3 Awareness of climate change adaptations among Dutch housing associations

Chapter 3 defined a starting point for the development of governance tools. The method used – content analysis – was chosen to conduct a quick scan of the current awareness of climate change adaptation among housing associations. It was conducted at the beginning of the research, so over the course of the research, the situation regarding their awareness could have changed, but considering the economic crisis and the political situation relating to their finances and activities, it can be expected that the situation has not significantly improved.

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Abstract

Climate change: the question is not anymore if it happens, but what the impact is of its effects such as drought, heat waves and increased precipitation on the quality of our lives in cities, offices and houses. A significant share of the Northern European housing stock is owned and maintained by large stock owners, such as housing associations. It is their responsibility to be aware of changes and risks that might challenge the quality of life of their tenants. Moreover, in order to provide housing with a good market value in the future, adaptation to climate change can no longer be overlooked. With the aim to discover the level of awareness of climate change adaptation among Dutch housing associations, a content analysis was undertaken on the policy plans and the annual reports of the 25 largest housing associations. Subsequently they were classified according to their level of awareness. The analysis returned no topics that directly referred to climate change adaptation, which implies that all housing associations are categorised as being 'unaware'. Therefore, in order to reach higher levels of awareness and to incentivize the implementation of adaptation measures, appropriate governance strategies need to be developed. Future research will define the characteristics of these strategies in relation to the level of awareness of the housing associations. Adoption of the measures could be easier if adaptation measures are combined with maintenance activities, as this has been the case with mitigation measures.

Keywords: Awareness, Adaptation, Climate Change, Mitigation, Social Housing.

§ 3.1 Introduction

There is clear scientific evidence of a changing climate at both the global and national levels. The Intergovernmental Panel on Climate Change (IPCC) states that "warming of the climate system is unequivocal". It reports that during the twelve-year period between 1995 and 2006, eleven years ranked among the warmest since the first measurements in 1850 (IPCC, 2007). The Royal Dutch Meteorological Institute (KNMI) found out that the long-term mean temperature in the Netherlands has risen by 1.7°C since 1900, while the global increase has been 0.8°C. In the period 2003-2008, three years ranked among the ten warmest years since records began in 1706 (KNMI, 2008). This evidence means that policymakers can no longer postpone activities and must start addressing the impact of climate change. Stakeholders such as housing associations play a major role in securing the quality of life in our cities because they own large stocks of housing and their decisions will therefore affect a greater percentage of citizens. This is particularly the case in many North-West European countries such as Denmark, Sweden, the Netherlands and Germany, where the rented sector owns and manages almost half of the housing stock (Dol and Haffner, 2010). In the Netherlands, the duty to secure the quality of dwellings is a legal obligation for housing associations (MinIKR, 2005). Therefore, they need to be aware of the changes that may adversely affect the quality of life of their tenants. Moreover, in order to provide for financial continuity (MinIKR, 2005), they also need to treat their houses as assets that maintain a good market value in the future, which implies that, among others, resilience to climate change has to be taken into account.

Relative to the total building stock of 7 million dwellings, the social rented sector with its 2.4 million dwellings is considerably large in the Netherlands (www.cfv.nl). The size of the social rented stock, together with the fact that housing associations have legal duties concerning quality of life (MinIKR, 2005), underline the importance of the engagement of housing associations for the development and implementation of climate change adaptation strategies. Moreover, the Dutch social rented sector is relatively easy to approach since a large stock of dwellings is owned by just a few organizations. In 2012, there were 381 housing associations in the Netherlands, which owned on average 6,300 dwellings (www.cfv.nl). The largest housing association owns approximately 80,000 dwellings.

§ 3.2 Climate change in the Netherlands

The impacts of climate change are numerous. The sea level will rise, threatening the low-lying areas and river deltas (KNMI, 2006). This effect will be more pronounced in countries where major rivers experience more run-off in winter (Bessembinder, 2008), threatening the adjacent areas, as is the case in the Netherlands. All in all, the risk areas for sea and river flooding cover 55% of the land area of the Netherlands (PBL, 2011). Another threat comes from intensified peak precipitation, which can cause local flooding (Bessembinder, 2008).

