Integrated Retrofit Design Methodology

Booklet 2

NewTREND

NewTREND, Booklet 2:

Integrated retrofit design methodology.

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1. Introduction

The energy retrofit of buildings and neighbourhoods is complicated and very time and effort consuming task that require careful planning and a high level of engagement between all stakeholders throughout the different phases of the retrofitting project to ensure that the project targets are meet and that the project is financially, environmentally and socially successful. Moreover, taking the surrounding neighbourhood into consideration when engaging a retrofitting project opens the doors widely for new cost effective and energy efficient retrofitting options, as at the neighbourhood level the synergies effect between the buildings can be exploited resulting into a win-win situation for the neighbourhood as whole and for its single individuals. However, at this scale the complexity of the project would increase manifold. With an absence of clear and well-structured methodology that guide all involved stakeholders throughout this complex task, the chances of realizing such large-scale retrofitting decreases and only individual solution at the single building scale are considered.

The objective of the integrated retrofit design methodology (IDM) is guide all involved stakeholders in the value chain of neighbourhood scale retrofitting projects in finding the most effective energy retrofitting solutions in neighbourhood retrofitting projects with regard to energy and cost efficiency and their overall sustainability performance. The integrated retrofit design methodology (IDM) is intended to support the stakeholders throughout the project life cycle from the early initiation and concept phases to the implementation and post occupancy phase of the project in a structured and systematic manner that considers the required communication and participation mechanisms between all involved stakeholders.

Hence the complexity, challenges and the dynamics of a multi scale retrofitting project that NewTREND address, differs greatly from the ones traditional newly built project faces, the NewTREND IDM organizes the retrofitting project based on novel approach that divides the retrofitting project into 10 phases, in which certain process and objectives are to be fulfilled by the project team

The IDM is developed to be used at single building and at neighbourhood scale of around 10 buildings. Applying the IDM to a larger retrofit scale might prove to be ineffective, as some of the IDM processes are not be suitable for a larger scale. Moreover, the IDM is limited to energy retrofitting solutions, considering cost efficiency and overall sustainability performance of the single buildings and the neighbourhood as whole. Thus, the IDM is not suitable when the retrofit project has a different focus.

IDM for STAKEHOLDERS

2. Methodology for stakeholder communication and participation

The NewTREND IDM defines for each phase of the IDM the processes which need to be followed by all involved stakeholder in the value chain of neighbourhood scale projects. Most effective energy retrofitting can only be achieved if all involved stakeholders work together in an efficient way. The research shows that often the occupants and users have been involved too late in the design process and the involvement did not take advantage of effective techniques. Hence, the engagement of the "Design Team" with the stakeholders was mostly based on a one-way communication strategy which includes consultation or information of the stakeholders after the design process already was finished. The stakeholders were not actively involved in the different phases but only informed and updated on the results and planned design variants. To avoid this in the NewTREND IDM, the IDM ensures that the stakeholder involvement can be considered in all phases of the IDM and that the most effective techniques and methods in each phase can be applied.

The IDM developed a set of innovative future-oriented methods for stakeholder involvement in the design process and linked them to the different IDM phases. To allow the practical implementation of these methods within each phase of the NewTREND IDM appropriate tools and supports are provided in the IDM in the form of advisory profiles.

The advisory profiles guide the responsible stakeholder in a step-by-step on how to implement the new methods in the retrofitting project. Thus insuring an adequate and effective communication between the different involved stakeholders in a retrofitting project can be achieved in each phase of the NewTREND IDM.

2.1 NewTREND approach to occupant and user involvement

This section of the report outlines the approach to occupant and user engagement being proposed as part of the NewTREND Integrated Design Methodology. It is clear that each individual building projects differ enormously in their characteristics, including those of their occupants and users and other stakeholders, and that there is a wide range of potential methods of engaging occupants and users which can be used in different combinations over different stages of the design process. Consequently, the approach we are recommending is deliberately flexible. It focuses on guiding building stakeholders through the critical questions that need to be asked in planning a process of occupant and user engagement, and helping them navigate the many options available and choose among them to devise their own tailor-made solution. At each step, it presents a number of options, with the aim of allowing stakeholders develop a process of occupant and user engagement customised for their individual project. There are three main steps involved:

- Deciding what level of occupant and user engagement is suitable for the project;
- Choosing the appropriate suite of methods;
- Combining these into a tailored engagement plan.

Step 1: This involves deciding on the level of occupant and user engagement which is suitable for the project. The client and design team should work through the questions outlined in section 2.1.1, to assess whether or not a participatory design process is desirable, and decide what level of participation is appropriate.

Step 2: Once a user of the methodology has decided what level of participation is appropriate, they will be in position to select one of the five models of occupant and user engagement laid out in section 2.1.2, namely: the community visioning model; collaborative design model; deliberative model; behaviour research model; and information and consultation model. For each of the five models, a recommended a sequence of engagement methods running through the various stages of a typical construction project is developed.

Step 3: Once a selection of engagement methods is made, the final stage is to draw up a detailed plan for occupant and user engagement, stage by stage, outlining when each of the engagement methods is to be carried out, how it is to be implemented, how the project team will communicate about engagements to potential participants, what resources or supports will be required, and who is responsible for each task.

2.1.1 Step One - deciding the level of participation

A high level of occupant and user participation may not be feasible or appropriate in every retrofit project. Matching the intensity and timing of the engagement to the character of the project and the overall goals of the participatory design process is crucial to establishing its legitimacy with both internal and external stakeholders. Where the aim is merely to meet legal requirements or communicate some information to the public, this may be achieved by a relatively shallow consultation process, involving traditional public notices and meetings (Bryson et al., 2013). On the other hand, there are many circumstances where the active support of occupants and users for a project is vital, and where their knowledge and experience of the building can enhance understanding of a problem and its potential solutions or improve the quality of a project. In this case a more far-reaching engagement involving deliberative approaches and small-group formats would be appropriate (Bryson et al., 2013). Developing a shared understanding amongst stakeholders of the nature and objectives of participation is crucial. Furthermore, the nature of the engagement and the tools and techniques chosen need to match the objectives. This should help prevent conflicts which might otherwise result from differing expectations of what the process is about.

It is therefore necessary at the outset of a project for the project manager to assess what level of occupant and user engagement is feasible and desirable. This will depend on three sets of factors: the characteristics of the building and project, the characteristics of the stakeholders (in particular the client and design team), and the characteristics of the occupants and users.

In the following is a list of factors which should be taken into account in deciding what level of participation is appropriate, as well as the timescale of the collaborative design process and the kinds of techniques which might be used. It sets out a series of questions which should be asked before initiating a co-design process, and which are designed to identify those characteristics of the project and its stakeholders which may be favourable or unfavourable to occupant and user engagement.

2.1.1.1 Building and Project Characteristics

The table below lists characteristics of the building and the project itself which need to be taken into account in deciding the appropriate level of participation by occupants and users, and suggests how these might impact on the potential for engagement.

Table 1: Building and project characteristics influence on suitable level of participation

Characteristic	Potential Impact
1.Building Function *What is the building's function? (e.g. residential, educational, health-related, commercial office, library, retail, local government)*	The function of a building will shape both the character of its occupants and users, and their relationship with the building. In a residential building the occupants will be strongly impacted by the outcome of the refurbishment and are responsible for most energy usage. Consequently, a high level of participation will usually be both feasible and desirable. In the case of a public facility like a library or school both building users and the professionals who work there may be strongly invested in the building and wish to have an input in the design. Tenants in a commercial office building on the other hand may have less investment in the site. However, where there are sitting tenants paying substantial rents, their needs (such as minimizing disruption) will have to be taken account of from early on in the project.
2.Building Characteristics *Is the building a heritage building? Does it have particular aesthetic features it is important to preserve?*	Where a building has notable heritage or aesthetic value, it will be particularly important to take account of the sensitivities of occupants and users (as well as other stakeholders) and a high level of participation in the design will be desirable.
3.Project Objectives *What are the objectives of the project? (e.g. energy efficiency, change of use, comfort, improved functionality, etc.)*	How important is the support of occupants and users to achieving the objectives of the project? Where the objective relates to improving comfort or functionality for occupants and users, their input should be sought early in the design process. In the case of energy efficiency, input from occupants and users should be sought regarding both the existing energy-use characteristics of the building and potential solutions, especially where energy-saving measures will need the active cooperation of occupants to be effective. In addition, where a project involves changes to the overall appearance or function of a building, greater occupant and user participation may be required than if its scope is confined to the upgrade of energy systems.
4.Project Scale *What is the scale of the project? (e.g. part of a building, small building, large complex, multiple buildings, district scale)*	The scale of a project will impact on both the level of engagement with stakeholders, the timescale and the methods used. In general, the larger the scale of a project the greater the number of stakeholders who will be impacted, and the more likely the impact will be significant. In such cases the risks of organized opposition resulting in planning delays increase. Consequently, building users, occupants and other stakeholders should be involved early on in the design process. A wide range of participatory techniques, from public meetings to design charrettes to one-on-one engagements, may be required to involve different stakeholder groups.
5.Technical characteristics *What depth of retrofit is involved? What kind of technologies will be installed in the building?*	The depth of retrofit and the level of energy efficiency aimed at needs to be considered. Certain kinds of measures (such as smart metering, or highly efficient heating and cooling systems) may require occupants' and users' co-operation to work effectively. In other cases, detailed information about energy use practices and building energy performance may be required from occupants as part of the design process. Effective post-occupancy evaluation will also often require the cooperation of occupants and users.
6.Timescale *What is the timescale of the project?*	Where a project has a tight timescale, this may limit the amount of time available for engaging occupants and users, in particular where there are restrictions on the duration of the design stage. However, it should be considered whether failure to include these groups may lead to opposition which will delay the project or limit the effectiveness of the energy efficiency measures installed.

7.Budget *What kind of finance is available to the project, and who is the funding source?*	Financial considerations may limit the scope for occupant and user participation, or place constraints on the methods which can be used. In some cases, the source of the funding may determine the kinds of retrofit measures to be implemented – for example a government grant may specify the installation of solar panels, or the type of insulation. However, consideration should always be given to the possibility of financial losses if opposition from building occupants and users delays a project.
8.Regulatory Restrictions *Is the project subject to regulatory restrictions which could place constraints on the scope for participation in the design?*	A building may be subject to a range of regulatory restrictions, some of which have potential to limit the scope for occupant and user participation in the design. This is particularly the case where the need to apply for financial grants or secure various permits limits the time available at the design phase. Regulations to do with heritage preservation, etc., may also severely constrain the choices available to those involved in the design, including building occupants and users.
9.District Considerations *Is the district around the building built-up? Are there adjacent buildings to which it is attached? What are the uses of the surrounding buildings? Is the building part of a district heating or cooling system?*	Consideration needs to be given to the extent to which the project will impact on building occupants and users and other stakeholders in the surrounding district. This is especially the case where there is potential disruption to residents and businesses, or sensitivities around heritage, amenity value, etc. Where stakeholders in the surrounding district are likely to be impacted by a project, there will be a need to solicit their views as part of the design process. Where surrounding residents are also users of the building, a greater level of participation may be appropriate.

2.1.1.2 Stakeholder characteristics

The table below, lists characteristics of key stakeholders, particularly the client and design team, which need to be taken into account in deciding the appropriate level of participation by occupants and users, and suggests how they might impact on the potential for engagement.

