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Solar Energy Investment Framework for Real Estate in Norway – a Case Study in Systems Engineering

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Abstract

The last decade has brought an increased focus on sustainability for real estate asset managers in Norway. The asset managers are exploring new ways to reduce their real estate's climate footprint by using green energy as energy supply. The use of solar power systems has become a popular way to achieve this goal. However, the asset managers are struggling to defend these investments, as they do not have the wanted profitability. The investment decision process is time and resource demanding.

This paper looks at the investment process that asset managers conducts when investing in solar power systems for a building. The researchers explore the drivers and barriers for solar energy investments and maps the current market actors. We establish an investment framework that aims to improve the resource utilization and reduce risk in renewable energy investments. The paper provides insights in how an abstract principle can help improve specific and executable practices through the holistic and structured approach of systems engineering.

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Introduction

The green shift has for the last decade caused a focus on sustainability in all parts of society. For companies, the shift has resulted in the exploration of sustainable solutions for businesses, with the goal to appear more environmentally friendly. This has been extra visible in countries with high economical standards, such as Norway. As Norway produces its majority of energy from sustainable resources, the sustainability aspect has been in peoples mind for quite some time.

Over the last few years, sustainable companies have become more attractive to investors as they look to find climate friendly companies to invest in. The impact a green image has on a company's reputation is important, both for the investors and for the firm.

The domain of this research is Norwegian real estate and their asset managers (AM). This paper looks at the process real estate AMs use when trying to improve their real estate's sustainability grade. One way the AMs tries to achieve this goal, is to invest in solar energy to decrease the climate footprint of their buildings. This paper looks at how real estate AMs conducts solar photovoltaics (PV) investments today, and how to improve this process. The case company operates within this branch and is a major actor in the Norwegian market. The case company has a clear vision to be a leading, sustainable AM in all its divisions.

The company manages its assets in the stock market, private equity and real estate. **Error! Reference source not found.** shows a typical solar PV system on commercial building in Norway.

Figure 1: A typical solar PV installation on a commercial building (Abelia, 2015)

The system of interest is the investment process for solar PV installations. Solar PVs is the technology that converts solar energy to electrical power. Solar panels are mainly used to achieve this. The AM proposes this technology as a solution to acquire sustainable energy for their real estates. However, the profitability linked to investments in solar PV systems is unlikely to achieve the company's investment requirements in terms of its profitability. This makes the investment process for solar PVs demanding, as the company must assess the investments outside the standard approval process. The use of solar PV's is relatively low in Norway, compared to other countries in Europe. By the end of 2019, Norway had an installed solar capacity of 120 MW (Bellini, 2020a), while Sweden had 698 MW (Bellini, 2020b). Germany is one of the leading countries in Europe with an installed solar capacity of 49,75 GW (Enkhardt, 2020) by February 2020.

The current solar PV investment process is time consuming. This is partly due to projects' lack of profitability, which results in approvals outside the standard investment process. As solar PV investment is new for the AM, their processes is not compatible with these types of investments. With a resource-demanding approval process for solar PV investments and no standards for AM's to follow, an increased use of solar PV systems is difficult to achieve.

The AM wants to increase the number of launched solar PV projects. They also want to increase their investment decision efficiency and knowledge of the system of interest. The reason for this is that it represents a risk to them, to not conduct such investments. This risk includes being less attractive as a landlord, in the future market. There is also a risk linked to future legislation where landlords may have to have a specific share of their energy consumption that is sustainable. Such legislation is likely to appear in countries that takes climate measures seriously, like in Norway.

We map the actors that are involved in the commercial acquisition process of solar power systems. Additionally, we explore the process and the underlying drivers and barriers for solar PV investments. With this as a basis, we will investigate how changes to the asset managers' investment process can result in a more efficient way of handling solar investments. Using the structured and holistic approach of systems engineering, we suggest a new framework for how the AM should approach these investments. The framework will include the essential processes and procedures needed to retrieve crucial data for the investment process.

We base our work on the following research questions:

- What is the current solar PV investment process used by real estate asset managers in Norway?
- How can a solar PV investment framework enable effective investment decisions for solar PV systems in real estate?
- How can asset managers use a solar PV investment framework to increase the number of launched solar PV projects?

Literature Review

To gain a general understanding of the system of interest (SOI), the authors searched through articles and websites. This helps us understand the basic functionality of the SOI. We used the Norwegian scientific library database, Oria, to search for scientific literature of the topic.

The word framework is explained as a reference model that supports the description, assessment and optimization of a business process (Weilkiens, Weiss and Duggen, 2017). This paper aims to identify the processes that form the basis for such a framework.

(Muller, 2011) visualizes how an abstract process can result in a specific tool that is executable, as shown in **Error! Reference source not found.**. This framework will focus on the processes and procedures. The AM can later use these identifications when forming a specific, executable tool.