Temperature increases will affect the natural environment (PBL, 2009) and the climate in cities (Salcedo Rahola *et al.,* 2009). The main impacts of heat relate directly to human health issues, rather than financial damage to properties caused by natural catastrophes such as flooding. Expected hazards include heat stress, summer smog, and an increase in allergies and viruses. A positive effect of a warmer climate is reduced illness and mortality in winter (PBL, 2009). Because 62% of the Dutch social housing stock is located in urban areas (with a density of > 1500 addresses per km^2, ABF, 2011), special attention is paid to the Urban Heat Island effect. This is the phenomenon by which the urban structure retains heat and is consequently warmer than the surrounding countryside. The largest temperature differences occur at the end of the day and can reach 10°C (Salcedo Rahola *et al.,* 2009). The Urban Heat Island effect is caused by several factors, being absorption of solar radiation, air pollution, 'street canyons', anthropogenic heat (cars, air conditioners, industrial processes etc.), heat-retaining materials, a lack of evaporative surfaces, and reduced wind speeds (Kleerekoper *et al.,* 2012).

The risk of flooding caused by the sea and major rivers will be tackled to a large extent as soon as the national government starts implementing the measures proposed by the 'Delta Commission' (Delta Commission, 2008), so the focus for housing associations will be to help to reduce the flood risks caused by precipitation.

Housing associations have the possibility to increase climate resilience by applying adaptation measures to their dwellings. By 'climate change adaptation' is understood "any action, either intentional or accidental taken to minimize the adverse effects of climate change or to take advantage of any beneficial effects" (HM Government, 2006).

The application of lighter colours on building façades in order to reflect radiation is only one of the range of measures which could be implemented by housing associations. By using lighter colours instead of darker colours, the surface temperature of the façade – and therefore the air temperature close to it – can be reduced by 3-4°C (Watkins *et al.,* 2007). Another related measure is careful consideration of the type of vegetation that housing associations plant in common gardens of e.g. apartment

blocks, in order to prevent allergies (MWH, 2012). The hazards of flooding caused by extreme precipitation can be reduced by applying adaptation measures to retain water temporarily, such as 'green roofs' (MWH, 2012) or to ensure effective drainage such as open pavements (www.klimatilpasning.dk; MWH, 2012) reducing the peak load on the sewage system. Another effective measure is to use materials that are not negatively affected by water so that if, despite all protective measures, flooding happens under extreme circumstances, the consequences are less intrusive (Pitt, 2007).

§ 3.3 Awareness

With the intention to reduce the effects of climate change (mitigation), policies have been adopted on both an international and a national scale. For example, the European Commission has approved Directive 2002/91/EC, known as the Energy Performance of Buildings Directive (EPBD) (EP, 2002). In the Netherlands, the EPBD has been applied to existing buildings since 1 January 2008. The EPBD has made it compulsory for housing associations to provide an energy label at each transaction (renting/selling) of their dwellings. In the Netherlands, the energy label is still merely a communicative instrument. This is mainly due to a lack of law enforcement and/or sanctions, and because there are no requirements relating to minimum energy performance (Tambach *et al.,* 2010). However, it does provide an insight into the energy performance of their dwellings. Most housing associations have 'labelled' all their units, so they now know the current energy performance of their building stock (Tambach *et al.,* 2010). For new buildings, legislation on energy performance is also in place. The building code prescribes the energy performance for new buildings using the so-called Energy Performance Coefficient. Buildings may only be built if they comply with the building code, so property owners and the construction industry are automatically aware of the legal mitigation measures, even if they appear to not work well enough to achieve the intended goals in the Netherlands (Daniëls and Kruitwagen, 2010). However, even if it were possible to stabilise greenhouse gas emissions, climate change and the associated effects would continue (IPCC, 2007). Consequently, measures have to be developed for adaptation. Policy on this theme is being made at both the international and national levels. The European Union has demonstrated its adaptation awareness by firstly launching a Green Paper on Climate Change in 2007, which set out ideas on adaptation measures (CEC, 2007), followed by a White Paper on Climate Change in 2009 (CEC, 2009), proposing legislation on the matter. At the national level, adaptation strategies are being developed in countries such as Denmark, Finland, France, Germany, Hungary, the Netherlands, Romania, Spain and the UK (Biesbroek *et al.,* 2010). Information is more diffuse at the local level, but adaptation strategies are already being implemented or under development