Table 2 : Stakeholder characteristics influence on suitable level of participation

Characteristic	Potential Impact
Client's Relation to Occupants and Users *What is the client's relation to the occupants and users of the building?*	The client may themselves be an occupant of the building, which will greatly facilitate a participatory design process. Or they may feel a duty of care to the occupants and users of a building which would encourage them to support a participatory design process (in the case of a public housing body or a public healthcare provider, for example). On the other hand, their relationship to occupants and users may be purely commercial or financial. Even here, the balance of power between occupants or users and building owners can fall in different ways: large commercial tenants on long term leases will be in a much stronger position to have a say in the design process than smaller tenants on short-term leases, for example.
Client Characteristics *Is the client an individual or an organisation? If an organisation, are they public/private, commercial/non-profit, etc? What kind of organisational culture and values do they have?*	Public clients, such a local authorities and government bodies, may be more open to a collaborative design process, especially where the project concerns a residential complex or a building which serves the public. NGOs and non-profits may have organisational values which predispose them to embrace an inclusive and participatory design process. Private commercial clients may be less open to participatory methods. However they may adopt them due to concern for their public image, the need for good relations with building occupants and users, or corporate social responsibility policies. Where the client organisation or institution itself occupies the building, the scope for participatory design will vary according the characteristics of the organisation and how they use the building. Is their remit public or private, voluntary, non-profit or commercial? Is the organizational culture strongly hierarchical or democratic? Is their interest in the building purely commercial or have they historic, sentimental and personal ties to it?
Design Team Characteristics *What experience of occupant and user participation does the design team possess?*	What is the attitude of the design team (architects, engineers, etc.) to occupant and user engagement? Do they view it as important or a distraction? Have they experience of collaborative design in previous projects? To be effective, participatory design requires both the client and the design team to cede some of their power over the design process. It is vital to establish at the outset whether they are willing to do so, and to what degree.

2.1.1.3 Occupant and user characteristics

The table below lists characteristics of the building occupants and users themselves which need to be taken into account in deciding the appropriate level of participation, and suggests how they might impact on the potential for engagement.

Table 3: Occupant and user characteristics influence on suitable level of participation

Characteristic	Potential Impact
Building Occupancy *Is the building occupied or in use?*	Sometimes buildings may not be occupied or in use at the time of refurbishment. In this case, unless the future occupants and users can be clearly identified, they are not going to be involved in the design process.
Building Use *Are the building occupants residents, commercial or industrial concerns, or a mixture?*	The way in which residential tenants engage with a building, and use energy, will differ widely from how commercial tenants (such as offices, retail or industry) engage with a building. This will have to be taken into account in designing the participatory process. In the case of commercial or institutional occupants, consideration should be given to how their staff might be included in the participatory design process.
Continuity of Occupancy/ Use *Will the occupants be the same/substantially the same after the refurbishment?*	If the building is going to have completely different occupants/ users after refurbishment, the scope for participation is limited.
Tenure *What is the occupants' tenure (e.g. owner occupier, long-term lease, short-term lease)?*	Tenure can impact on the influence occupants are able to exert over the design process, their investment in the building, and the long-term benefits of occupant involvement in design. Owner occupiers and tenants on long-term leases will be in a strong position to have their views taken into account. They may also be strongly invested in the building, both financially and emotionally, which may increase their willingness to engage with an intensive participatory process. Finally, they are likely to continue to occupy the building in the future, so the benefits of participation in terms of energy efficiency and effective use of energy-saving technologies can be significant. Short-term tenants, on the other hand, are in a weaker position to make their voice heard, and are likely to be less invested in the building.
Commitment to Building *How committed to the building are its occupants and users?*	Occupants and users can have varying degrees of commitment to, and emotional investment in, a building, and this will influence their readiness to commit time and energy to a participatory design process. Duration of occupancy/ use, length of tenure, financial investment in the building, the function of the building and its aesthetics and heritage value all have an impact here.
Socio-Economic Characteristics *If occupants are residential, their number, age, education, socio-economic background, gender* *If commercial or institutional, company size, type of activity, staff*	These characteristics will suggest the level of engagement that may be expected from occupants, as well as steps that might be necessary to make the collaborative design process assessable and inclusive. For example, if some occupants have little education, they may need extra supports in order to participate. If occupants have children, childcare may need to be provided to facilitate them in attending meetings, workshops, etc.
Capacity for Collective Action *Are occupants represented by a tenants' or housing association or similar organisation?*	When occupants and users are numerous and organised, their ability to influence the design process will be significantly enhanced. Where they have a formal representative body, such as a residents' or tenants' association or a trade union, this can facilitate a participatory process by providing a channel for their input into the design process. However, care needs to be taken to ensure that the body is genuinely representative of building occupants and users. Factors like level of education, length of occupancy, security of tenure, financial investment etc. can also impact on the ability of occupants and users to act collectively in pursuit of their interests. Where occupants are strongly organised, this can increase both the necessity and feasibility of a high level of occupant involvement in design.
History of Occupant Engagement *Have occupants and users previously been involved in a participatory design process or consultation? Was their experience of the process positive or negative? Was the planned design subsequently implemented?*	Especially in public buildings, occupants and users may have past experience of consultations, negotiations, and discussion around proposed refurbishments. In some cases this may have strengthened their capacity to engage in the design process, by giving them some level of familiarity with design or experience in community organising. On the other hand, if there have been repeated promises of refurbishment which were not followed through, or if occupants and users feel they have not been listened to in the past, this may discourage future participation.

Knowledge of Building *What level of knowledge of the building and its energy systems do occupants and users possess?*	In many cases occupants and users may have significant knowledge of the building and its energy system, both from an experiential perspective (comfort levels, ventilation, lighting, etc.) but also in terms of technical characteristics and performance. In other cases, occupants and users may have more limited knowledge – for example where they have no control over the buildings heating and ventilation systems, or if their relationship to the building is temporary or limited.
Financial Investment *Are the occupants financing or part-financing the refurbishment?*	If occupants are making a financial contribution to the refurbishment, they are in a strong position to influence the design. They may also be more likely to take part in a participatory design process, because they will have more invested in the project's outcome.

2.1.1.4 Three dimensions of participation

The factors listed above can be related to three different variables, which in turn will inform the model of occupant and user engagement chosen. These are:

The depth of participation, in other words the level of control over decision-making which occupants and users will have in comparison to other stakeholders such as design professionals. This will depend on the characteristics of the occupants and users themselves (how well-organised they are, how committed to the building, whether they have a financial stake in the project); those of the client and design team (how much control over the design process they are willing to concede); and those of the project (scope, scale and level of technicality).

The breadth of participation, in other words how wide-ranging occupant and user participation in design, depends on Will occupants and users be involved in setting the overall objectives of the redevelopment? Will they be encouraged to come up with their own design solutions, or will they be asked to choose from a menu of options? Will occupants and users be involved across all areas of the project, or will the project team engage with them only on certain, potentially controversial, aspects of it? This will depend on the project characteristics (for example, whether it is a case of a full-scale renovation of a building or a more limited and technical retrofit) as well as those of the occupants and users.

The inclusivity of participation, in other words how wide a range of stakeholders needs to be included in the process. Is it more important to include some categories of occupants and users than others? Will all occupants and users participate actively in the design, or a representative cross-section? Are there other groups of stakeholder, such as neighbours and community representatives, who should be included in the process? This will depend very much on the characteristics of the project itself, such as its scale and objectives, as well as those of the occupants and users, including their number, tenure and commitment to the building.

2.1.2 Step Two - selecting a model of occupant and user engagement

This sub-section introduces five different models of occupant and user participation, which combine different degrees of depth, breadth and inclusivity of participation. Each of the models suggests specific methods of occupant and user engagement for use in each project phase. Having worked their way through the questions in sections 2.1, clients and members of the design team will be in a position to choose the model that most closely matches the project they are engaged in and their own needs. Here the models are introduced and briefly outlined. Stakeholders may also, if they desire, choose to combine methods from different models to generate an approach specifically tailored to their own project.

1. Community Visioning Model

This model incorporates the highest level of occupant and user participation, in terms of both depth, breadth and inclusivity is most suited to projects on a district scale, or where there are very large numbers of occupants or users who have strong views about the redevelopment. These may have a sense of collective identity and some form of organisation. The community is either initiating the project, or the other stakeholders are open to very high degree of community participation and control. The parameters of the project are not set tightly in advance, so there is wide room for fresh ideas, visioning and long-term planning. The focus of the engagement will be on developing a shared vision of the future building/neighbourhood, rather than on the technical characteristics of the project. Accordingly, occupant and user participation will be concentrated in the earliest phases, although it will continue throughout the project. Examples might be the regeneration of a public housing estate, or the refurbishment of a community-owned facility such as a local hall.

Table 4 : community visioning model at each project phase

Community Visioning Model	Initiation stage	Community appraisal
	Preparation stage	Community Advisory Group Online forum/social media
	Diagnosis stage	Online forum/social media
	Strategic definition stage	Open Space Meeting Online forum/social media
	Concept stage	Online forum/social media
	Decision-making stage	Community Advisory Group Public forum Online forum/social media
	Implementation stage (Design development, tendering and construction)	Community Advisory Group Online forum/social media
	Handover and close-out and in-use stage	Post-occupancy workshop Online forum/social media

In the community, visioning model, engagement begins at the initiation stage with a community appraisal/building appraisal, which provides an inclusive and participatory means of defining the overall objectives of the project. At the preparation stage, a Community Advisory Group is established which is representative of the occupants and users and which works closely with the project team from then onwards to realise the vision set out in the community appraisal. At the strategic definition stage, the process is once more widened out to include the entire community, when an Open Space Meeting is used to establish clear design guidelines and possibly choose between various technical options for the retrofit. The Community Advisory Group once more comes to fore at the decision-making stage, although if there is a difficulty in choosing between design options it may refer the matter to a public forum. Finally, during the in-use stage, a post-occupancy workshop is held to assess occupant and user satisfaction with the renovated buildings and the success of the project in meeting its objectives. Social media and an online forum are also utilised throughout to facilitate two-way communication between the project team and building occupants and users.

2. Collaborative Design Model

This model involves a significant depth and breadth of participation but is less inclusive than the Community Visioning Model. It is suited to a situation where a high level of participation is required, but where in-depth discussion of specific design options is more important than broad scale visioning. Occupants and users will be committed and engaged, but the community are less likely to be initiating the project and it may be more focused on a particular set of issues within a building than on generating a broad vision of the future. In-depth engagement on the part of a representative cross-section of occupants and users is more important than including all members of the community. Ongoing involvement of occupants and users throughout the design implementation phases and into post-occupancy evaluation will also take on greater importance.

Table 5 : Collaborative design model at each project phase

Collaborative Design Model	Preparation stage	Design charrette Online forum/social media
	Diagnosis stage	Online forum/social media
	Strategic definition stage	Design charrette Online forum/social media
	Concept stage	Online forum/social media
	Decision-making stage	Community Advisory Group Online forum/social media
	Implementation stage (Design development, tendering and construction)	Community Advisory Group Online forum/social media
	Handover and close-out stage and In use stage	Post-occupancy workshop Online forum/social media

In the collaborative design model, an initial design charrette is held at the preparation stage to enable occupants and users voice their concerns and priorities, shaping the design process from early on. A second charrette is held at the strategic definition stage, which enables occupants and users to participate in setting the detailed design guidelines which will influence the concept design. At the decision-making stage, a Community Advisory Group is established which is representative of the occupants and users and works closely with the project team throughout the implementation stage to realise the vision set out in the design charrettes. Finally, during the in-use stage, a post-occupancy workshop is held to assess occupant and user satisfaction with the renovated buildings and the success of the project in meeting its objectives. Social media and an online forum are also utilised throughout to facilitate two-way communication between the project team and building occupants and users.