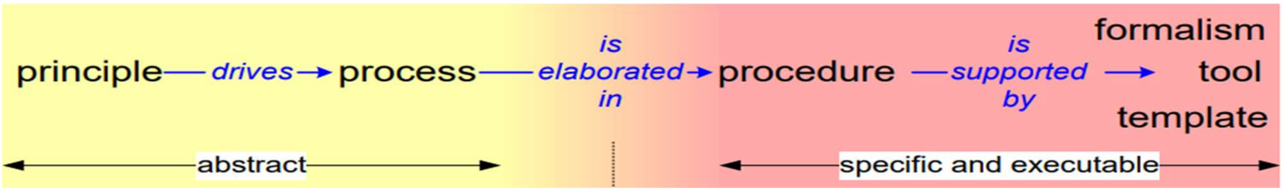

Figure 2: What is a process: From principle to tool (Muller, 2011)

When developing a framework, capturing the user-needs is essential for successful knowledge sharing. (Jensen, Muller and Balfour, 2019) lists three criteria that a knowledge-sharing tool should address: Usability, Accessibility and Desirability.

Usability: The first criteria addresses how the user interprets the method. It should be perceived as effective and easy.

Accessibility: The second criteria involves how information is accesses. The new method must have a significant advantage to current methods in terms of how easy information is accessed.

Desirability: The third criteria covers to what grade the new method is wanted. The user must prefer the new method to current methods

These three criteria are used to close the gap between the stakeholders and the problem domain. (Jensen, Muller and Balfour, 2019) states that the criteria represent the human requirements that needs to be addressed for a successful implementation of a method.

Business models for solar PV investments. The demand for solar PV’s in Norway has increased significantly the last decade (Zaitsev *et al.*, 2015) and the electric power sector is in the beginning of a fundamental change (Richter, 2013). This transition has resulted in innovation in business models for the producers of sustainable energy. Larger scale solar plants as well as the smaller prosumers are affected. A "prosumer" is defined as someone who both produces and consumes energy (EE&RE, 2017).

One business model is the Power Purchase Agreement (PPA). Wih the PPA, the prosumer does not own their solar PV system. Rather, they rent out their roof or another area to an external party that installs the solar power system. The agreement includes the consumer that purchase energy from the owner of the solar PV system, usually over a long period, at a given price. In this way, the consumers will receive sustainable energy produced at their own property. The solar PV system owner will have a predictable income over a long period, which they find acceptable for their investment.

A study from Sweden concludes that the PPA is the most economically viable business model for a prosumer (Molavi and Bydén, 2018). It also argues that due to the non-existing initial investment cost, the model is attractive in terms of risk. The study compares the PPA to the Leasing of Solar PV System and Prosumers Self-Ownership with and without battery storage.

The power price in a PPA is normally higher than regular power prices. The model is based on the customer's will to pay more for the sustainable energy, provided to their building. This model decreases the risk for the AM in terms of not having to run a solar PV project themselves. Table 1 shows the pros and cons with a PPA stated by (Olson, 2018).

Table 1: Pros and cons of Power Purchase Agreements (Olson, 2018)

Pros	**Cons**
No upfront capital costs.	More complex negotiations and possibly higher transaction costs than buying a PV system outright.
Predictable energy prices.	Administrative cost of paying two electric bills (one for the grid and one for the PV system) when the solar power do not provide the full energy demand of the building.
No system performance or operating risk.	Potential increase in property taxes if property value is reassessed due to improvements made to accommodate the PV system.
Projects can be cash flow positive from the start.	The site lease may limit the building owner's ability to make changes to the property if they affect the PV system or access to it.

Drivers and Barriers for solar PV investments. The use of solar PV's is increasing in Norway, but other European countries are still far ahead when comparing the installed solar PV capacity. We visualize Scandinavia's and Germany's installed solar capacity in Figure based on data from Zaitsev *et al.* (2015).

One big driver for solar PV systems in industrialized countries is the strong political backing (Engelken *et al.*, 2016). This represents society's desire of becoming more environmentally friendly. Norway's dominating energy production is by hydropower, which we consider sustainable. This can partially explain the low installment of solar PV's compared to Norway's European neighbors. (Engelken *et al.*, 2016) argues that a big barrier for new renewable energy sources is challenging a well-established energy infrastructure. There may be a cognitive barrier at an individual level causing this, which can result in failure to evaluate new energy systems rationally. This can create barriers for new energy system's penetration in a seemingly sustainable and well-functioning energy infrastructure.