in world cities such as Cape Town, Durban, Quito, Tokyo, Walvis Bay and Windhoek (MIT, 2011) and European cities such as Madrid, Manchester, London, Stuttgart, Basel, Berlin and Freiburg (Carter, 2011). Another indicator that cities are becoming aware of a changing climate is their involvement in research projects such as Climate Proof Cities (www.knowledgeforclimate.nl), Klimzug-Nord (www.klimzug-nord.de) and GRaBS (www.grabs-eu.org). Since climate change adaptation emerged only recently as plan development field (Biesbroek *et al.*, 2010, Lindley *et al.*, 2007), much effort is still being channeled into setting up adaptation programmes, which may eventually lead to legislation.

§ 3.4 Methodology

In order to find out if the awareness of adaptation has already reached the operational level of policy making, a case study was carried out among housing associations in the Netherlands. The study consisted of a content analysis (Bryman, 2008) on policy documents from 25 housing associations to reveal their awareness of climate change and a classification of the associations according to their level of awareness. The sample comprised the 25 housing associations with the most rental units in 2008 (ABF, 2008). By selecting these 25, the sample contained as much dwellings as possible of which the state of adaptation would be known. If the sample would have been selected on another way, for instance randomly, it would almost certainly contain fewer dwellings. In total, the selected associations own 881,000 dwellings, which is around 37% of the Dutch social rented housing stock of 2.4 million dwellings (ABF, 2008). Moreover, the sample contained housing associations spread over the whole country, reducing geographical bias (Figure 3.1).

Two types of policy documents were selected for their ability to report on the projects implemented by the associations and their general strategies. The first type of documents were annual reports describing the associations' projects and their activities in the previous year. The second type was the corporate policy plan. In the latter, housing associations usually describe their planned strategies for the forthcoming 3-5 years. Although some housing associations had more up-to-date information available on their websites, it was decided to not use websites for this research because information on websites can change quickly, and it is not always clear whether this information has been approved by Executive Boards, as is the case for policy documents such as those mentioned above. The reference years were 2009 for the annual reports and 2010 for the corporate policy plans.

FIGURE 3.1 Geographical distribution of the 25 largest Dutch housing associations (each circle represents the main office of a housing association)

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GROUP	DIRECT NOTION	INDIRECT NOTION
Climate	Climate	Indirect Notion
	Climate Change	Climate
Adaptation	Heat	Climate Change
		Green façade, green façades
		Trees, mobile trees
		Shadow, panes, pergolas, shelters, shades, blinds, shutters
		Thermal Mass
		Evaporative, evaporation, spray curtains, mist sprays
		Cooling, night cooling
		Cooling beams, walls, columns, slabs
		Airconditioning
		Floor height
		Reflective surface, albedo
	Flooding	Airtightness
		Sewage
		Flooding
		Guttering (increase dimension)
		Parapet gutter, internal downpipe (reduce use)
		Spouts, gargoyles
		Drains
		Rainwater, rain, rainfall
		Water retention; storm water tanks
		Basins, reed beds, ponds
		Infiltration, infiltration facility, grit box, infiltration crate
		Permeable and porous pavements
		Materials (water resistant)
Mitigation	CO_2	Green roof, green roofs
		CO_2
		Sustainable energy
		Renewable energy
		Solar energy, roof surface, roof inclination
		Solar boiler
		Wind energy, windmill
		Geothermal
		Biomass
		Rest heat
		Photovoltaïc, pv
	Living costs	Heat and cold storage
		Living costs
		Energy prices, energy costs

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GROUP	DIRECT NOTION	INDIRECT NOTION
		Energy saving, low energy, energy neutral, climate neutral
		Heating system
		Heat pump, heat pump boiler
		Compact building
		Sun room
		Thermal bridge
		Orientation, zoning,
		Position windows, daylight reflectors
		Energysaving light bulbs, HF/TL lighting, LED
		Passive house
		Low temperature heating, floor heating, wall heating
		Heat recovery (ventilation, shower)
		Smart ventilation system (CO_2 driven, presence, time limits)
Insulation	Insulation	Energy performance, energy label
		Insulation
		Double glazing, insulated glazing, HR++ glazing