3. Deliberative Model

This model is suited to a situation where a moderate but still significant level of occupant and user participation is required, usually centred around specific issues. The project team maintain the predominant role in decision-making, but they want a degree of involvement from occupants and users which goes beyond a once-off consultation. The engagement is less about devising a long-term vision for the building or generating creative design solutions, than facilitating occupants in giving an informed response to the plans or choosing from among a set of potential design solutions. There is a stress on achieving consensus through deliberation. This model may be particularly useful where some aspects of a building project are controversial and it is desired to achieve agreement on the way forward among occupants and users or in the wider community. Formalised occupant and user engagement will be maintained from the design phase through construction and into post-occupancy.

Table 6 : Deliberative model at each project phase

Deliberative Model	Preparation stage	Online forum/social media
	Diagnosis stage	Online forum/social media
	Strategic definition stage	Community Advisory Group Online forum/social media
	Concept stage	Online forum/social media
	Decision-making stage	Consensus conference forum/social media
	Implementation stage (Design development, tendering and construction)	Community Advisory Group Online forum/social media
	Handover and close-out stage	Post-occupancy workshop Online forum/social media

In the deliberative model, initial engagement with occupants and users is via social media and a dedicated online forum within the NewTREND platform. At the strategic definition stage, a Community Advisory Group is established which is representative of the occupants and users and advises the project team how to ensure the design guidelines reflect their concerns. This is reinforced at the decision-making stage when a consensus conference enables a representative group of occupants and users deliver an informed verdict on a range of different design options or technical solutions. The Community Advisory Group continues to work closely with the project team throughout the implementation stage. Finally, during the in-use stage, a post-occupancy workshop is held to assess occupant and user satisfaction with the renovated buildings and the success of the project in meeting its objectives. Social media and an online forum are also utilised throughout to facilitate two-way communication between the project team and building occupants and users.

4. Behavioural Research Model

The behavioural research model may be quite inclusive but is focused on the technical aspects of the project and affords occupants and users little actual power in decision-making. It is suited to a situation where the priority is not so much giving occupants and users input into and control over the design process, as gaining an understanding of their needs, attitudes and concerns and, in particular, their behaviour and the drivers of their interactions with energy and technical building systems. Occupants and users are engaged as objects of study rather than active participants in co-design, and the process is largely driven by the interests and concerns of the design team, although an element of consultation is also included. The focus is likely to be on the technical aspects of energy retrofit, maximising energy efficiency, understanding user behaviour, and making sure the energy systems installed are suited to the occupants and will be used effectively. Post-occupancy evaluation will play an important role, as a means of assessing the effectiveness of the energy solutions implemented.

Table 7: Behavioral research model at each project phase

Behaviour Research Model	Preparation stage	Surveys Focus groups Interviews Online forum/social media
	Diagnosis stage	Online forum/social media
	Strategic definition stage	Public forum Online forum/social media
	Concept stage	Online forum/social media
	Decision-making stage	Open day Online forum/social media
	Implementation stage (Design development, tendering and construction)	Online forum/social media
	Handover and close-out stage	Post-occupancy focus group Online forum/social media

In the behaviour research model, focus groups, interviews and surveys are used during the preparation stage to research occupant and user behaviour. This information feeds into the design team's choice of design options and energy solutions. A public forum is held at the strategic definition stage to consult occupants and users about the detailed design guidelines, while an open day towards the end of the decision-making stage allows them give their reaction to the concept design. Finally, during the in-use stage, a post-occupancy focus group is held to assess of the project in meeting its objectives, especially in terms of energy savings, as well as occupant and user interactions with new technical systems and any changes in their behaviour. Social media and an online forum are utilised throughout to facilitate two-way communication between the project team and building occupants and users.

5. Information and Consultation Model

This model offers minimal depth and breadth of participation but wide inclusivity, since all occupants and users are informed and consulted. It is suited to a situation where a relatively low level of participation is required, but where inclusivity is important to ensuring the smooth implementation of a project. The client and project team may be reluctant to cede power, occupants and users may be disengaged, or the project may be highly technical. Engagement will therefore make little demands on occupants and users, and will be characterised by the provision of information and a basic level of consultation, primarily orientated towards enabling occupants and users inform the project team of objections or problems as they arise, and so facilitate troubleshooting and ensure the smooth implementation of the project. A modest level of engagement will continue throughout the project, to address any problems which arise during construction or post-occupancy.

Table 8: Information and consultation model at each project phase

Information and Consultation model	Preparation stage	Online forum/social media
	Diagnosis stage	Online forum/social media
	Strategic definition stage	Public forum Online forum/social media
	Concept stage	Online forum/social media
	Decision-making stage	Open day Online forum/social media
	Implementation stage (Design development, tendering and construction)	Online forum/social media
	Handover and close-out stage	Online forum/social media

In the information and consultation model, initial engagement with occupants and users is via social media and a dedicated online forum within the NewTREND platform. A public forum is held at the strategic definition stage once detailed design guidelines have been prepared, to inform occupants and users about the objectives of the project and allow them voice any concerns. This is followed by an open day late in the decision-making stage, when the main features of the design have been settled, which again gives occupants and users to chance to raise any issues. Social media and an online forum continue to be used throughout the implementation stage and into post-occupancy to facilitate two-way communication between the project team and building occupants and users.

The NewTREND approach to occupant and user involvement is summarised in Figure 1.

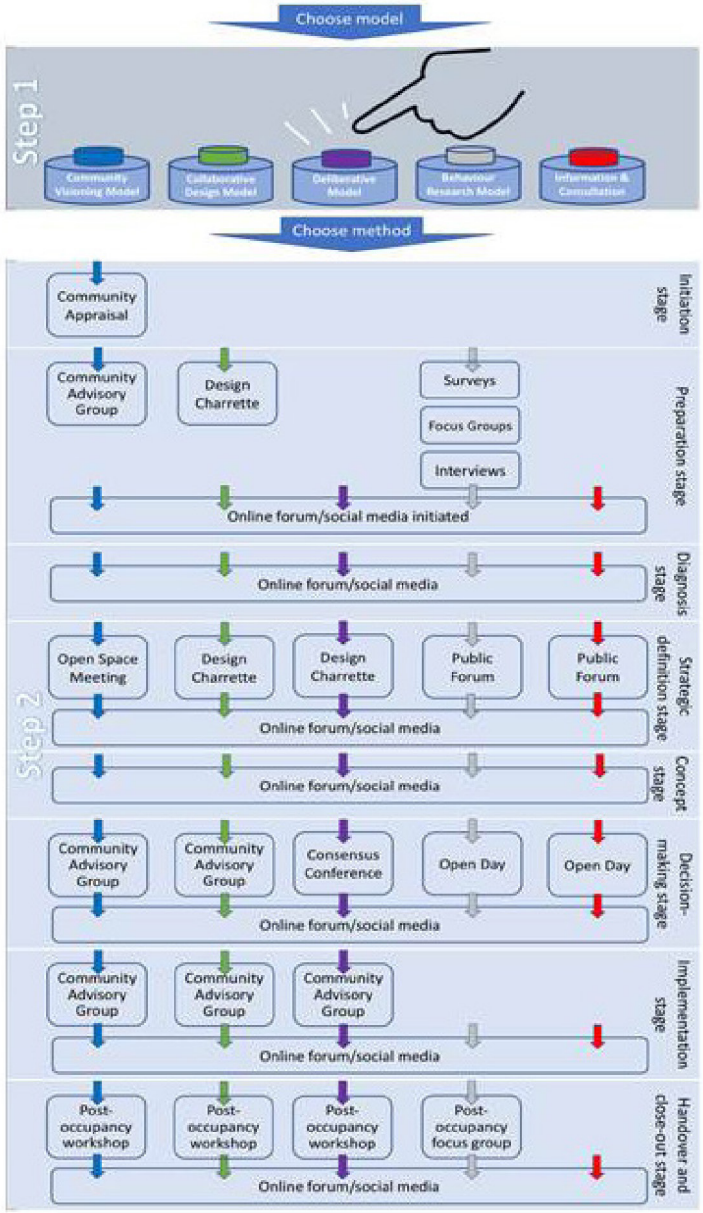


Figure 1: Overview of NewTREND approaches to occupant and user involvement in design

2.1.3 Step Three - Implementing a participatory design process

The final stage is to draw up a detailed plan for occupant and user engagement, outlining when each of the engagement methods is to be carried out, how it is to be implemented, who is responsible for each task, how potential participants will be encouraged to get involved, what resources or supports will be required, and what will happen with the feedback generated. The following steps should be included in this plan:

Achieve a shared understanding of the goals: It is important from the outset to achieve a shared understanding among all participants around the goals of the process and its limits. Ensuring that everyone has a clear idea what to expect will help establish trust between stakeholders and limit the potential for misunderstanding and conflict. Any approach to occupant and user engagement will need to balance the interests of occupants with those of other stakeholders, in particular the client and design team. These in turn need to be willing to cede some influence over the design to occupants for participation to be genuine. This will usually be because they see benefits for themselves and the project in the application of a participatory design methodology.

Set out the timescale for participation: The greater the level of participation desired, the earlier building occupants and users should be included in the design process. For example, at present occupants and users are rarely included in the strategic definition phase of a refurbishment project, or the preparation of a design brief, yet it is at these stages the parameters of the project are laid down.

Maximise participation: Assess what steps can be taken to maximise participation. This may involve everything from simply publicising the process through social media, to dropping leaflets and putting up posters advertising events, to calling door-to-door to building occupants, to hiring a public relations company. It may also be desirable to involve other stakeholders such as neighbours and local businesses, in which case they too will have to be notified of the process and encouraged to take part.

Assess the supports that may be needed: In order to be successful, some methods require more support to be provided to participants than others. Some groups of occupants and users may also require additional supports to fully engage in the design process. These issues should be taken into consideration in deciding which methods to apply. A clear idea of the support needed will be vital to assessing the resources, in both finance and personnel, required to run a successful participatory design process.

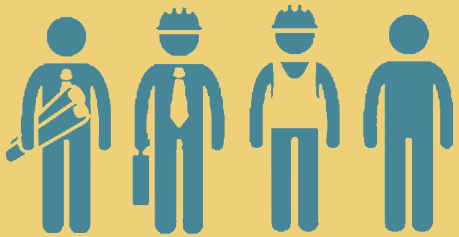
Ensure inclusivity: It is also important to consider the inclusivity of the process, making sure all occupants/users have the opportunity to have their voices heard and that events are not dominated by 'usual suspects' such as established community spokespeople. The following actions can usefully be integrated into any participatory design process to ensure inclusivity:

- Assess the demographics of occupants/users to take account of differentials in power, influence, knowledge, information and access;
- Devise a strategy to address any factors which might prevent some people engaging in the process, for example deficits of education or knowledge;
- Co-produce the agendas of meetings and workshops with occupants/users;
- Make sure the format of events is inclusive. Avoid formal, hierarchical approaches. For example, at meetings place chairs in a circle rather than in rows facing a top table;
- Ensure events have well-trained facilitators who will ensure everyone participates and meetings are not dominated by a few loud voices;
- Take steps to ensure the accessibility of meetings and other events. Events should be advertised widely, held at convenient times and places, and the organisers should provide transport and childcare where necessary;
- Identify community champions early on who can engage wider circles of occupants and users in the process.

Outcome of engagements: There needs to be clarity on the outcome of each engagement and its status, i.e., for engagement with occupants and users a clear statement of its conclusions should be written up and feed back into the design team, and there should be agreement on the status of those conclusions – whether they are consultative, advisory, to be given strong consideration, binding, etc.

Feedback and implementation: After each engagement, it will be necessary for the design team to assess the feedback provided by occupants and users and see how it can be integrated into the design. A specific person needs to be charged with implementation, including practical steps which can be taken to implement occupant and user views and specific timescales in which this is to be carried out. How does this feed into the next stage of occupant and user engagement?