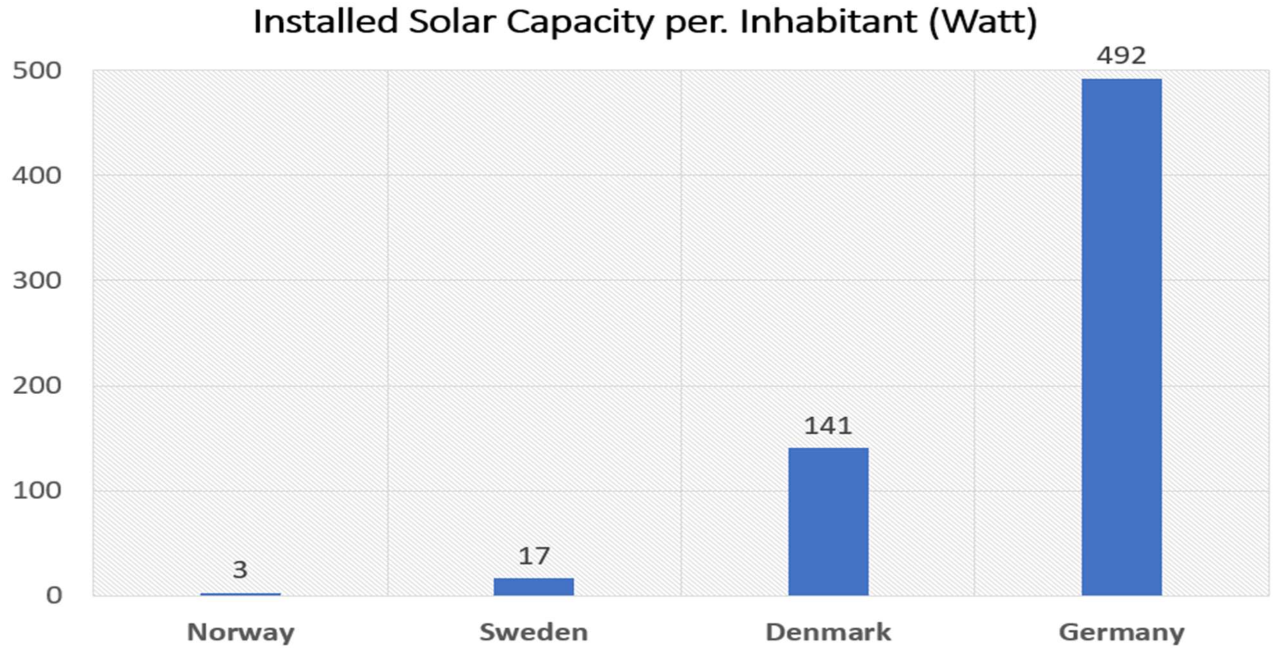

Figure 3: Installed Solar Capacity per Inhabitant (Zaitsev *et al.* 2015)

Research Methodology

We seek to understand the current practices in the Norwegian real estate and solar PV market. This area is dominated by practitioners, tacit knowledge and limited standardization. We base our research on interviews with the main actors and field visits. We used a semi-structured interview approach with prepared questions. The prepared questions guide the interview objects in the topic. We conducted the interviews as a conversation so that the interview objects could share more information in areas where we had little knowledge. This method supports a "exploration" approach and may cause difficulties for analysis'. As the objective was to gain as much information as possible in several fields, this method is fit for such an "exploration" approach (Kokkula et al., 2020). The authors had no need for a structured comparison or analysis of data, where this method can cause difficulties.

We interview asset managers from two different companies in Norway. The interviews aimed to capture the AMs thinking when they are to invest in solar power. We use the information gained in these interviews to map a workflow and compare the two companies' approaches.

The interviews also unveiled the different actors that are involved in the acquisition process. This led to more interviews with additional actors that are involved in different steps of the process. These interviews helped us gain a full picture of the industry and the value chain of solar power systems. Table 2 shows the interview objects and their roles.

The interviewees gave us access to their investment calculations for various project, which helped us unveiled the cost allocation and their effect on profitability.

We developed the framework based on our understanding of the as-is investment process, and modified it in a suggested to-be process. We used both literatures directly aimed for System Engineering use (Jensen, Muller and Balfour, 2019), and articles on how to form a framework for a specific user (Lyke-Ho-Gland, 2015). We validated our final framework with one asset manager. This is a limited validation and is only an indication of the framework's applicability in this domain.

Table 2: Interview objects and their roles

Interview Object	Role
The main interview object from the case company: The interview object works within sustainability at the company and is a major driver for solar PV investments. This person is the main source for the research. The person has provided project data and connections to other market actors.	*Real Estate AM*
The second AM. This person was interviewed to compare the different companies' investing approach. The person provided investment data.	*Real Estate AM*
The case company's external advisor. This is the hired advisor hired by the case company. The interview object provided information regarding investment approach in solar PVs.	*External Solar PV Advisor*
The second advisor. This person attended the interview with the solar PV advisor. The person had experience within solar PV projecting and added key information in the process.	*Energy Engineer/Senior Advisor*
The "system advisor". This interview object is the CEO of company within sustainable energy advising. The company can provide everything from an initial production calculation, to a total delivery of an installed solar PV system. The company organizes various actors from their network to deliver an installed system to the customer.	*Advisor/Importer/Organizer*

As-Is Investment Process

Real estate asset managers have to operate within given boundaries. It is common practice that an investment committee must approve all investments conducted in an owned real estate. This committee assesses and approves the investment. The word "investment" is in our work seen as a measure to either maintain or increase the real estate's value. When exploring the use of solar PV's for a building, the committee assesses the investment in terms of its profitability.

The AM has in January 2020 decided to install solar panels on the roof of one it's buildings. This is the first approved solar PV project by the company. The company decided to conduct this investment regardless of the investment's lack of profitability. The company typically operates with an IRR (Internal Rate of Return) of 8-10% for their investments, while the solar PV project only reached 5-6%. However, a roof rehabilitation of the building is due, a significant cost for the company. The AM have argued for conducting the solar PV investment as it caused a minor increase to the overall renovation cost. The company's sustainability vision was also highly used in the argumentation, as it maintains their status as a green AM. The company has ended up approving the solar PV investment, regardless of its lack of profitability. This is based on maintaining the company's green image.