TABLE 3.1 Taxonomy of topics searched for in content analysis

The keywords were structured into a taxonomy (Table 3.1) which was subdivided into four main groups: climate, adaptation, mitigation and insulation. The first group, 'climate', was created in order to obtain a general view on the awareness of climate change among the housing associations and included the notion 'climate change'. This group also included the notion 'climate', in order to find words referring to climate change, but not literally expressing it, which is the case in a phrase like "This climate-friendly roof, (...)". (Eigen Haard, 2010). The keywords were selected in order to discover if housing associations are, with respect to their dwellings, aware of climate change, meaning "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods" (UN, 1992). The second group, 'adaptation', focused on revealing the awareness of the impacts of climate change housing associations are required to adapt to. The group included the notions 'heat' and 'flooding', being to date considered the main impacts on the urban environment in the Netherlands (PBL, 2009).

As the social housing stock is mainly located in urban areas, housing associations have to deal with these impacts. However, not only the notions 'heat' and 'flooding' as such were searched for, but also notions referring to measures to adapt to the impacts of heat and flooding, in order to gain insight in the state of adaptation of the building stock. The adaptation measures are derived from a climate change adaptation checklist by the Greater London Authority (GLA, 2005). An example of this kind of measures is the notion 'tree', which was counted as an adaptation measure in the 'heat' category,

because trees have cooling capacities by means of shadow and evaporative cooling (Gill *et al.,* 2007). The search for this category of notions was carried out against the background that even though a housing association did not show awareness of climate change, (part of) its housing stock can be adapted, which in the end does provide more living quality for the tenants. The third group, 'mitigation', included the notions 'CO_2' and 'living costs', which would help to discover the awareness of climate change mitigation among Dutch housing associations. The selection of 'CO_2' was based on the establishment of the governmental policy focusing on CO_2 reduction in the 'Clean and Efficient' programme in 2007 (MinVROM, 2007). 'Living Costs' was selected as this topic came into consideration in the 'Agreement Energy Savings in the Social Rental Sector' between the Dutch national government and the housing associations in 2008. In this document the importance of taking energy saving measures was acknowledged in view of the development of living costs (MinVROM *et al.,* 2008). Living costs are defined as the total costs for living, such as rent or mortgage, including additional expenses for taxes, insurance, sewage, gas, water and electricity (Blijie, 2010). Being mitigation to date more developed as a research topic than adaptation (Biesbroek *et al.,* 2010), the governance of mitigation has been more institutionalised, resulting in funding and regulation schemes (Anguelovski and Carmin, 2011). The analysis has to point out if these governance measures have led to more awareness of climate change mitigation among housing associations. The reason to divide the mitigation topics into 'CO_2' and 'living costs' was to discover the motivation of the housing associations to apply the mitigation measures, being respectively the (global) environment, or the socio-economic circumstances of their tenants. Parallel to the adaptation group, in 'mitigation' was also searched for measures related to mitigation, in order to find out if housing associations were taking mitigation action without naming it as such. The notions related to energy saving are connected to 'living costs' because they refer to a better energy performance of the dwellings, meaning lower energy consumption and a lower energy bill for tenants, whereas the notions related to sustainable energy are connected to 'CO_2', because they imply less emissions, not necessarily resulting in lower energy bills for tenants. The measures were taken over from the 'Toolkit sustainable housing' (Hameetman *et al.,* 2006) and from the energy chapter of the guideline for education on sustainability: 'Basisdoc XS 2' (Stofberg and Duijvestein, 2008). 'Insulation', the last group, included the notion of 'insulation' and 'double glazing'. It was added separately because of its role in both mitigation and adaptation. Insulation measures were suggested in both the adaptation measures checklist by the Greater London Authority (GLA, 2005) and the mitigation reference documents by Hameetman et al. (2006) and Stofberg and Duijvestein (2008). Insulation is an adaptation measure because it keeps heat outside the dwellings on warm days, whereas on cold days it keeps the warmth (heating energy) inside the dwellings and thus can be considered as mitigation measure.