NewTREND PROJECT ROLES in the IDM



3. NewTREND project roles based on stakeholders identification in the IDM

3.1 Introduction to NewTREND project roles approach

In each single retrofitting project the involved stakeholder groups or retrofitting actors are made up of different people having different tasks, functions, and roles in a project. The NewTREND IDM needs to be able to flexibly handle these circumstances and therefore must be applicable for a variety of different kinds of retrofitting projects which may differ among others in considered building type (residential, office, industrial, etc.), size of project (single family house or large apartment block, etc.), or scale of intervention (deep renovation or single measures). Due to these facts, it is impossible to predict and cover all potential interactions between retrofitting actors or resulting stakeholder configurations and their related tasks and functions which may appear in real retrofitting projects. In the retrofitting of a single family house the stakeholder configuration may be very small and may consist only of a few persons involved in the project (e.g. owner, architect, and constructor). On the other hand, the retrofitting of a large office building as part of a large-scale neighbourhood retrofitting project may consist of a very complex and large stakeholder configuration. In such large-scale projects, generally a huge number of people are involved, all having specific tasks and functions in the project which cannot be foreseen beforehand the project starts. Even during the project persons may change or new persons may enter the project stakeholder's configuration according to the specific course of the project. The example shows that both types of projects set completely different requirements to the NewTREND IDM. It even gets more complex if the different tasks which the involved stakeholders may fulfilled in each stage of the project need to be pre-defined and assigned to each stakeholder. The real tasks in a project and when they need to happen never can be described by pre-defined processes in a method as they are unpredictable as well. These examples show that it is not useful to base the structured and flexibly applicable IDM process on rigid procedures which can only be used by few project types having very similar stakeholder configurations or scopes.

To overcome these issues, the IDM takes advantage of the concept of project roles. Hence, in NewTREND all involved stakeholders in a project are assigned to a limited number of project roles. Using this approach, it

is possible to bring the unpredictable number and type of stakeholders and their specific interactions back to a manageable amount of abstract project roles and processes. However, by working with this abstraction in the IDM as well as in the CDP development it is not possible to specify each single process which should be completed by each stakeholder in detail. For example, it makes no sense to specify in the design phase of a project which specific member of the design team is going to create a given variant or to trigger a simulation at which time in the project. Another example is that it makes no sense to define in the Preparation Phase of the IDM which member of the design team will enter the thermal properties of the building in the Data Manager Tool. This level of detail cannot be predicted or defined as the composition of the design team is not steady.

3.2 Definition of NewTREND project roles in the IDM

The aim of the NewTREND project roles is to represent all identified stakeholder groups of energy retrofitting projects in a general way. Therefore, the NewTREND project roles are not representing real persons in projects but aim to model their related interactions, tasks, functions, and expertise in an abstract way. This means that theoretically each person involved in a retrofitting project can be assigned to any NewTREND project role if the person meets the defined needs of the project role.

In NewTREND the following project roles are developed:

- NewTREND Provider
- Manager/Coordinator
- Client/Owner
- Design Team
- End-User
- Constructor
- External Parties

Table 9: Description of project role 1 : NewTREND Provider

Project Role 1: NewTREND Provider	
Description:	The project role "NewTREND Provider" combines all activities which are needed to set up a NewTREND IDM process and the necessary software environment to be used by the other project roles Are not directly involved as stakeholders in a retrofitting project Establish a working technical framework to launch the IDM process Initiate the NewTREND CDP setup in cooperation with the "Manager / Coordinator" and "Client/ Owner" Can offer their service for a fee in the exploitation phase of NewTREND or as free service within the NewTREND case studies as project partners of the consortium
Most common stakeholders:	NewTREND Project Consortium Members with sufficient technical knowledge External service providers
Main tasks within the IDM process	Providing consultancy for the "Manager / Coordinator" and "Client/ Owner" roles in establishing a NewTREND Framework Defining the minimum data requirements for new NewTREND DIM Retrofitting Projects and setting up a NewTREND CDP Platform Managing all DIM relevant database issues Providing technical support to all NewTREND CDP users during the whole IDM process
Connection to the NewTREND CDP access rights:	Hold the developers account for the CDP and lead the initiation phase of the NewTREND IDM Have access to all functionalities of the CDP Platform and can implement changes and operations on the CDP structural and code Create admin user account and assign them to the "Managers / Coordinators" of the project

Table 10: Description of project role 2: Manager / Coordinator

Project Role 2: Manager / Coordinator	
Description:	The project role "Manager / Coordinator" includes the entirety of leadership tasks in a retrofitting project as well as organisational techniques which are necessary for the conduction of retrofitting projects Manages the retrofitting project from an administrative point of view and coordinates all planners in the design team Establishes strong communication with all involved project roles and act as a central hub between them Initiates the NewTREND process in the beginning of each retrofitting project in cooperation with the NewTREND Provider and the client/owner role Identifies in the beginning of a project all involved stakeholders in the retrofitting project and assigns each stakeholder to the correct IDM project roles
Most common stakeholders:	Project Managers Retrofitting Managers Facility Managers Often covered by Architects in small scale projects
Main tasks within the IDM process	Determining and documentation of project goals Establishing clear roles and responsibilities Selection of the project members Determination of communication and decision-structures Definition of time schedules and project milestones Monitoring and controlling the project progress Organisation of the project closure Contract Management Cost control Cost check Reporting
Connection to the NewTREND CDP access rights:	Hold admin rights on the CDP Has access to the central control panel in the internal area of the CDP and to all CDP functionalities inclusive admin functions Coordinates the NewTREND CDP user account management and assigns user access rights to each person in the project for the CDP functionalities Can change geometric information in the DIM or to add further information (e.g. .shp-files, polygons, etc.) to the model

Table 11: Description of project role 3: Client / Owner

Project Role 3: Client / Owner	
Description:	The project role "Client / Owner" represents the person or group of persons which initiates the NewTREND IDM Process by commissioning the "NewTREND Provider" Directly or indirectly owns buildings which are in the scope of the retrofitting project and pays for the cost of the retrofitting project Commissions the "Design Team" and the "Manager / Co-ordinator" Are from a technical and architectural perspective supposed to be lay persons within the NewTREND IDM
Most common stakeholders:	Owners Owner-Occupiers Investors Landlords
Main tasks within the IDM process	Initiate the retrofitting project Sets targets, constraints, and restrictions for the retrofitting design Make the final decisions in the design process
Connection to the NewTREND CDP access rights:	Hold non-expert access rights on the CDP Do not interact with the S&D Hub Use the CDP for informal purposes and for communication

Table 12: Description of project role 4: Design Team

Project Role 4: Design Team	
Description:	The project role "Design Team" is composed of all stakeholders that are directly involved in the design process of the retrofitting project "Design Team" is composed of professionals and experts in the different fields of building and district retrofitting Composition of "Design Team" can vary from project to project depending on scope, scale, and targets of the project Holds strong communication to "Clients/Owners", "Managers/Coordinators" and "End-users" Responsibly for planning the architectural and technical details of the retrofitting design Are supposed to have deep knowledge in the field of building and neighbourhood retrofitting as well as building simulation and BIM Consult the "Client/Owner" in the Decision-Making Process
Most common stakeholders:	Architects Construction Engineers Building Physicists Structural Engineers Energy Efficiency Consultants Sustainability Consultants and Green Raters Facility Managers
Main tasks within the IDM process	Sustainability assessment and energy analysis of the building and neighbourhood Creation of retrofitting concept and planning of design variants based on set targets and considering restrictions and give constraints Reporting to "Client/Owner" and "End-users" about results and outcomes of different phases Conducting deep analysis of building and neighbourhood
Connection to the NewTREND CDP access rights:	Holding expert user access right on the CDP but no admin rights Have access to all CDP functionalities beside admin and developer's functions Using the S&D Hub functionalities (triggering simulations and KPI calculations) Using the analysis function and tool on the CDP Exchange information and results with external functions and tool not included in the CDP via common interfaces Using the Data Manager tool and filling in building and district attributes on the DIM Server Creation of thematic relevant surveys and questionnaires on the CDP

Table 13: Description of project role 5: End-Users

Project Role 5: End-Users	
Description:	The project role "End-users" characterises all stakeholders in a retrofitting project which use and interact with the retrofitted buildings and the neighbourhood Do not own the building but occupy it for different purposes depending on the building function (living, working, sports, education, health care, etc.) Are supposed to be lay persons with little architectural and technical knowledge on building retrofitting
Most common stakeholders:	Occupants
Main tasks within the IDM process	Provide feedback to the "Design Team" at crucial steps in the IDM process Provide data about the building to the "Design Team" Visit physical meetings and workshops for occupant's involvement during the IDM process Communicate with the "Design Team" Express their opinions and preferences on design variants, targets and restrictions for the design process and the decision-making
Connection to the NewTREND CDP access rights:	Hold non-expert user access rights Can use CDP functionalities for providing data, for occupant involvement and communication Have access to the Technology Library

Table 14: Description of project role 6: Constructors

Project Role 6: Constructors	
Description:	The project role "Constructors" is composed of all stake-holders which are directly involved in the construction works in the retrofitting project Fulfil only construction works on the building but no upstream planning or design tasks in the IDM process Are not involved in the planning or design process of the building Communicate with different members of the "Design Team" or among each other's Are directly paid by the "Client/Owner"
Most common stakeholders:	Constructors Companies Construction Workers Sub-Contractors Plumbers Installers
Main tasks within the IDM process	Conduct the whole construction process of the design variant Communicate with the "Design Team" Provide information to the "Design Team" Communicate with "End-users" on construction works
Connection to the NewTREND CDP access rights:	Hold non-expert user access rights Using the Data Manager tool and filling in building and district attributes on the DIM Server Can use the CDP functionalities for communication with other project roles

Table 15 : Description of project role 7: External parties

Project Role 7: External Parties	
Description:	The project role "External Parties" represents all stakeholders in a retrofitting project which are not actively involved in the planning and design process but contribute in various ways to the project on demand Are not directly commissioned or paid by the "Client/Owner" to participate in the retrofitting design Can provide relevant data for the project results Can be professionals and experts as well as lay persons
Most common stakeholders:	Administrative Bodies Building Authorities Municipalities Politicians ESCOs Energy supplying companies Neighbours Land Surveying Office Banks and Financing Bodies
Main tasks within the IDM process	Observe the project from an external point of view and in a passive way Interact on demand with the "Design Team" and "Client / Owners" in important steps of the IDM process Provide third-party data for the "Design Team" Provide consultancy and guidance of the "Design Team" on general aspects for the retrofitting project Can provide restrictions and constraints for the retrofitting project
Connection to the NewTREND CDP access rights:	Hold Guest rights in the user account of the CDP Are only able to use basic functionalities of the CDP for communication and to provide data

The IDM through the NewTREND approach

4. The Integrated Retrofit Design Methodology throughout Project Life Cycle

4.1 General scope of the IDM and connection to the NewTREND platform

To clarify the final general scope of the NewTREND IDM and NewTREND Platform the following chapter has been created. Thus, the main objectives of the NewTREND IDM are as stated in the Description of Work (Page 15):

"[…] finding the most effective energy retrofitting solutions in neighbourhood retrofitting projects with regard to energy and cost efficiency and their overall sustainability performance. […] support the stakeholders not only in the conceptual planning stage but also in the practical realization of the optimized concept."

As stated above, the scope of NewTREND IDM is limited to energy retrofitting solutions also considering the impacts caused by energy interventions on the cost efficiency and overall sustainability performance of the single buildings and the neighbourhood as whole. Due this fact the NewTREND IDM will mainly be focused on all processes which are directly related to energy efficiency. In practice building and neighbourhood retrofitting projects cover several further aspects beside energy efficiency which the "Design Team" should consider. The main aspects among others for instance are climate protection, architecture and design, infrastructure and mobility, socio-cultural condition, and spatial development. Especially on building level retrofitting also aspects like the level of deterioration and the condition of existing building components affects the retrofitting design. Moreover, in all retrofitting projects several non-energy related measures are also part of the retrofitting design. For example, the renovation of a bath room or laying new floor coverings or the renewal of internal coating. However, the NewTREND IDM will in the design process and variant creation not include any non-energy related interventions as those are out of the scope of the NewTREND project. Nevertheless, the NewTREND IDM and tools will enable to utilize the information from NewTREND via common interfaced as input for planning of the non-energy related measures.