Process Description. The process started with an idea to include a solar PV investment in a roof rehabilitation. The AM have suggested this as a possibility to approve a non-profitable investment. In most investments conducted by the AM, the company uses external advisors. When the project of the roof rehabilitation started, the AM hired three different external advisors: A Construction Advisor (RIB), a Plumbing Advisor (RIV) and a Solar PV Advisor (RIS). As the AM competence is insufficient for the detailed projecting, the AM offered the project to a contractor.

The RIS conducted the first inspections for a solar PV system. The RIS measured the roof and calculated a rough estimate of the production area. The RIS used this calculation to get a price estimate from two system suppliers within the solar PV market. The RIS compared the system supplier's two price estimates and calculated the profitability. The RIS then suggested the most profitable offer for the building.

The profitability calculations showed that the investment would be profitable over time, but not sufficient to reach the required return on investment. Regardless, the AM brought the suggestion to the investment committee. As this committee have rigid approval guidelines for the investments, they denied the suggestion. The AM then had to argue for the investment to the company's leaders: The CEO and the Management Director. The AM argued the investment from the project driver perspective. The arguments where:

- The investment will reduce the building's greenhouse gas emissions.
- It will develop the real estate to maintain an environmentally friendly standard, which the AM's customer base is likely to find valuable in the future market.
- It is a rather small project with low cost, compared to the total investment of the roof rehabilitation project.
- It gives the AM an experience with such a project, which is important for future investments. The used solar PV advisors are tenants in the building that creates the possibility for them to analyze data and log experiences.
- It is easy to display to partners and customers, which represents the vision and value of the company's green philosophy

The project got the grant from the management because of the arguments mentioned above. The investment itself was not profitable, but the company managers assed the value created to the company's reputation as satisfying. They concluded that the solar PV investment did not affect the total investment appreciably. Figure 4 maps the asset manager's As-Is workflow to achieving the approval of the solar PV investment. This workflow ends where the project gets its approval, as this is the focus area of this paper.

Investment Financials. To gain the approval for the solar PV investment, the AM includes the cost in a roof rehabilitation. When looking isolated at the solar PV investment's key factors, it becomes clear why. The investment's profitability is not sufficient in terms of the company's requirments. The word, profitability, "is a business's ability to produce a return on an investment based on its resources in comparison with an alternative investment" (Horton, 2019).

The company measures and compares the investment's profitability in key figures, such as Payback Period, Net Present Value and Internal Rent. If these key figures do not satisfy the company's requriements, the committee denies the investment.

With data retrieved from the real estate AM and their external advisor, we estimated the key fac-tors for the solar PV investment. The company did not do this or found it relevant after the project got its approval. The calculations are estimates based on the following factors shown in Table 3. The data also unveiled the cost structure of the solar PV system. The cost structure is not included in this paper.

We calculate the financial key figures using the life warranty of the solar panels, which is 25 years. This period is much higher than what the AM usually calculates investments for. The discount rate is set to 10 %, which is approximately the requirement set by the company. Using these parameters and adjusting for the different investment factors, we have calculated three financial key figures presented in Table 4.