Every policy document was analysed according to the taxonomy. One disadvantage of content analysis is that one notion can have multiple meanings, which requires interpretation by the researcher. Moreover, notions that belong to one of the groups

in literal terms but do not refer to climate change were excluded from the results, in order to not 'contaminate' results but have a clear view on the climate change related topics. For example, the word 'climate' was excluded when referring to 'indoor climate' or 'social climate'. In order to classify housing associations according to their awareness of climate change, a suitable model was searched for, which had to have the ability to clearly represent the link between two variables, being aware/unaware and adapted/unadapted. One possibility was the BCGmatrix, which focuses on the positioning of business units of a company and market developments (Sarrico and Dyson, 2000). This model was not found suitable, because the values of the model deal with performance dimensions of business units, whereas in case of the awareness of the housing associations the state of the subjects (aware/unaware or adapted/unadapted) has to be represented. Another model was Hersey and Blanchard's situational leadership model, giving directions on the optimal leadership style suitable for a certain 'level of maturity of a subordinate' (Thompson and Vecchio, 2009). This model was not chosen to classify the housing associations because Hersey and Blanchard's model focuses on leadership strategies and not on the state of the subjects. However, the four stages of the learning model as described by Hughes (2002) did represent the state of the subjects to be classified, so this model was used as basis. This model links two variables, 'conscious / unconscious' and 'competent / incompetent' in a logical manner. Moreover, the 'conscious / unconscious' variable would also provide an opportunity to consider the adaptation strategies already being implemented by housing associations, without them being aware of their contribution of the measures to climate change adaptation (see Table 3.2).

	LEARNING STAGE (HUGHES 2002)		ADAPTATION AWARENESS				
			Value	Strategies	Value	Projects	Total
1	Unconscious competent	One is not even aware that he or she lacks knowledge or skill	-	No or indirect references in policy plan (unaware)	-	No references in annual report (unadapted)	- -
2	Innovation by partnering approach	One is aware that he or she lacks a knowledge or skill	+	Direct references in policy plan (aware)	-	No references in annual report (unadapted)	+ -
3	SWOT analysis conceptual approach-es	One acquires the missing knowledge or skill and applies it in articulated or codified ways	+	Direct references in policy plan (aware)	+	Direct and indirect references in annual report (adapted)	+ +
4	Assessment likelihood implementation strategies	One's knowledge or skill becomes second nature, applied seemingly without thought or effort	-	No or indirect references in policy plan (unaware)	+	Direct and indirect references in annual report (adapted)	- +

TABLE 3.2 Four levels of awareness of housing associations.
Adapted from Hughes (2002)

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Basically, appearance of notions in the annual reports determines whether the housing associations are being considered 'adapted' or 'unadapted', whereas appearance of notions in the policy plans determines whether housing associations are being considered 'aware' or 'unaware'. However, the indirect notions have to be treated differently in the annual reports and in the policy plans. In the annual reports, indirect notions refer to measures that have been applied already, so both direct and indirect notions lead to the 'adapted' category. On the contrary, in the policy plans, indirect notions refer to measures that will be taken in future developments but because the references are indirect, these do not imply more awareness, so in this case, only direct notions lead to the 'aware' situation. The highest level that can be reached in the learning process model is level 4, whereas for adaptation awareness level 3, 'aware, adapted' was considered the most suitable. The rationale for such a change of target is that on this level, the building stock is climate resilient and the housing associations are aware of the consequences of a changing climate. On the other hand, housing associations in level 4 are considered to have a climate resilient building stock, but because of their unawareness they are not alert to future changes that may negatively influence their tenants' quality of life (see Figure 3.2).