Moreover, it is important to clarify the scope of the NewTREND IDM and tools in terms of accuracy and level of detail for the retrofitting process. The focus of the NewTREND IDM lies on the building and neighbourhood energy retrofitting design. However, it is not possible to cover the detailed design of each of the planned measures. For instance, if one of the results

of the NewTREND IDM design phase shows that the implementation of a new ventilation system in the building would be the most energy effective retrofitting scenario the NewTREND tools will not be used to create a detailed design of each diameter, length, and position of the ventilation ducts. Hence, NewTREND cannot include direct functionalities on the CDP for all potential detailed design purposes on all building components or systems. For these purposes, specialized desktop tools which cover all needs of planners are already available on the market and should be used instead. However, NewTREND supports and facilitates the use of external tools for detailed design through providing the necessary base information like a geometric model, a central DIM Server to store information and a communication platform for all stakeholders. This improves the traditional design approach as all the created information will be available in a central place and can be accessed by all members of the "Design Team" instead of being scattered between different stakeholders.

4.2 The NewTREND three modes approach

The availability and accuracy of the data is required in order to have a realistic estimation for the behavior of the retrofitting project in hand as well as it is interaction with its surrounding. In contrast to planning new building projects, retrofitting existing buildings and neighbourhoods pose a far greater challenge in terms of data acquisition, the extensivity of the acquired data and its accuracy, thus its reliability. As it is often the case that most of the required data are confined within the built structure or that available records do not accurately reflect the up to date state of the building due to the numerous changes that occurs along the buildings years of operation. To overcome this challenge, NewTREND offers its users the possibility to operate in three different modes of operation namely; Basic, Advanced and Premium. The main difference between the three modes lies in the nature of the data and on the level at which the data is collected. Which in turn have a direct impact on the required effort to collect the data and on the outputs NewTREND will be able to offer to its users in each mode.

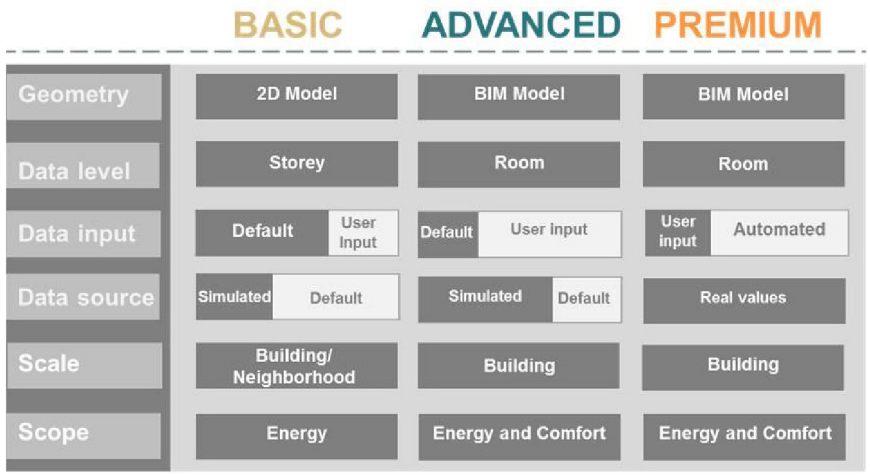


Figure 2: NewTREND modes

In Basic mode, the geometrical model can be a simple 2D model that would later be populated with data collected at building storey level. Where, in advanced and Premium mode the geometrical model shall have rooms geometry included and the BIM/DIM model would be populated with data collected at building room level.

As for the nature of the inputted data, both basic and advanced modes require that some of data is collected from the site and inputted manually in the platform. In case some of the data is missing, default values will be used to fill in the data gaps. Premium mode on the contrary requires real values originating from monitored data for its function.

Thus, it can be said, that basic mode is best suited when for the project team only little to no information about the building exists and the project team is interested primarily in assessing the energetic performance of the building in relatively short time.

The advanced mode can be used when the project team have detailed information about the building up to room level and is interested in assessing the energetic and comfort conditions of the building.

Premium mode can be of help to the project team, when the energetic and / or comfort conditions of the building is known and they are interested finding out how the building is preforming in comparison to other buildings or in finding the reasons behind the building underperformance.

Choosing the mode of NewTREND the best suite the objectives of the project at this early stage would help guide the project team into collecting only the required information in the selected mode. Thus, reducing the redundancy of the information, as well as the time and effort required in collecting the data in the preparation phase.

4.3 Overview on the IDM Processes and the IDM Process Map

The integrated design methodology divides the retrofitting project into 10 phases, in which certain process and objectives are to be fulfilled for the project team to be able to design and realize the retrofitting project in the most cost effective and energy efficient manner, which is the goal of the NewTREND. As the complexity, challenges and the dynamics of a multi scale (Single building, number of buildings, neighbourhood) retrofitting project with high level of end user participation that NewTREND address, differs greatly from the ones a traditional newly built project faces. Thus, it became apparent that the current design processes are not suitable for NewTREND goals and objectives, therefore, new process and phases where needed to be developed, to support the use of the integrated design methodology (IDM) in retrofitting projects. Within the NewTREND, the project process is stretched along 10 different phase namely, the initiation phase, the preparation phase, the diagnoses phase, the strategic definition phase, the concept phase, the decision-making phase, the design development and tendering phase, the construction phase followed by the handover and close out phase and finally the in-use phase. Each of these phases sets a number of objectives, which the project team need to fulfil to further proceed to the following phase. However, as described before, the focus of NewTREND is on the process that are related to energy aspects of the retrofitting projects, therefore, in the description of the process at each phase, the focus is giving to the energy and sustainability related aspects of the project.

To allow the user to better navigate through the different phases of the project the IDM overview map is created. for better usability of the overview map, the map is divided into three main sections namely: the project phase, the main IDM process in the phase and the main responsible project role / roles for each main process in each phase as described in figure 3.

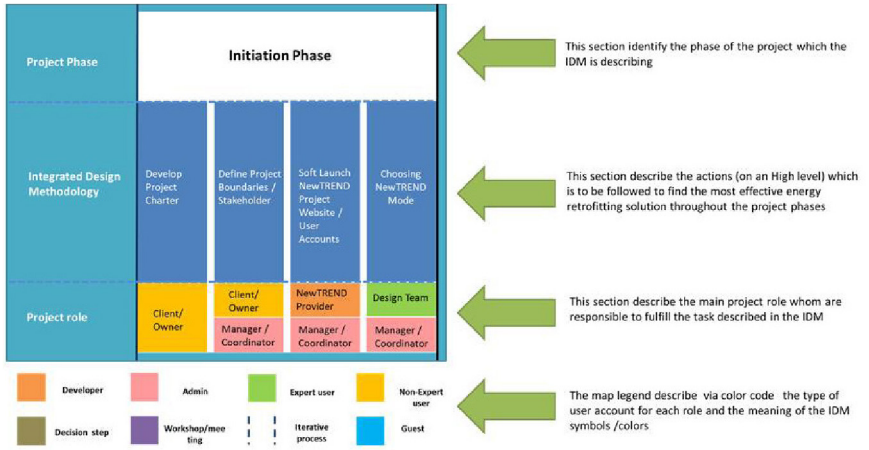
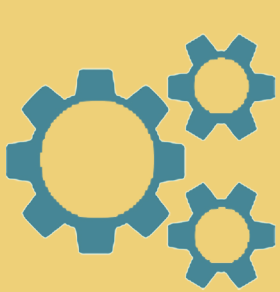


Figure 3: Description of the IDM overview map



The IDM PROCESSES PHASES

5. The IDM Processes in the initiation phase

The project initiation phase is the first phase in the project in which the project goals and scope are being defined. In other words, in this phase the project initiator "Client/ Owner" need to define the expected outcome of the project and what is to be accomplished by this project. Furthermore, the "Project Coordinator" and "Owner" would need to define the project boundaries, team, and other possible stakeholders. Based upon the project scope and the stakeholder analysis the "Project Coordinator" and "NewTREND Provider" would initiate a soft launch of the project's website, in which first configuration of the project website is done and the different stakeholders are assigned to their role and the desired NewTREND project mode is being selected.

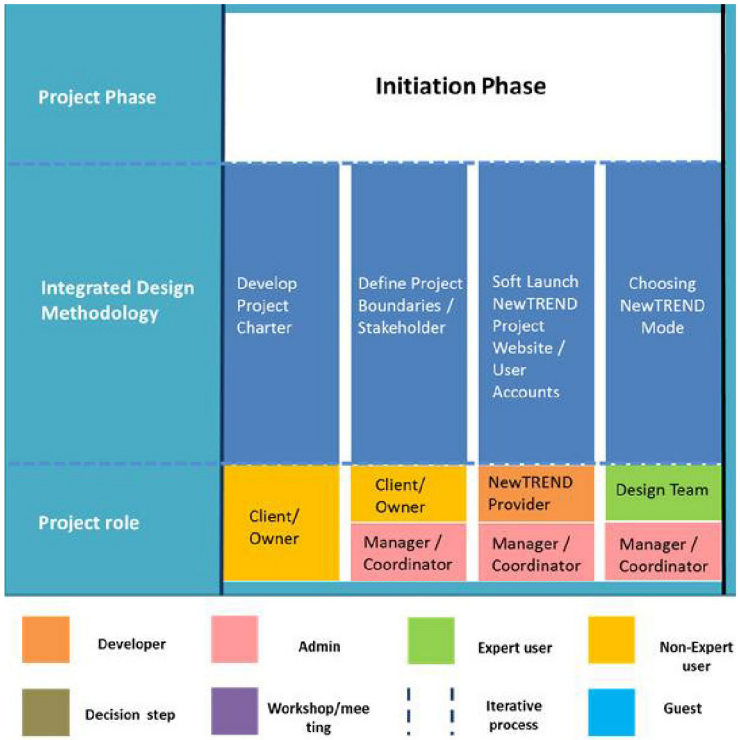


Figure 4: Overview of the IDM process in the initiation phase

By the end of the initiation phase the project team is expected to achieve four main objectives:

- Define the project scope, objectives and expected outcomes
- Define the project physical boundaries and stakeholders
- To soft launch the NewTREND web platform and to assign relevant stakeholders to their project roles
- Define the NewTREND mode

5.1 Innovative participatory methods in the initiation phase

The initiation phase is where the project stakeholders decide on what level of occupant and user participation to include in the project and prepare a detailed implementation plan for this. During the initiation phase, project stakeholders (primarily the design team in conjunction with the client) need to carry out the three steps laid out in Section 2.2, namely:

- Deciding on the level, breadth and inclusivity of occupant and user participation
- Selecting a model of occupant and user participation
- Preparing a detailed implementation plan

A specific member of the "Manager/ Coordinator" team should be tasked to carry out this work.

Under most of the models, direct engagement with occupants and users will not take place at this stage, which is concerned with defining the scope, objectives and expected outcomes of the project.

However, in the case of the Community Design Model, a community appraisal will be instigated at this phase of the project. This will assess the challenges and development potential of a particular community or building, assess how specific problems can be overcome, and thereby play a large role in shaping the scope and objectives of a project. Community appraisal will be used either where a group of building occupants or users are themselves the initiators of a project, or where occupants and users are strongly organised and in a position to have their voice heard right at the initiation of a project.