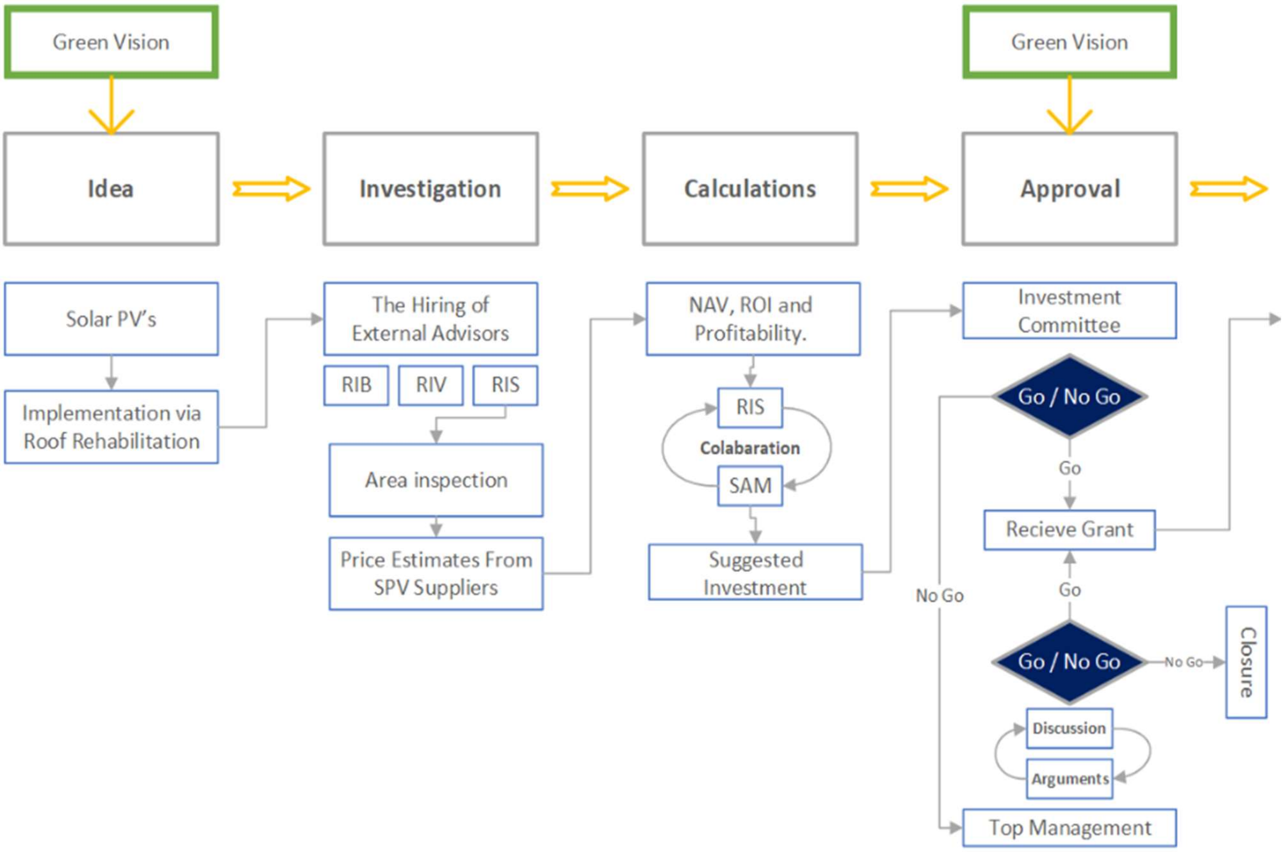

Figure 4: As-Is Investment Process

Table 3: Financial calculation factors

Factor	**Explanation**
Investment Sum	This is the total cost of the investment. For a solar PV investment, this includes all costs, from materials to projecting.
Yearly savings	This is the income of the investment, which is the amount a company saves in energy payments to the power company.
Running costs	The running cost of an investment is any cost done to the system in its life cycle. Solar PV systems has little to none maintenance costs, given that the system works like it should. The only running cost is switching the inverters, typically every ten years.
Inflation	The decreased value of future income calculated today, needs to be taken into account as inflation affects the NPV.
Deductible interest	If an investment is subsidized with loans, companies are eligible to get deduction on the taxes, based on the loan interest.
Change in energy prices	The energy prices are thought to increase in the next few decades. This affects the income side of the investment as it will increase to these estimates.
Change in energy production	The solar PV modules has a linear loss of efficiency, given as a warranty from the producers. This loss in efficiency affects the amount of power it able to produce. This again affects the income of the investment and needs to be taken into account.
Discount rate	The discount rate is the set rate used in the NPV calculation and represents the required return on the investment, adjusted for risk of the project.

Table 4: Financial key figures

Key Figure	**Value**
Payback Period	14.5 years
Net Present Value	-493 000 NOK
Internal Rent	6.27%.

Market Actors and Value Chain. The solar PV market in Norway today consists of various actors in different segments, illustrated in Figure 5. The customer that acquires the solar PV system often uses external advisors to help them select their product of choice. The external advisors leave the customer out when it comes to more technical question. This happens with the divided expertise of the different actors. The advisor is in contact with an actor who has access to the material needed to install the solar PV system. These actors can be a supplier, importer or the manufacturer itself. What actor the advisor approaches, depends on the advisor’s network.

Another way to conduct the investment is to contact an overall system supplier. In Norway, customers commonly use this method, as there are a low number of system suppliers that makes up a big part of the market. This method leaves all responsibility to the system supplier that import parts, estimate costs, and installs the system themselves.