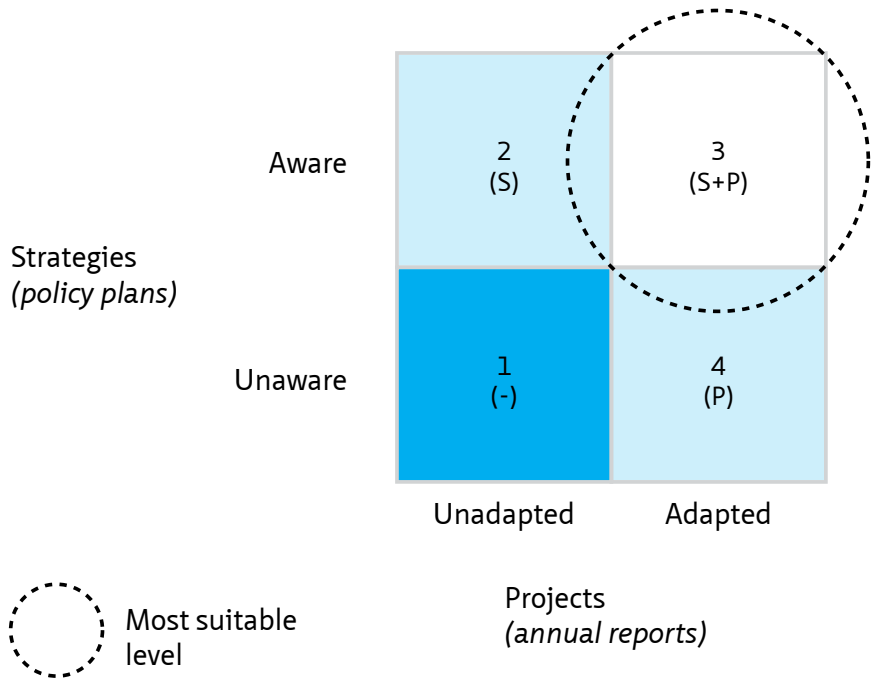

FIGURE 3.2 Schematic representation levels of awareness
(S=Strategies, described in the Policy plans; P=Projects, described in the Annual reports)

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§ 3.5 Findings

The policy plans of 19 (76%) housing associations were available for analysis. In these plans, 'climate'-related notions are mentioned by 3 housing associations (see Figure 3.3). Climate change is not mentioned in any policy plan, which is also the case for 'adaptation'-related notions. However, the policy plans do pay attention to 'mitigation'-related notions ('CO_2 and 'living costs'). 'Living costs' is mentioned in 13 plans while 'CO_2' is mentioned in only 8. 'Insulation' is mentioned by 7 housing associations in their policy plans.

Annual reports of 24 (96%) housing associations were available for analysis. These reports hardly referenced notions related to the main themes 'climate' and 'adaptation' (see Figure 3.4). In fact, only 10 of the reports mention 'climate' at all.

Zooming in, 'climate change' was referred to even less, being mentioned by only 3 housing associations. There are no direct references to 'heat' and 'flooding'. However, when we also take into account the indirect references (e.g. 'cooling'), 'heat' is mentioned by 11 housing associations and 'flooding' by 10. In total, 15 housing associations do refer to adaptation in their annual report, by mentioning notions related to 'heat', 'flooding' or both. Notions relating to mitigation, however, show up far more frequently. Direct references to both 'living costs' and 'CO_2' appear in 18 annual reports. Adding the indirect references, 'living costs' appears in all the annual reports analysed, while 'CO_2' appears in 19 of the reports. These high numbers are caused by notions related to energy, such as 'energy-saving', 'energy-efficient' and 'energy label'. 'Insulation' is mentioned by 22 housing associations.

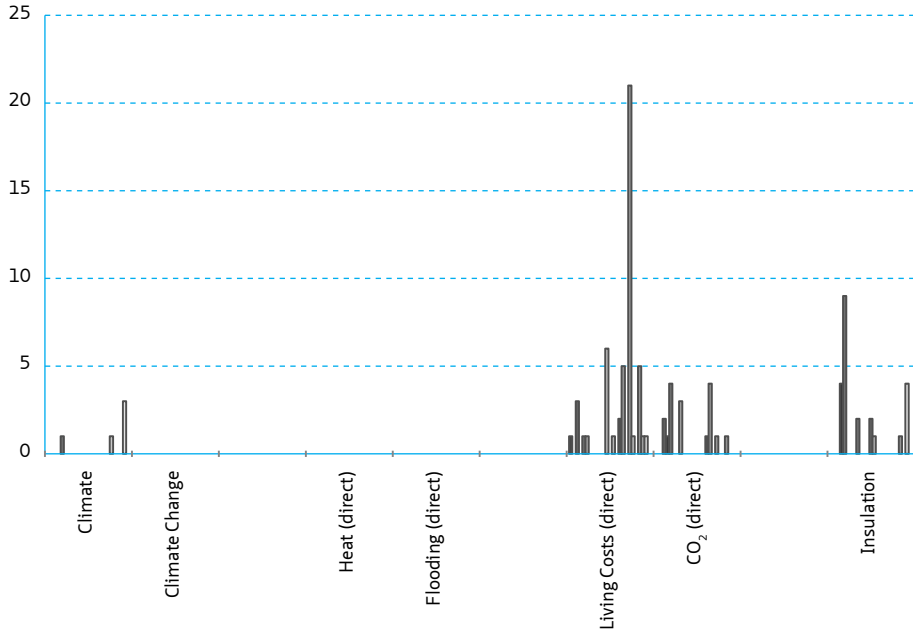

FIGURE 3.3 Content analysis of policy plans (each bar represents the number of notions found in the policy plan of one housing association)