6. The IDM process in the preparation phase

The preparation phase is the phase in which a fully functioning NewTREND platform is launched, the project stakeholders have been assigned to their project role and provided with the correct access rights to the project platform and the information about the building and its surrounding is being gathered to serve as input for the diagnoses phase.

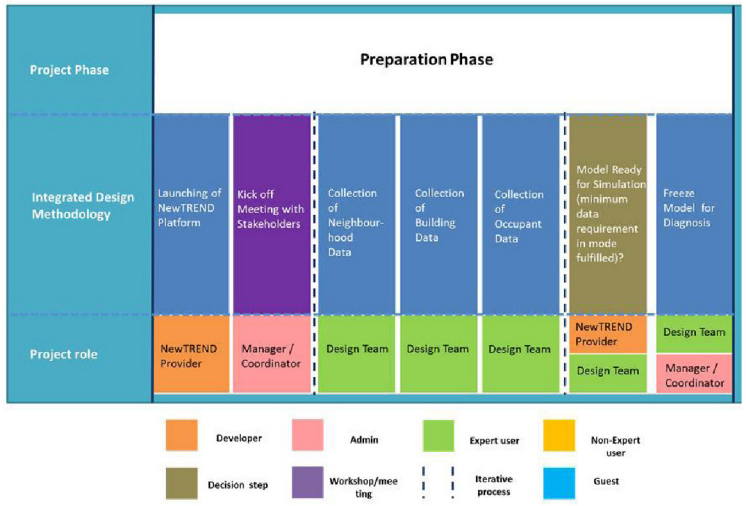


Figure 5: Overview of the IDM process in the preparation phase

By the end of the preparation phase the project team is expected to achieve three main objectives:

1. To collect sufficient building and district related information to start the required simulations in diagnoses phase in the desired NewTREND mode.

2. To launch the NewTREND web platform and to provide all stakeholders with user accounts with the appropriate access rights

3. To conduct the first project kick-off meeting with all relevant stakeholders

When the project management team is satisfied with the fulfilment of the above-mentioned objectives, the project management is to freeze the BIM/DIM model to allow the start of the diagnoses phase.

6.1 Innovative participatory methods in the preparation phase

The preparation phase is one of the most important from the perspective of occupant and user participation, because it is here that most of the information is gathered which will feed into the design and enable the simulation to take place. In addition to technical data about the building and neighbourhood, this includes information about occupant and users' needs, desires, energy practices, attitudes and proposed solutions.

A substantial level of direct engagement with occupants and users will therefore take place at this phase. However, the format will vary depending on the objectives and characteristics of the project and the level occupant and user participation which is desired.

Community Design Model

At this stage, a Community Advisory Group should be established to inform the design process and provide feedback on occupant and user perceptions of the building(s) and neighbourhood level strengths and weaknesses, problems and potential solutions, as well as occupants and users' needs and expectations from the renovations. A Community Advisory Group typically involves between ten and thirty occupants and users sitting as a committee to inform and advise decision-making, with a series of meetings taking place over an extended period of time. The group will deliberate among themselves and engage in dialogue with the design team and project management about potential solution and overall targets for the project.

Collaborative Design Model

During the preparation phase a design charrette should be carried out. This will provide occupants and user with an opportunity to express what they see as the problems in the existing building(s), suggest potential solutions, and identify other potential improvements or developments which could be made to the building(s) in the course of the retrofit. The charrette should aim to aggregate these suggestions into a series of clear design guidelines on which consensus can be achieved between the main stakeholders.

During the preparation phase, extensive occupant and user engagement is undertaken, using methods such as surveys, focus groups and interviews. These methods, in particular surveys, can be used to gather quantitative information on issues such as energy usage and comfort levels. However, they can also gather a wide range of information on matters such as occupant and user preferences for the building renovation, perceived problems, attitudes to different energy technologies, patterns of energy use and willingness to modify behaviour. This can inform the design team in both their overall building design and in their choice of technical solutions for energy efficiency. In contract to the previous models, in the research model this process is very much driven by the design team and project management, with occupants and users acting primarily as sources of information.

All Models

Irrespective of the model of occupant and user engagement which is being followed, during the preparation phase the design team or project management should establish online methods of communication with occupants and users which will be maintained through to the end of the project and beyond. This should include a secure online forum to which occupants and users have access as part of the NewTREND platform, as well as more informal communication through social media sites such as Facebook and Twitter, where the project should establish a dedicated account. These forums can be used to provide occupants and users with regular updates on progress, circulate any information, receive their feedback and responses, and allow them air any concerns or grievances as they arise.

7. The IDM process in the diagnosis phase

After the data entry process during the preparation phase has been finished all necessary data to run a first simulation for assessing the current state of the whole neighbourhood and all buildings in the neighbourhood is available. The diagnosis phase would start. The aim of the diagnosis phase is to analyze the current state of the building and the neighbourhood. The first step in the process is conduct a quick run of the simulation to assure that the simulation results seem plausible and can be further used in further steps of the diagnoses. Afterwards, the current state is to be analyzed according to its global sustainability by the use of the NewTREND KPIs on building and neighbourhood level. Thus, all KPIs will be calculated by the Simulation & Design Hub based on the simulation results. Additionally, each KPI will be calculated against a benchmark which allows evaluating the KPI result compared to average value for the building type and climate zone. This allows the user of the Simulation & Design Hub to identify the strengths and weaknesses of the district in terms of energy efficiency, cost efficiency and overall sustainability. A low KPI value in this case means that the results which the KPI addresses must be improved.

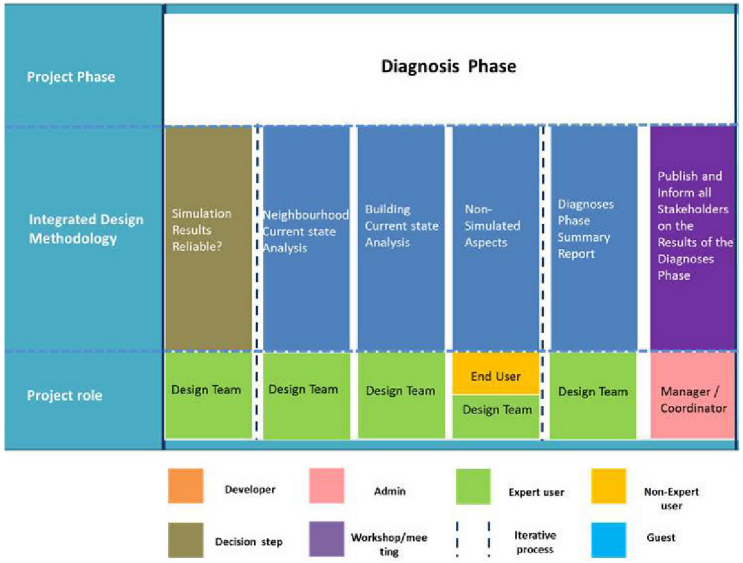


Figure 6: Overview of the IDM process in the diagnosis phase

By the end of the diagnoses phase the project team is expected to achieve three main objectives:

1. To analyse the current state of the Neighbourhood
2. To analyse the current state of the Building
3. To inform all relevant stakeholders about the results of the diagnoses phase

7.1 Innovative participatory methods in the diagnosis phase

From the perspective of occupant and user participation, the diagnosis phase involves little additional engagement. The design team will analyse the current state of the building and neighbourhood against the benchmarks set during the preparation phase, taking account of information previously gathered from occupants and users. The result is a summary of the weaknesses identified at building and neighbourhood level, from both a technical and quality of life perspective. The most important interaction with occupants and users in this phase will therefore involve communicating to them the results of the diagnosis.

All Models: Irrespective of the model of occupant and user engagement which is being followed, at the end of the diagnosis phase the design team should communicate a summary of the weaknesses which have been identified. This might usefully be done by electronic means, with the online forum or social media providing an opportunity for people to respond with comments, questions, criticisms or corrections. This is particularly important for ensuring the diagnosis matches the benchmarks for the project established in collaboration with occupants and users during the initiation and preparation phases.

8. The IDM process in the Strategic definition phase

The Strategic Definition Phase follows straight after the Diagnosis Phase in the NewTREND IDM process. The main goal of the Strategic Definition Phase is the definition of the main framework conditions for the later retrofitting design based on the results of the diagnosis phase. The Strategic Definition therefore serves as pointer for the later design phases by setting meaningful targets for the retrofitting project and by identifying the main constraints and restrictions which may limit the retrofitting design.

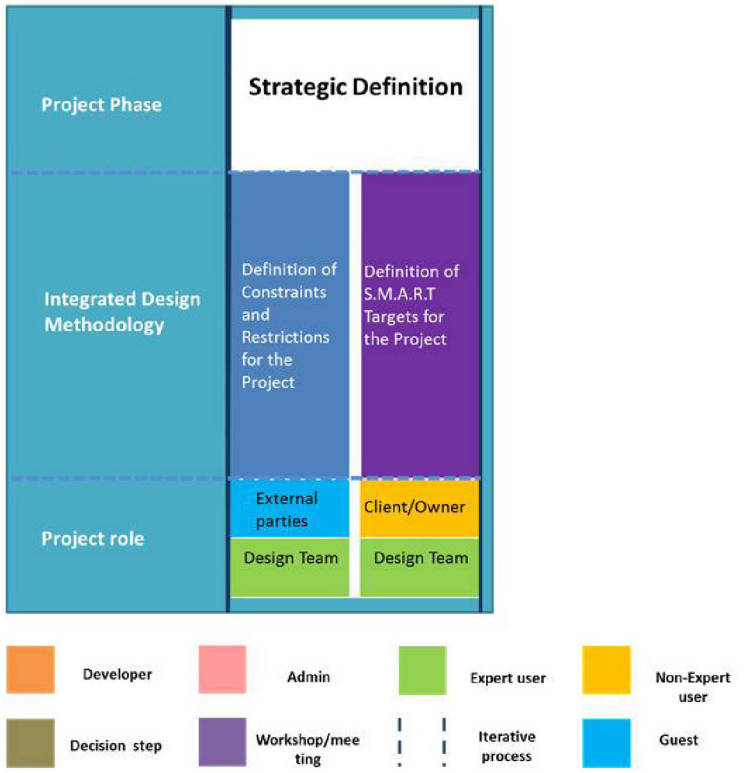


Figure 7: Overview of the IDM process in the strategic definition phase

By the end of the strategic definition phase the project team is expected to achieve two main objectives:

1. To define the projects constringes and restriction
2. To define S.M.A.R.T targets for the project

8.1 Innovative participatory methods in the strategic definition phase

At the strategic definition stage occupant and user participation again take centre-stage, since it is here that the framework conditions for the retrofit design are defined based on the results of the diagnosis phase. A series of S.M.A.R.T. targets are set, and constraints and restrictions on the project identified. This needs to be done in conjunction with building occupants and users.

Community Design Model

During the initiation phase a Community Appraisal involved occupants and users in assessing the strengths and weaknesses of their building, identifying problems and also areas for development or improvement. In the strategic definition stage, an Open Space Meeting is used to enable them to translate this into a clear vision and specific targets which can guide the design process. In an Open Space Meeting, participants create and manage their own agenda of parallel working sessions, so it is a strongly inclusive format enabling a high degree of participation. While the Community Appraisal can help set overall objectives for the project, the Open Space meeting should decide how to achieve these and result in a clear set of design guidelines. The meeting may also hear presentations from the design team on various technical options for the renovation and express a preference for one over the others.

Collaborative Design Model

During the strategic definition phase a design charrette should be carried out. This will provide occupants and users with an opportunity to engage directly with the weaknesses identified in the building(s), suggest potential solutions, and contribute to setting targets for the retrofit. The charrette should aggregate individual feedback into a series of clear design guidelines on which consensus can be achieved between the main stakeholders.

