I am also. This year, the first standard for steel has been established, and several dozen Dutch technical agreements have been established between the Ministry of the Interior and the Rijkswaterstaat, and they are set to be launched in June (Mo).		The interesting thing is that almost all the parties have started doing something with it. We have also been in touch with a demolition company which couldn't find anything and become enthusiastic about it. They even started a circular department within their firm. So, they're also on this, and they also got excited about it. They are now taking steps to make more reused materials available. So, it's nice to see that these companies are doing this because they see a business model in it (Mo).		That's one aspect, and ensuring regulations. So, I am also. This year, the first standard for steel has been established, and several dozen Dutch technical agreements have been established between the Ministry of the Interior and the Rijkswaterstaat, and they are set to be launched in June (Mo).
Decline	Internal								
	External								

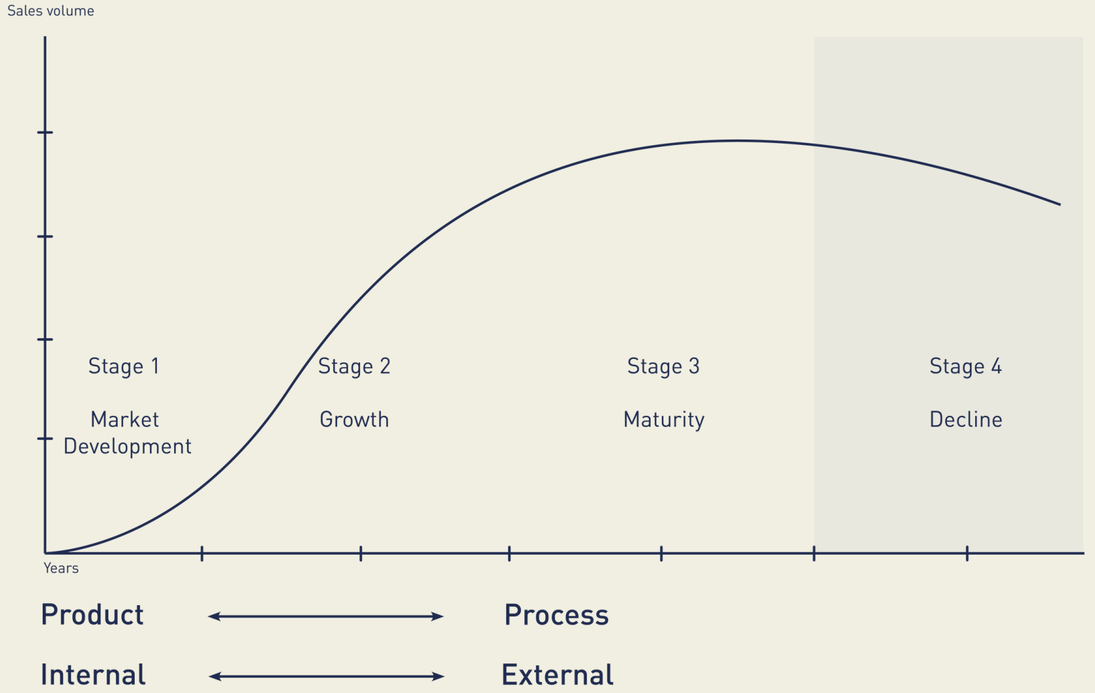
Very much
Many
Normal
Few
Very few



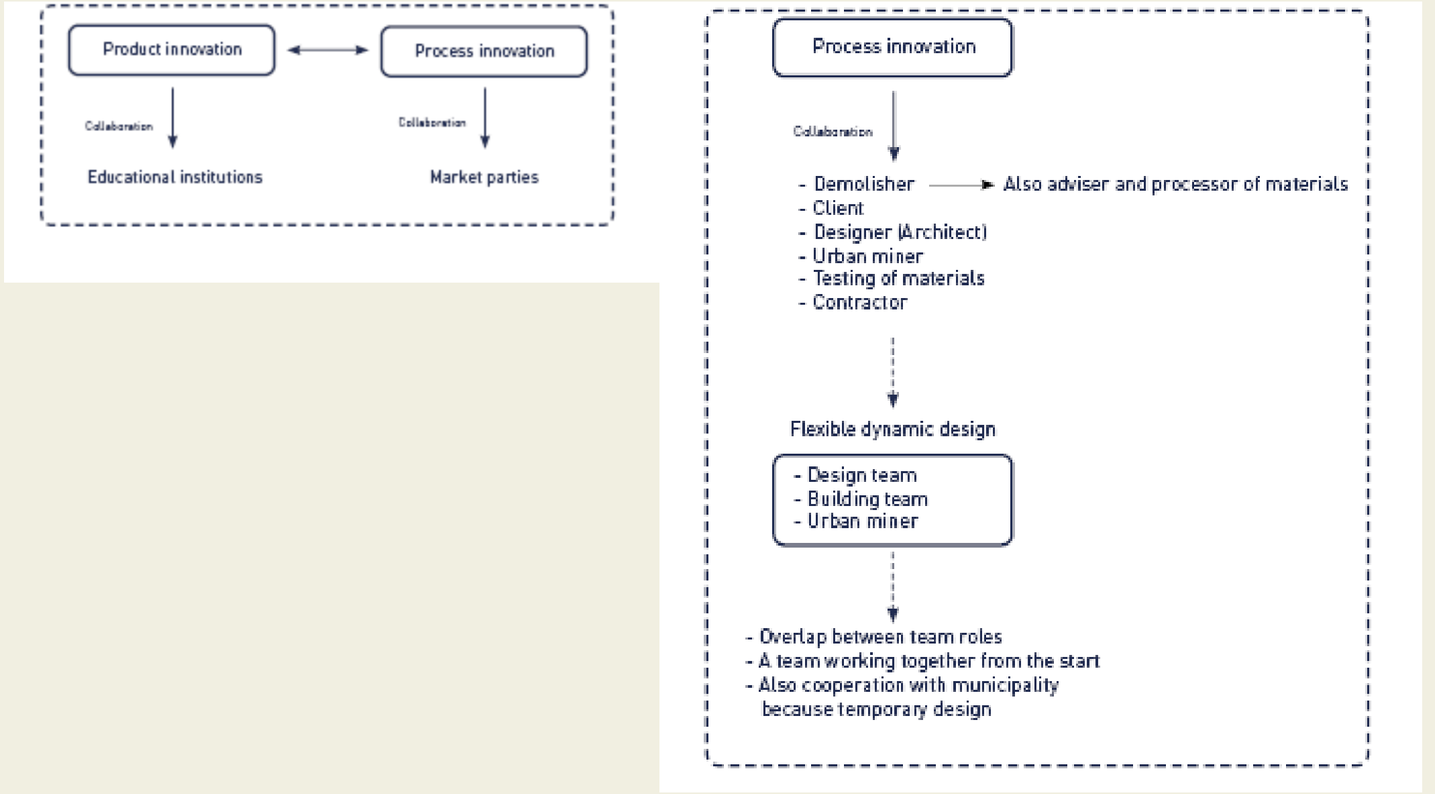
Results

Characteristics / Collaborations / Stages Life Cycle		Level of Specificity		Level of Uncertainty		Level of Trust & Commitment		Time Frame	
		Product	Process	Product	Process	Product	Process	Product	Process
Market Development	Internal	The first commercial step of ours where a donor skeleton was used, and, of course, moved to the next project. We had some ideas about but this is on a large scale and also a material that came from a completely different source. We had to work out a lot of practicalities and innovations. You have steel lying around in the building. Well, then you can say, I can place it somewhere else. And that's also what we have done happened, but truly the concept of having structural elements lying or standing somewhere and using them this completely different building, that's new in this project (Mo).	So, completely rusted, you name it. So, I said, 'Well, maybe we can do something with these.' And then we calculated what the material and labour of profiles were there, how much length they had. So, we revisited the shopping list we initially had for the project and compared it with the site ourselves. We found about 80% of what we could reuse in the design. They wanted to get rid of the material, so it was free. That's how it was and if you're interested, we need to negotiate with these parties on how to do it together, so that's also a collaboration with the supplier. And at one point, they said, 'You should do that together with the contractor,' because the contractor had already been selected, so we did that with the contractor. The interesting part was that the client said, 'I'm actually a bit disappointed that you don't have 100%, so keep looking.' This motivated us to find even more to reuse. We adjusted the design not at the location but on the profiles that we had available and reused them. And it shows that in the design process, you need to make adjustments. Last but not least, we've written a comprehensive procedure protocol on how to handle the material's quality (Ima).	