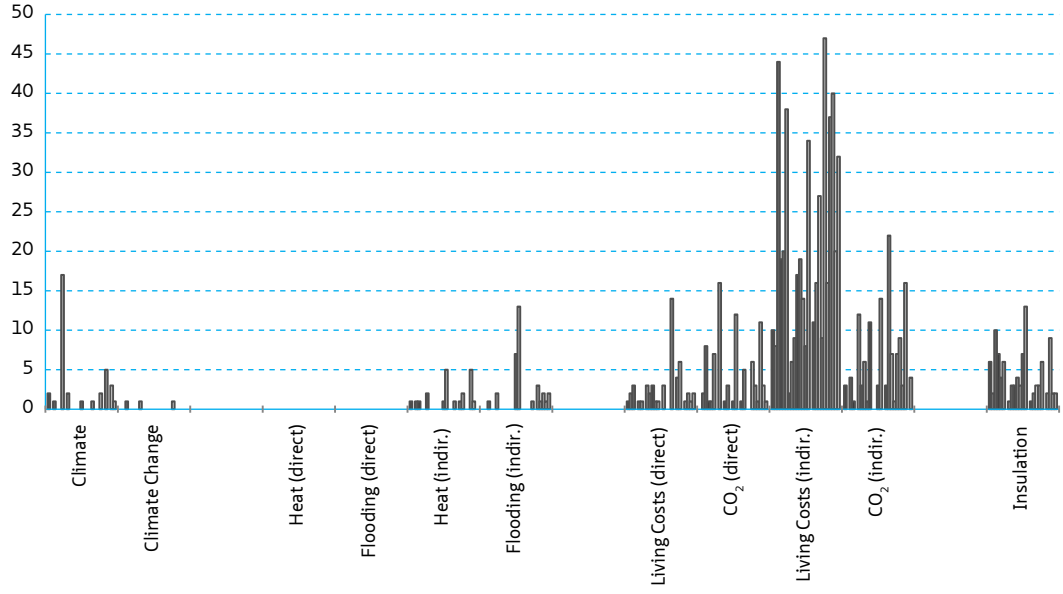

FIGURE 3.4 Content analysis of the annual reports of 2009 (each bar represents the number of notions found in the anual report of one housing association)

§ 3.6 Discussion

The categorization of the housing associations has taken place in steps. Firstly, the state of awareness of climate change adaptation was determined, which depended on the appearance of direct notions in the policy plans. However, as explained in the previous section, no notions were found so none of the housing associations was attributed to the 'aware' categories. Secondly, the state of adaptation was considered, by assessing the appearance of direct and indirect notions referring to climate change adaptation in the annual reports. It can be stated that 15 housing associations can be classified as being 'adapted', because they do refer to adaptation measures in their annual reports (Figure 3.5).

The awareness of adaptation among Dutch housing associations contrasts strongly with the awareness of mitigation, as notions related to this topic were frequently found in both the policy plans and annual reports. This indicates that the housing associations do have taken measures to a large extent and the majority is even aware of mitigation (Figure 3.6).

However, when the measures regarding insulation are taken into consideration, the number of housing associations classified as 'unaware / adapted' increases significantly, as shown in Figure 3.7.