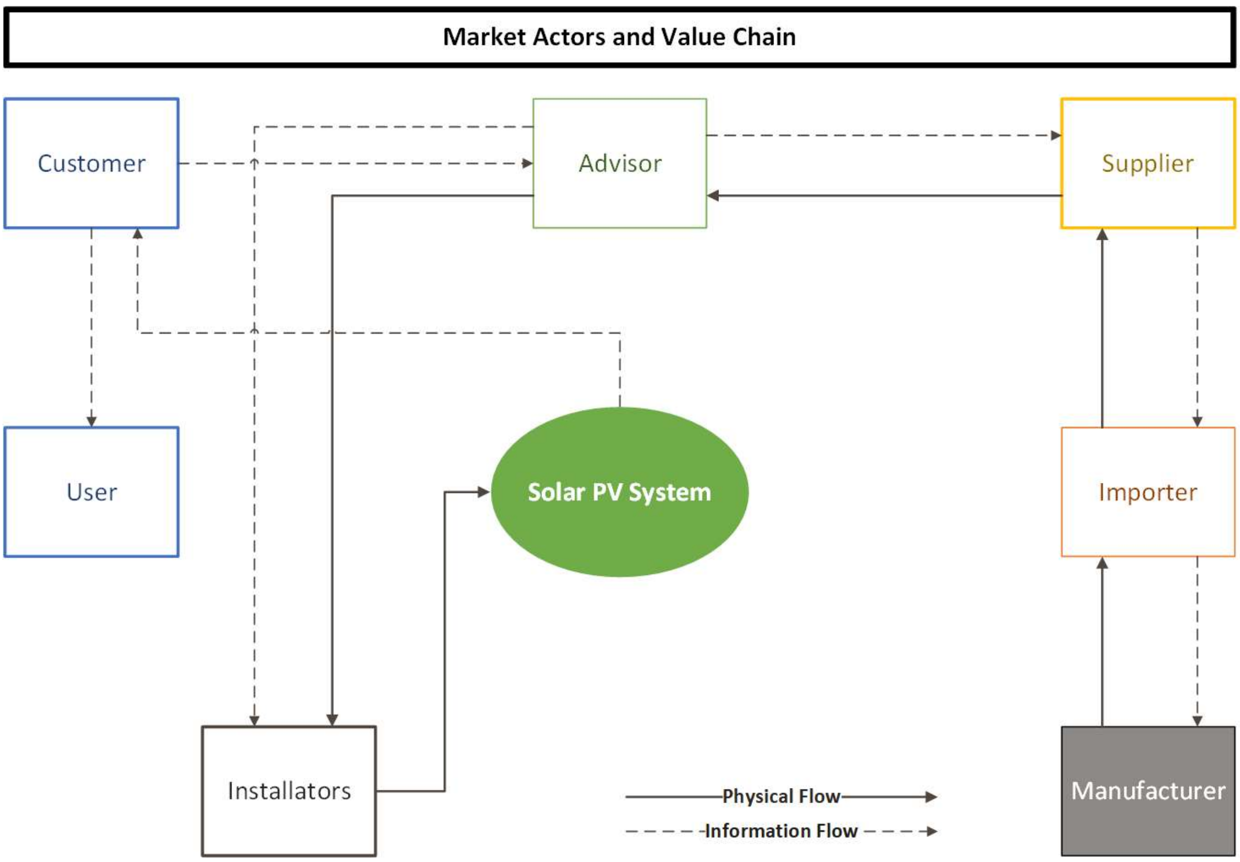

Figure 5: Existing Market Actors and Value Chain

The installation of a solar PV system is a rather straightforward job for electricians. However, the installation also requires a roofer to make sure the system does not damage the roof. A customer who does not use a system supplier has the possibility to use known professionals or let the advisor organize one of their partners. Figure 5 shows the actors in the solar PV market. It also shows the value chain of the solar PV system. The figure shows the flow of both information and physical objects. There are several ways to approach the acquisition of the solar PV system. This figure shows the method where the customer hires an advisor that organizes the project.

Different Investment Models. When an AM is investing in solar PV system, the main question is who will pay the cost and collect the income. This is important to how the AM defends the investment in the approval process. The case company's initial approval to invest in a solar PV system uses a model where they take all cost and income themselves. We call this model self-ownership. However, this may not be profitable in the future, so the company and the AM are looking for other models to support their investments.

A preferable model to use for the AM, is that the tenant in the building covers the investment. The AM does this by increasing the rental fee, due to the delivery of green electricity. This model is highly dependent on the individual tenant, as they have to share common values in terms of sustainability. Most tenants do not wish to increase their rent just to get green solar energy. Such an agreement can also be difficult to conduct with a high number of different tenants in a building.

Another preferable option for the AM is to enter into PPA. This reduces the AM's risk and provides a predictable future cost.

Results

Investment Framework Needs

Through the interviews conducted with the main AM, it became clear that they needed a more standardized way of conducting the solar PV investments. The authors suggest a framework to cover this need. The framework will focus on the early part of the investment process. This omits the process from wanting to invest in solar PVs for a building, to getting an investment grant from the company. The AM spends a considerably amount of time and resources to explore what business model they are to use when investing in solar PV's. A standardized framework on how to approach this is likely to create value for the AM.

The framework focuses on the model selection process for solar PV investments. This is the process where the AM chooses what business model they are to apply in the given situation. This model could be PPA or Self-Ownership etc. Through interviews, the AM expressed their needs to such a framework, seen in Table .

Solar PV Investment Framework

In this work, we create a framework to support the development of a future executable model decision tool. It aims to capture different perspectives and elements that AMs find necessary in such a tool. The AM will be able use this framework in the process of creating their first estimate of a solar PV investment. The AM will also identify the most suited model in the given situation. The framework will be adaptable with the current As-Is process of the AM.

The framework shown in Figure is divided in five sub-processes. All sub-processes include procedures that the AM should conduct. The result of the procedures is suggested specific data that the AM are to acquire through this framework. This AM can then use this data in the future executable tool.

Table 5: Asset Manager Needs

Need	Explanation
Increase decision efficiency.	The framework should help to increase the efficiency when making an investment decision.
Increase knowledge.	The framework should help the company increase their knowledge on one or more aspects within the investment decision process.
Improve cost efficiency.	The framework should to some grade improve the cost efficiency in one or more areas of the investment decision process.
Time/Precision ratio.	The time used to make a conclusion should be no longer than what the external advisors uses today. This is approximately 1 month.
Adaptable to the company's investment approval process.	The company's main approval process is an organizational matter, which this framework shouldn't touch. The framework should therefore only help the AM in the early phase of the investment process, to help them stand stronger when applying for approval.
Framework modifications.	The framework should be able to be modified as the company gains knowledge and experience.

Basic Building Assessment (BBA). The first process aims to perform an initial assessment of the building suggested for a solar PV installation. The process includes a basic assessment of the building's physical attributes. The process' goal is to find out if the building is suitable for a solar PV installation or not.