Deliberative Model

During the strategic definition phase, a Community Advisory Group should be established to deliberate on the weaknesses identified during diagnosis, the targets for the development, and the constraints and restrictions on the project. A Community Advisory Group typically involves between ten and thirty occupants and users sitting as a committee to inform and advise decision-making, with a series of meetings taking place over an extended period of time. The group will receive ongoing information from the design team and project management, for example the summary report of weaknesses identified in the diagnosis stage, as well as presentations by members of the design team on these and possible options for remedying them. They will deliberate among themselves and engage in dialogue with the design team and project management about potential solutions and overall targets for the project.

Research Model

A public forum might be held late in the strategic definition stage, at which the occupants and users are presented with a report on the weaknesses at building and neighbourhood level which have been identified, the overarching targets for the project which are under discussion, as well as constraints and restrictions which have been identified. They will then be able to put any questions they may have to members of the design team, as well as giving feedback and observations which may inform the final set of S.M.A.R.T. targets.

Information and Consultation Model

A public forum should be held late in the strategic definition stage, at which the occupants and users are presented with a report on the weaknesses at building and neighbourhood level which have been identified, the overarching targets for the project which are under discussion, as well as constraints and restrictions that have been identified. They will then be able to put any questions they may have to members of the design team, as well as giving feedback and observations which may inform the final set of S.M.A.R.T. targets.

All Models

Irrespective of the model of occupant and user engagement which is being followed, the design team or project management should maintain online methods of communication with occupants and users, using them to circulate information and receive feedback.

9. The IDM process in the Concept phase

In the concept phase, the “Design team” is requested to develop design concept that fulfil the defined S.M.A.R.T targets in the strategic definition phase. As it’s often the case, the design team might come up with number of different concept variants, all of which fulfil the S.M.A.R.T targets. Therefore, all valid variants would then be later assessed in the decision-making phase to choose the concept to be developed.

Figure 8 Overview of the IDM process in the concept phase

By the end of the strategic definition phase the project team is expected to achieve the following objective:

1. To develop a number of design variants that fulfil the S.M.A.R.T targets as defined in strategic definition phase.

9.1 Innovative participatory methods in the concept phase

As in the diagnosis stage, there is little opportunity for fresh occupant and user input in the concept stage. Instead, the members of the design team should use the occupant and user feedback gathered earlier to inform their development of variant design concepts that fulfil the targets of the project. The main interaction with occupants and users will come at the very end of the stage. Here, in the case of the Community Visioning, Collaborative Design, and Deliberative Models, the design variants should be communicated to occupants and users in order to inform their participation in the next stage. This can be done by giving them access to the appropriate areas of the NewTREND online platform.

All Models

Irrespective of the model of occupant and user engagement which is being followed, the design team or project management should maintain online methods of communication with occupants and users, using them to circulate information and receive feedback.

10. The IDM Process in the Decision-Making Phase

After the “Design Team” has created a sensible set of optimum retrofitting variants the project roles which oversee the decision-making must select the most effective variant for the practical implementation. Therefore, the IDM proposes in the decision-making phase a detailed selection process which is based on new developed selection method. The project roles which oversee the decision-making are in the most projects the “Clients/Owners”. However, as the IDM also facilitates a most intensive involvement of the “End-Users” and other project roles in the design and decision-making process, also these project roles must be strongly involved through the IDM process. Hence, the decision-making process considers the preferences of all involved stakeholders through an involvement of different relevant project roles. Thus, the decision-making process in the IDM is based on a Multi-Criteria-Decision-Analysis (MCDA) approach which allows to flexibly considering the preferences of different stakeholders. Through the MCDA approach the qualitative preferences of all involved stakeholders are translated into a quantitative priority level for each criterion. Based on the different priority levels a quantitative weighting system which specifies a single weight for each criterion can be derived. The criteria for the MCDA approach in the NewTREND IDM are the core key performance indicators (KPIs). The weighting system afterwards is used to conduct a value assessment for all KPIs to achieve an overall result for each assessed design variant. Based on the overall result for each variant, which is depending on the individual priorities of the stakeholders, a ranking of the variants is done. Thus, the “Design Team” has a powerful and logic feature to support the complex decision-making process in energy retrofitting projects for buildings and neighbourhoods.

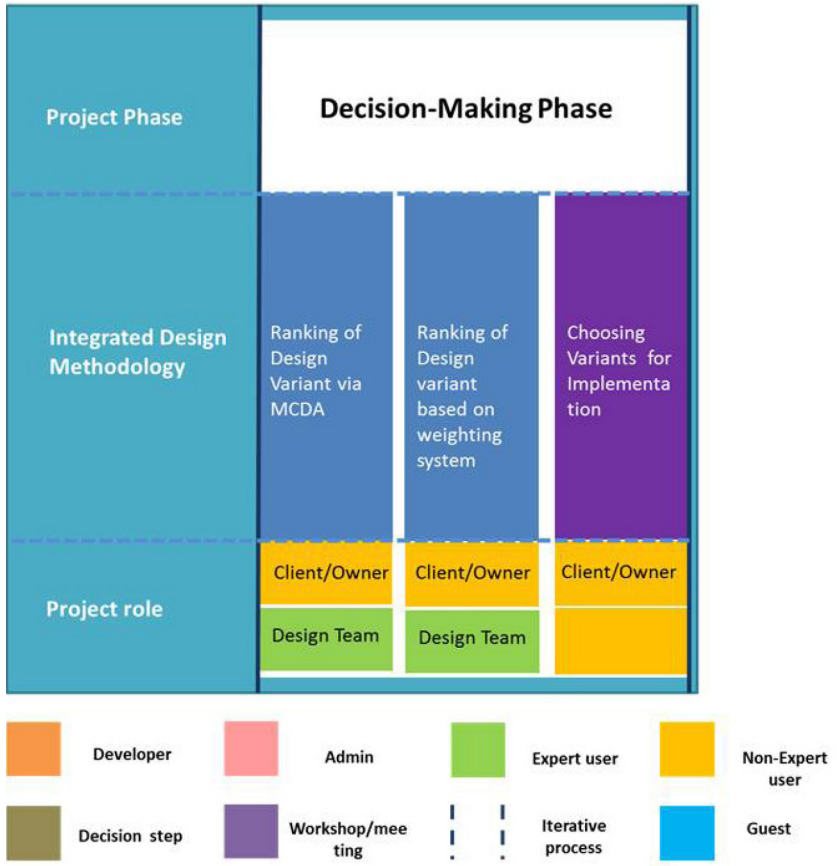


Figure 9: Overview of the IDM process in the decision-making phase

Depending on the type and size of the project the value assessment can be done for the whole neighbourhood using the neighbourhood KPIs or only single buildings using the building KPIs. For small projects including only two or three buildings the value assessment may be done on building level for each building. The “Design Team” needs to decide by an expert judgement what scale of KPIs should be used.

10.1 Innovative participatory methods in the decision-making phase

Occupant and user participation becomes critical once more at the decision-making stage, where a selection is made from among the variant design concepts previously generated. In all cases, feedback from occupants and users should be invited at this point, before a final decision is made on the design for the project. A key question is the level of influence over this decision they are to be afforded vis-à-vis other stakeholders, in particular the client/owner. In some cases, particularly under the community visioning model, the final say over the design may lie with building occupants and users (especially if they are also the owners of the buildings in question). In the collaborative or deliberative models, the views of occupants and users should carry strong weight, but depending on the individual project, the final say may lie with a building owner or municipal authority that are different from the occupants of the building(s). In the case of the behavioural research and information and consultation models, engagement with occupants and users will be consultative only, and it will be up to the design team and the client to decide how much of their feedback should be incorporated in the final design.

Community Design Model

After the design team has ranked the variant design concepts using the MCDA approach, and assessed them for value, the results should be encapsulated in a summary report. This is then presented to a Community Advisory Group which is fully representative of the community, and whose members also have access to the NewTREND platform. These should deliberate on the various options, calling members of the design team or other professionals into their meetings as needed to provide additional information, before reaching a final decision as to their preferred variant. In the event that there is controversy over the solution to be chosen, and the Community Advisory Group fails to reach a consensus, a public forum open to the whole community may be required, where a final decision can be reached by ballot or show of hands.

Collaborative Design Model

After the design team, has ranked the variant design concepts using the MCDA approach, and assessed them for value, the results should be encapsulated in a summary report. This is then presented to a Community Advisory Group which is fully representative of the occupants and users, and whose members also have access to the NewTREND platform. These should deliberate on the various options, calling members of the design team or other professionals into their meetings as needed to provide additional information, before reaching a final decision as to their preferred variant.

Deliberative Model

During the decision-making stage, a consensus conference should be carried out. This consists of a panel of building users who engage with the design team at a public event (i.e. before the wider group of occupants and users) on the different design variants, having been given a detailed information pack beforehand. They will be able to put questions to the design team, raise concerns and offer suggestions. The design team will also be able to give a detailed response. The aim is to achieve a broad degree of consensus between different stakeholders on the variant to be chosen. The results of the consensus conference can then inform the final decision on the design.

Research Model

In this model, the design team and client/owner select their preferred design after the variant design concepts have been ranked using the MCDA approach. An open day is then held to inform occupants and users about the proposed design. This may include plans, maps, models and sections, virtual walkthroughs, and other graphic methods as well as the presence of several members of the design team throughout the day to interact with those attending and answer their questions. Occupants and users in turn will be able to inform themselves in detail about the project, address any questions they may have to members of the design team, and provide them with feedback on issues of concern. This can then be taken account of by the design team, who will have the option of modifying their preferred design before proceeding to the implementation stage.

Information and Consultation Model

In this model, the design team and client/owner select their preferred design after the variant design concepts have been ranked using the MCDA approach. An open day is then held to inform occupants and users about the proposed design. This may include plans, maps, models and sections, virtual walkthroughs, and other graphic methods as well as the presence of several members of the design team throughout the day to interact with those attending and answer their questions. Occupants and users will be able to inform themselves in detail about the project, address any questions they may have to members of the design team, and provide them with feedback on issues of concern. This can then be taken account of by the design team, who will have the option of modifying their preferred design before proceeding to the implementation stage.

All Models

Irrespective of the model of occupant and user engagement which is being followed, the design team or project management should maintain online methods of communication with occupants and users, using them to circulate information and receive feedback.

11. The IDM Process in the design development and tendering phase

The design development phase the “Design team” is required to further crystalize the project concept by developing detailed drawings and specifications to facilitate the implantation of the design concept. The drawings describe the design intent of the architects and engineers, including the quantities of materials and the relative relationship of each item. The specifications describe the quality of the materials and the general standards by which those materials shall be installed

Depending on the complexity of the project, it might necessary to engage more consultants to the “Design team” as is in this phase the exact location and specifications of the fittings and equipment as well as the exact requirement of the induvial rooms are defined and included in the project design. It is most important that the developed design reflects the “End User’s“ requirements defined in concept phase. Moreover, in this phase the “Design Team” in coordination with “Manager / Coordinator” is tasked with implementing the “End user” engagement strategies and methods such as “ quizzes, polls, libraries and virtual retrofitting sightseeing walk” to help the “End user’s“ getting accustom with the planned retrofitting interventions .

Furthermore, in this phase the “Design team” in cooperation with “Manager/ Coordinator” need to develop a detailed breakdown of the project budget that reflects the project cost estimations and to make sure that developed design is within the project performance targets defined in the previous stages.