All side point, we sat down with a demolition company and told them we have a shopping list. And they said, 'Interesting because we have a lot of demolitions, and they also had a history with that client. So they said, 'No problem.' But, like I mentioned when we started with Hoogstraal, they weren't really focused on this circularity thing. They did it 20 years ago, 30 years ago or so, 8 years ago. They didn't think about it at all. Now, they have actually established a department for circularity. And I'm like, I can see how the market has changed over time, and it's nice to see. So, the demolition company that we initially wanted to work with, they couldn't find them. So, I thought, 'Well, that's a shame.' That's when we started searching ourselves and came across a demolition company that's circularity is more put lying in a corner. Now, it's interesting to see that we're working the first demolition company, to call us and say, 'Hey, we have this and that, and we're going to remove it. Can you use it (Mee)?	Yes, the breakthrough of the project came because we took the initiative ourselves. So, in the tender documentation, there was nothing in that has the passion for it, really has to take the lead and go all in (Mo).	Yes, the breakthrough of the project came because we took the initiative ourselves. So, in the tender documentation, there was nothing in that has the passion for it, really has to take the lead and go all in (Mo).		Yes. So' each project we were running at that time, we had to figure out the best way, so it did take time and effort (Mo).
	External		We had a material investigation done in consultation with the client. So, we had a certified inspection lobby to determine the steel quality, rust formation, delamination, and various other factors. A company conducted this material analysis for us (Mo).		The municipality didn't play a very significant role in the projects where, for instance, I was in recipality on the quality control procedure and calculation system. In innovations, you naturally have more contact with the municipality as there are known-when something is new. But when it's existing or reused, we didn't have regulations for it. Sometimes that's also quite challenging because they ultimately have to give their approval, and we are responsible for the calculations. The municipality then has to say, 'Okay, it's approved, and you will get a permit later (Mo).	The municipality didn't play a very significant role in the projects where, for instance, I was in recipality on the quality control procedure and calculation system. In innovations, you naturally have more contact with the municipality as there are known-when something is new. But when it's existing or reused, we didn't have regulations for it. Sometimes that's also quite challenging because they ultimately have to give their approval, and we are responsible for the calculations. The municipality then has to say, 'Okay, it's approved, and you will get a permit later (Mo).	You can see that clients want it, but they also don't want it. So, it's a push-pull thing in a certain way, perhaps from above, like a decision made by the municipality, province, or some other authority. Sometimes, they're also forced to do it to implement it aren't necessarily intrinsically motivated about the topic, and that does affect the motivation for cooperation from the client's side (Ve).	
Growth	Internal						When it comes to collaboration on circularity in the projects where, for example, we incorporate donor skeletons, we find that all parties involved are very motivated to make it happen. This means that both the client, the architect, the suppliers, and the main contractor must be willing to go the extra mile and not wait for the other initiate it as well. But everyone needs to embrace it (Mo).		Similar projects during this project, because it's a project that has had a long duration. But during the project, we've already encountered several projects with reused donor skeletons and reused constructions (Mo).