Investment Models. The second process includes a mapping of the situation. This regards to what investment models are available and the requirements associated with these models. The mapping includes an overview of the tenants in the building and the AM's competence to conduct an investment. The AM needs the tenant mapping to understand what investment models can fit the building. This is dependent on the number of tenants in a building and their willingness to invest in sustainable energy. The process ends with an overview of all suitable investment models for the specific building situation.

Calculations. The third process is calculating different parameters for different investment models. This process has three procedures: Data Collection, Calculation of Key Figures and Comparison of Key Figures. The process includes the collection of vital data that the AM uses to calculate each model's profitability figures. This process should also provide an organized comparison of the different model's key figures.

Model Selection. This process aims to make a decision on what investment option is the most suited for the specific building and situation. The decision is based on both financial and non-financial data, as the model introduces the risk aspect of the different options. The risk assessment procedure includes four risk aspects that the AM should include in future investment decisions:

- *Option Bound Risk:* This is the risk specifically linked to an option. As different investment options represent different types and grades of risk.
- *Financial Figure Risk:* This is the risk linked to uncertainty in financial numbers. For example, the uncertainty linked to future estimates of energy prices.

- *Future Legislation Risk:* This aspect addresses the risk of governmental orders related to the reduction of a building's greenhouse gas emissions. This may result in an increased future cost, via taxes and fees.
- *Tenant/Market Risk:* With the increasing focus on sustainability, asset managers risk to lose reputation and possibly attractiveness in the market, by not increasing a building's sustainability, e.g. by conducting solar PV investments.

The AM will consider both the financial and risk/reward profile of an option as part of the final selection process.

Approval. The last process in the framework is the approval of the investment option. This approval is not the final approval to make the investment, but rather an approval to proceed with the most suitable option for the building and situation. This approval has two procedures that include investment requirements and an evaluation of these. We suggest this approval process to be more dynamic than the traditional process, in terms of investments. A more fluid approach to the assessment of the risk/reward aspect, may result in better decisions in each situation.

Experience Based Modifications. The presented framework aims to be dynamic as AMs gain experience. This way, the framework should be able to change as one learn what works and not. It should therefore be possible to eliminate, change, or add elements in all steps of the framework.

Framework assessment by the AM. We interviewed with the AM to evaluate the provided framework. Through this interview, the AM made the following comments.

- "Yes, I would say that the framework captures our need. It reduces external resources by including the solar PV advisor later in the process. It also helps us getting a deeper understanding. It can increase the efficiency by making crucial decisions early on to a lower cost than today."
- "It may increase the number of solar PV investments for us, as it can help to reduce the barrier to making an investment. This can result in the projects being done to a bigger grade. I also think a well-developed tool, based on the framework, can cause a higher cost efficiency and focus our resources where they make the right decisions."
- "The knowledge can also be valuable to us in a negotiation with contractors or a PPA situation."

The AM concluded that the framework is suitable with the company's process and thought that the framework can be a helpful tool to support their investments.

Discussion

<u>RQ1: What is the current solar PV investment process used by real estate asset managers in Norway?</u>

The research done for this paper discovered that real estate AMs are willing to invest in solar PV systems. There is little or no consideration to the investments' profitability, as the focus is on the company's green image.

We discovered that the situation the AMs operate in is not well organized, as solar PV investments are new to the company. This causes an investment process entrusted to third party actors, as the AM does not have the required knowledge. When looking at the market actors, one can argue that the AM's lack of knowledge enables these actors to exist. This is a natural result as most companies is outsourcing tasks that are outside of their core business. The use of different external actors may however result in little control for the AM and a non-optimal project flow.