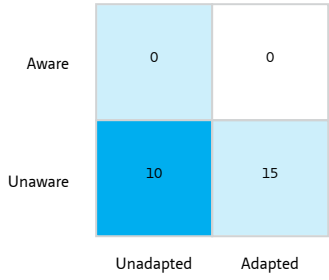

FIGURE 3.5 Classification of housing associations regarding 'adaptation'

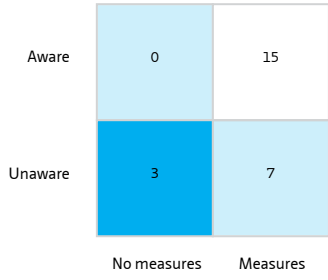

FIGURE 3.6 Classification of housing associations regarding 'mitigation'

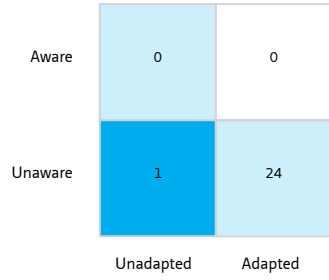

FIGURE 3.7 Housing associations with adaptation references including insulation

The figures above show that most housing associations in some way or another already apply adaptation measures on their dwellings, but they are not aware of it. For example, they may have taken these measures in projects without being aware that the measures also had adaptation characteristics, but in the analysis they were counted

as such (indirect notions). These measures were taken in order to enhance quality of life (e.g. planting trees, installing cooling equipment) or improve energy performance (insulation). This means that applying adaptation measures is neither impossible nor unrealistic; the question is rather whether the measures taken are the right ones and whether they are enough to make the dwellings climate-resilient. In order to make the entire building stock climate resilient, however, the right adaptation measures must be implemented as standard. These measures therefore have to be included in policy strategies and maintenance budgets.

Awareness is very important in order to take the right measures and to take all possible measures. Moreover, it may prevent maladaptation, which is adaptation that brings negative trade-offs. An example of this is air conditioning, a measure which is to adapt a dwelling to increased temperatures but this measure demands extra energy and therefore produces greenhouse gases, which in turn aggravate climate change (Barnett and O'Neill, 2010).

Even though many impacts are projected with 2050 or even 2100 as horizon (Klein Tank and Lenderink, 2009), adaptation measures can and should be taken as soon as possible. Since newly built houses account for less than one per cent of existing dwellings (www.cbs.nl), maintenance and refurbishment activities of the existing building stock offers the best opportunity to "mainstream" (Pinkse and Kolk, 2012) measures. By mainstreaming adaptations synergies are sought between the adaptation measures and the work that was already planned. In the case of mitigation, the notions related to energy saving measures (living costs, indirect) are more found than notions related to sustainable energy measures (CO_2, indirect), which might indicate that housing associations have chosen to mainstream mitigation measures with activities aiming to reducing living costs for their tenants. Moreover, improving the energy performance of dwellings by installing insulation is an effective strategy for mitigation as well as adaptation, preventing respectively heat loss in winter and heat stress in summer. It would be advisable to begin adaptation activities in dwellings that are the most sensitive to the hazards of climate change. For the Netherlands, sensitivity maps of urban areas are under development within the research project Climate Proof Cities (TNO, 2011).

§ 3.7 Conclusion

Dutch housing associations display no awareness of climate change adaptation in their policy documents. However, this does not mean that the building stock is not adapted to climate change. By categorizing the housing associations on the basis of their awareness, strategies can be developed in order to increase awareness among housing associations in a proactive way. As the subject of insulation shows, adaptation is possible and feasible, but housing associations need to be aware of climate change adaptation in order to know what to do to insure their tenants' quality of life and not miss opportunities to incorporate climate change adaptations when refurbishing or maintaining their housing stock. Governance strategies in the field of mitigation, such as the implementation of legislation concerning energy labels, seem to be an interesting point of reference, because housing associations have shown an awareness of climate change mitigation. However, further research is necessary to define which of these mechanisms are the most suitable for initiating or adding to the climate change adaptation measures implemented by housing associations.

The method used – content analysis – has proven to be effective for a quick scan of the current awareness of climate change adaptation among housing associations. However, because the method focuses on reports and these do not usually extend to the level of individual buildings, it is possible that adaptation measures are already being implemented on a larger scale, but they were not described in the analysed documents or misinterpreted by the researchers. Further research should focus on the level of individual buildings by, for example, interviewing project leaders who know the state of the dwellings or by carrying out a condition assessment of the buildings focusing on adaptation measures.

Thus, to conclude, besides raising awareness of climate change among housing associations, research needs to be carried out into the methods for adapting residential buildings effectively, because only in an 'aware-adapted' situation the quality of life of tenants can be maintained. This will enable housing associations to ensure that their building stock meets the needs of a modern society.

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