	External		To create profiles for the constructies and then to collaborate with those authorities to figure out how to make it compliant with regulations, and that's also a collaboration with suppliers based on new materials, at least at that time and largely even now. So, if you want to make that happen, you need to have everyone on board to be included in, let's say, the building code and other regulations. How to address that (Ni)		Yes, it's about more sustainable concrete, right? Yes, they have already been involved in several dozen pilot projects. Nevertheless, Rijkswaterstaat is also a very conservative party. They're still a bit timid some innovation, but I see this mainly on the side of structuring contracts and providing the right circular criteria that can make such a project a success (Ni).		When you look at the collaboration for circularity in the projects where we, for instance, incorporate donor skeletons, we notice that all parties involved are very motivated to make it happen. This means that the client, the architect, suppliers, and the main contractor must stand ready to go the extra mile, to support it regardless, as we often initiate it as well. But everyone must embrace it (Mo).		
Maturity	Internal			Based on our current projects, we have now found a workflow for how to do it, how it can be done. What you can see from that is, if you have a building that's already there and you're going to disassemble it, and then use it for a new building, that's actually very simple to design for because you already know everything about it. You know the design, and you don't need to do much research because everything already have the basis for your design (Mo).					
	External		That's one aspect, and ensuring regulations. So, I am also. This year, the first standard for the reuse of concrete elements in combination with Dutch technical agreements have been established between the Ministry of the Interior and the Rijkswaterstaat, respectively, and they are set to be launched in June (Mo).		That's one aspect, and ensuring regulations. So, I am also. This year, the first standard for the reuse of concrete elements in combination with Dutch technical agreements have been established between the Ministry of the Interior and the Rijkswaterstaat, respectively, and they are set to be launched in June (Mo).		The interesting thing is that almost all the parties have started doing something with it. We have also been in touch with a couple of parties which couldn't find anything and become enthusiastic about it. They even started a circular department because of it. And I think that's nice to this, and they also get excited about it. They are now taking steps to make more reused materials available. And I think it's nice to see that the companies are doing this because they can a business model in it (Mo).		That's one aspect, and ensuring regulations. So, I am also. This year, the first standard for the reuse of concrete elements in combination with Dutch technical agreements have been established between the Ministry of the Interior and the Rijkswaterstaat, respectively, and they are set to be launched in June (Mo).
Decline	Internal								
	External								

Very much
Many
Normal
Few
Very few



Discussion


Product innovation
Process innovation
Collaboration
Collaboration
Educational institutions
Market parties
Process innovation
Collaboration
- Demolisher
Also adviser and processor of materials
- Client
- Designer (Architect)
- Urban miner
- Testing of materials
- Contractor
Flexible dynamic design
- Design team
- Building team
- Urban miner
- Overlap between team roles
- A team working together from the start
- Also cooperation with municipality
because temporary design