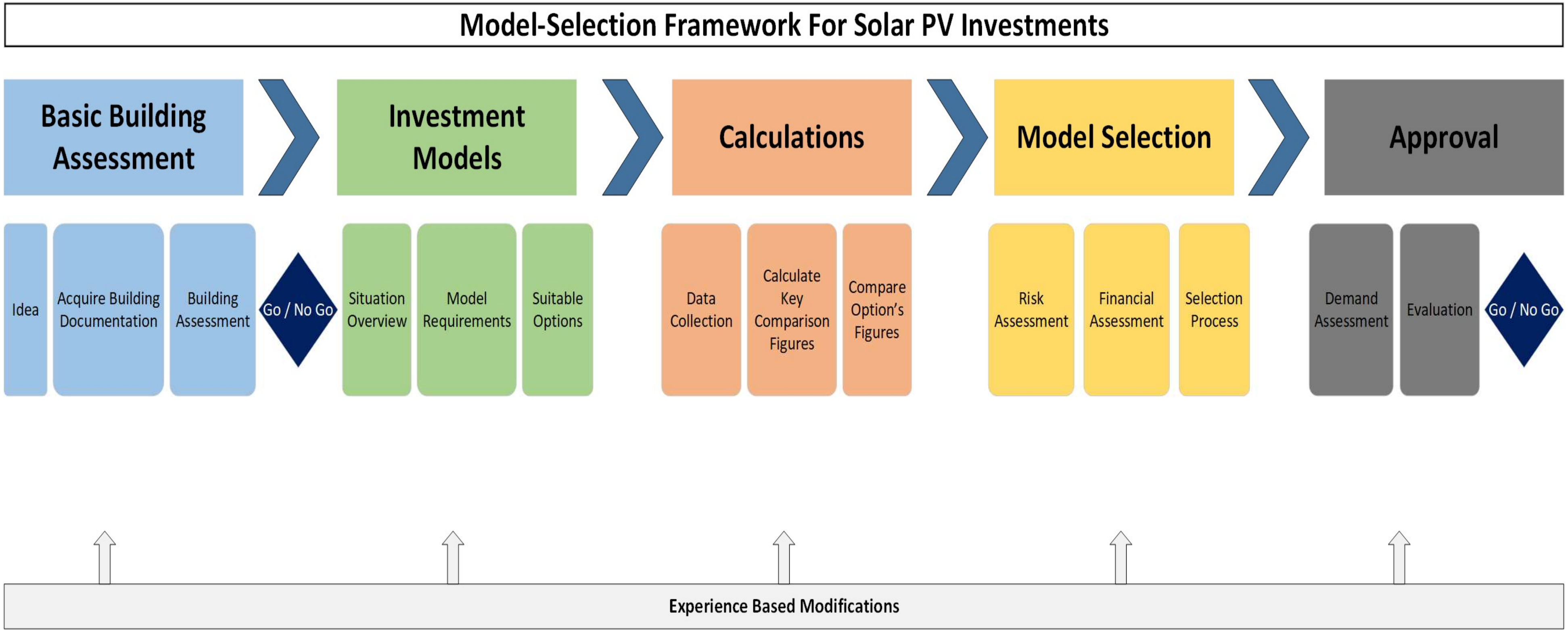

Figure 6: Solar PV investment framework.

RQ2: How can a solar PV investment framework enable effective investment decisions for solar PV systems in real estate?

Through interviews with AMs, we discovered a need to have an organized way of approaching the solar PV investment decision. We propose a framework that could support the AM's decisions. Based on the AM's later assessment of the framework, such a framework could increase the efficiency in their investment process. One can argue that structuring the investment process in any other way than the current situation would increase their efficiency. However, the framework is based and formed on the AM's needs, with the possibility of further improvements. It can therefore form a basis where the AM can implement improvements as their knowledge grows.

With the use of a framework, it can help the AM standardizing the way of conducting solar PV investments in the future. It can also make it easier to identify the projects with the highest potential to the AM. In terms of risk, the framework can help enlighten different aspects for the AM. The AM already has good knowledge of financial risks for their investments. However, the AM knowledge on the technical system they are investing in are little. The framework therefore aims to enlighten these areas and link them to the financial risk they represent.

The AM wants to have better control over their solar PV investments. The framework creates this by increasing their knowledge and doing basic calculations themselves. By having this knowledge in the organization, the AM believes it can result in a reduced use of external resource. The AM can also use the knowledge when negotiating contracts with external actors.

In the future, the developed framework can be a valuable tool for AMs. The framework should also be tested with multiple AMs, as this research is based on a single AM's experience and knowledge.

RQ3: How can asset managers use a solar PV investment framework to increase the number of launched solar PV projects?

With a more streamlined process for AMs, the number of launched solar PV projects may increase. As the AM gains experience and efficiency increases, one can assume that the company's confidence in solar PV investments also increases. This may again increase the number of launched solar PV projects, as the company lowers the barrier to conduct the investments.

A weakness in this work is the low number of asset managers involved. We captured the real estate AMs need based on interviews with one person. We interviewed two different AMs when analyzing the investment approach. The main AM from the case company evaluated the framework. Because of the limited number of people involved, we should not expect the framework to have universal validity.

Conclusion

Today, AMs conducts solar PV investments with little or none consideration to the investment's profitability. Sustainability-focused AMs see solar PV installations as means to maintain a green image to the public.

We discovered that the process for conducting the solar PV investment is ineffective and entrusted to third party actors. This results in the AM having little detailed control and knowledge of the projects.

We found that AMs wanted more control and knowledge of their projects. To achieve this, we developed a framework for the AM to create a standardized way of conducting the solar power investments. The framework helps to decrease the AMs external resource need and helps directs the resources to areas where they contribute to making better investment decisions. The AM can also use the framework for further improvements to their investment tools.

The approach of using a framework to help the case company's investments, have been successful to some grade. Although the framework was abstract to the practitioners, they recognized the framework as an approach to get a deeper understanding. Based on the results and evaluation from the AM, it will create value to them. In addition, the AM assessed the framework as a valuable method to improve specific and executable practices that has the potential to reduce the resource needs and improve the investment decision. With time, the framework is more likely to increase their number of launched solar PV projects.

The framework development required a structured mapping of the tacit principles and existing processes. The method of approaching the AMs through interviews, worked well. Through these interviews, we connected to other actors that made the market mapping easier. This mapping was important to the development the framework. This approach can possibly be adapted to other similar situations.

Future work should include testing the framework on more real estate AMs to understand the framework applicability in multiple organizations. It is also possible to explore the use of the framework with other renewable energy investments. The basics may be applicable with little modification to adapt it to investments that are not suited for traditional investment processes.

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