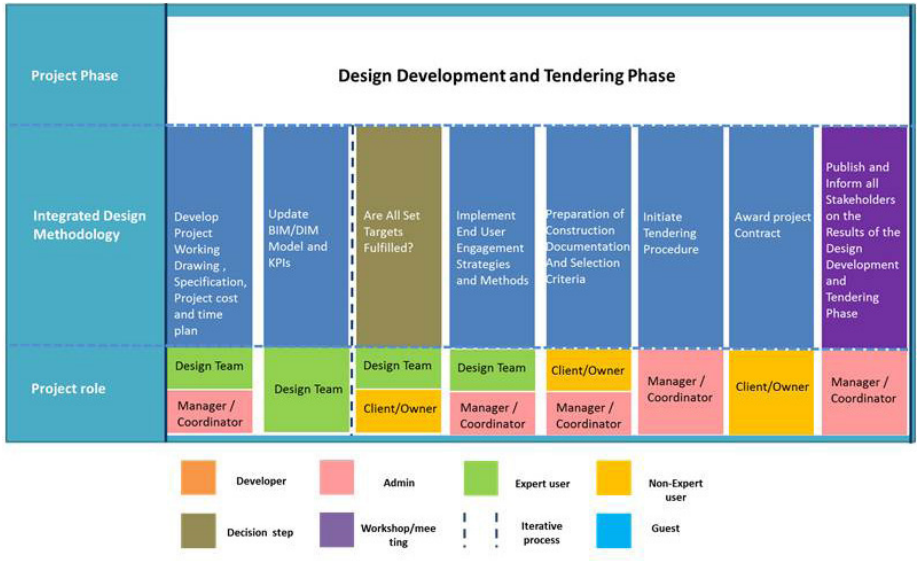


Figure 10: Overview of the IDM process in the design development phase

- The above-mentioned activities require the approval of the "Client/ Owner" taking into account the "End User" preferences before moving to the Tendering phase. Therefore, holding regular meeting with the "Client/ Owner" and "End User" and maintaining clear communication channels between all involved stakeholders is very important to ensure a smooth development of the project. The CDP functions like Time line, Notification, forum and Messenger can be of help to facilitate the communication between the stakeholders. By the end of this phase the "Design team" is expected to achieve the following objectives:
- To develop working drawings and specification documents that describe in detail the project architectural, mechanical, electrical, and structural systems and allow for the project realization
- To ensure that the developed design reflect the end user requirements and is in line with the project performance targets set in the previous phases

- To develop and implement end user engagement strategies and methods
- To develop a project budget breakdown
- To obtain the "Client/Owner" approval on all planned interventions
- To Publish and communicate the results

11.1 Innovative participatory methods in the design development and tendering phase

Since the activities in the design development, Tendering and construction are overlapping and very close to each other in nature, as at this point the main aspects of the project and the design have been already established with a fair level of detail and consensus. At these three phases the focus moves from receiving ideas and suggestions to ensuring the final design is consonant with the agreed-on priorities and targets. Therefore, the description of the participatory methods of these three phases has been merged with each other under the brooder term "implementation phase". The full description of the participatory methods is to be taken from the construction phase chapter

Construction Phase

12. The IDM process in construction phase

After all offers, have been evaluated, any negotiations required have been concluded and successful bidder is selected. The construction phase begins with awarding the chosen bidder with the contractual document. The project team have the following objectives to achieve during the construction phase:

- Hold a kick-off meeting of with all involved project parties
- Develop and implement a construction phase plan
- Develop and Implement a complaint management procedure
- Update and maintain the BIM/Dim model to refract the as built situation
- Update the project time line and budget
- Develop the hand over and in-use strategies
- Hold regular meetings with the buildings end user
- Publish information about the progress of the construction work
- Complete the construction work

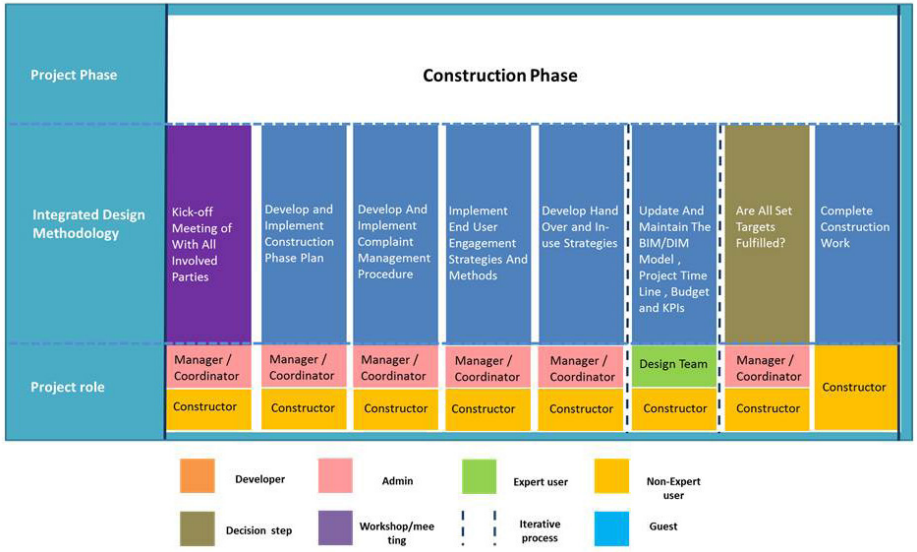


Figure 11: Overview of the IDM process in the construction phase

Also, it is important to decide at this stage if the NewTREND mode Premium is to be used in the In-use phase, thus to allow for planning the building monitoring systems that are to be used after the completion of the construction works.

12.1 Innovative participatory methods in implementation phase

The implementation phase comprises a series of different sub-stages, namely the development of the design into detailed drawings and specifications; preparation of construction documentation; tendering; and construction activity. Different levels of occupant and user participation may be appropriate for these different sub-stages. However, there is a level of commonality across them all. By this point, the parameters of both the project itself and the design should have been established with a fair level of detail and consensus. If there has been substantial occupant and user engagement to date, the focus will now move from receiving ideas and suggestions to ensuring the final design is consonant with the priorities and principles already agreed on, and that implementation and construction proceed with the minimum of disruption and inconvenience. As a result, periodic but in-depth engagements will be replaced with ongoing, but less detailed, consultation, feedback, and dispute resolution mechanisms.

Community Design Model/ Collaborative Design Model/ Deliberative Model

Ongoing communication with occupants and users through the Community Advisory Group should be maintained throughout the implementation phase, especially at key points such as the completion of the final plans. A dedicated online forum and social media can provide a space for two-way communication, especially during construction activity, where feedback can be provided to a broad group of occupants and users and where individual problems can be flagged and dealt with as they arise.

Behavioural Research Model/Information and Consultation Model

In these models the main purpose of engagement with occupants and users during the implementation phase is to ensure the project goes smoothly and resolve any problems or issues as they arise. A dedicated online forum and social media can provide a space for two-way communication, especially during construction activity, where feedback can be provided to a broad group of occupants and users and where individual problems can be flagged and dealt with as they arise.

Hand over and Close out Phase

13. The IDM process in hand over and close out phase

Near the end of the completion of the construction works, the hand over and close out phase would start. The handover of a project to the "Owner" at the end of construction is a very important stage of the project procurement process and facility operation success. A well organised, efficient and effective transfer of information from project works to "End user" Owner" is essential. The transfer of the project from contractor to client can have an effect on health and safety, reliability, standards of operation, maintenance and operational cost efficiencies of the project. The handover and close out period can be a very stressful time for contractors' staff, and building owners and occupants alike as spaces become occupied and operation of the facility starts. The commissioning and fine tuning operations during handover can impact heavily on occupants if not managed in a structured manner.

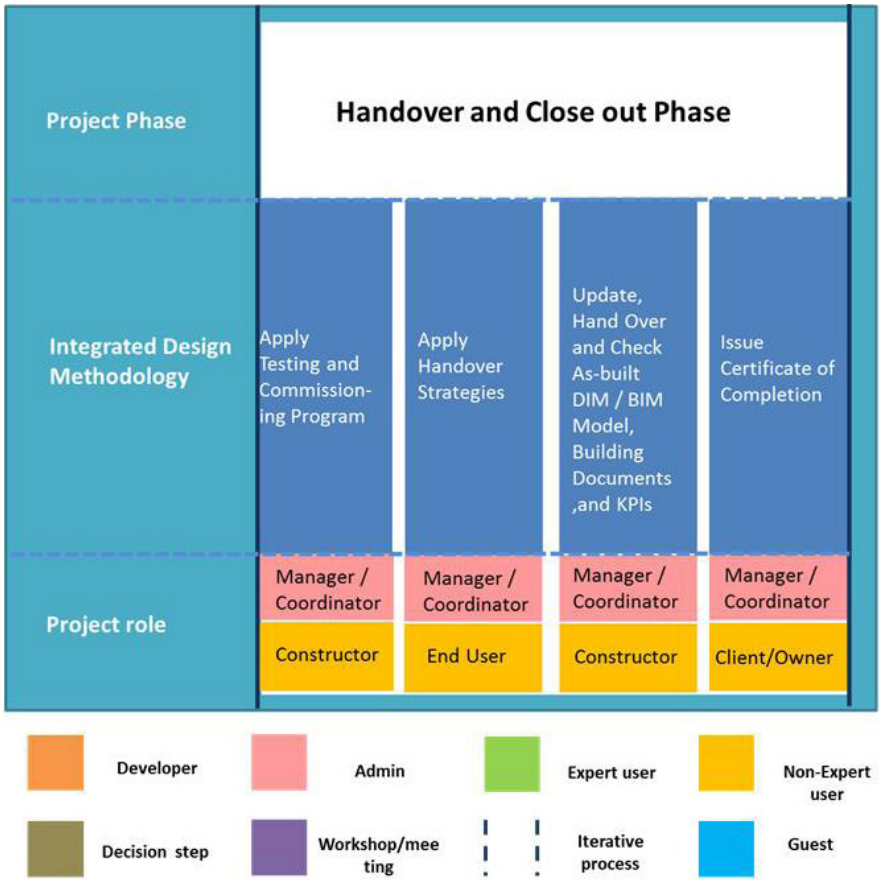


Figure 12: Overview of the IDM process in the handover and closeout phase

The Project team in the Handover and close out phase has to achieve the following objectives:

- Kick-off meeting of the handover phase
- Update, hand over and check the as-built DIM / BIM model and building documents
- Update, hand over and check the final project costs to reflect the actual vs the forecasted budget
- Apply the testing a commissioning program
- Implement hand over strategies
- Issuing a certificate of completion

13.1 Innovative participatory methods in the hand over and close out phase

The activities in the handover and close out phase share a lot of similarities with the activities that occur in the in-use phase. Therefore, and to avoid repetition, the description of the participatory methods of these two phases has been merged with each other and are to be found in the “In-use phase” chapter.

14. The IDM process in the in-use phase

A careful planning of the in-use phase is significantly important, as without appropriate planning and strategy for post-occupancy management in place, the newly installed systems and retrofit measures can be misused preventing the achievement of the initially set energy saving targets. A major cause of this can be the users and occupants continuing to use the building the same way as before the retrofit project and having no awareness of their individual impact on overall building performance. Additionally, the newly installed technologies and measures can result in a complex new system, which requires its users to be educated on its usage to achieve optimum operation. Hence, continuous monitoring and feedback are very important subjects in the In-use phase. This can be achieved one the one hand, by operating the NewTREND in Premium mode, where all simulated parameters would be replaced by actual one. Thus, enabling the "project manager" to monitor the project performance and identify weakness early on. On the other hand, the buildings "Project Manager" needs to apply measure of ccontinuous post occupancy investigation to avoid sub-optimal use and to ensure that correct use of the building and its systems.

Furthermore, thanks to the use of DIM/BIM model of the building, any changes that happen to the building during its life can be reflected into the building's DIM/BIM model. Therefore, it is important at this stage that the "Owner" Of the project or the facility manger, whom will take the role of the "Project management" at this stage, is to keep the building documentation and model updated.

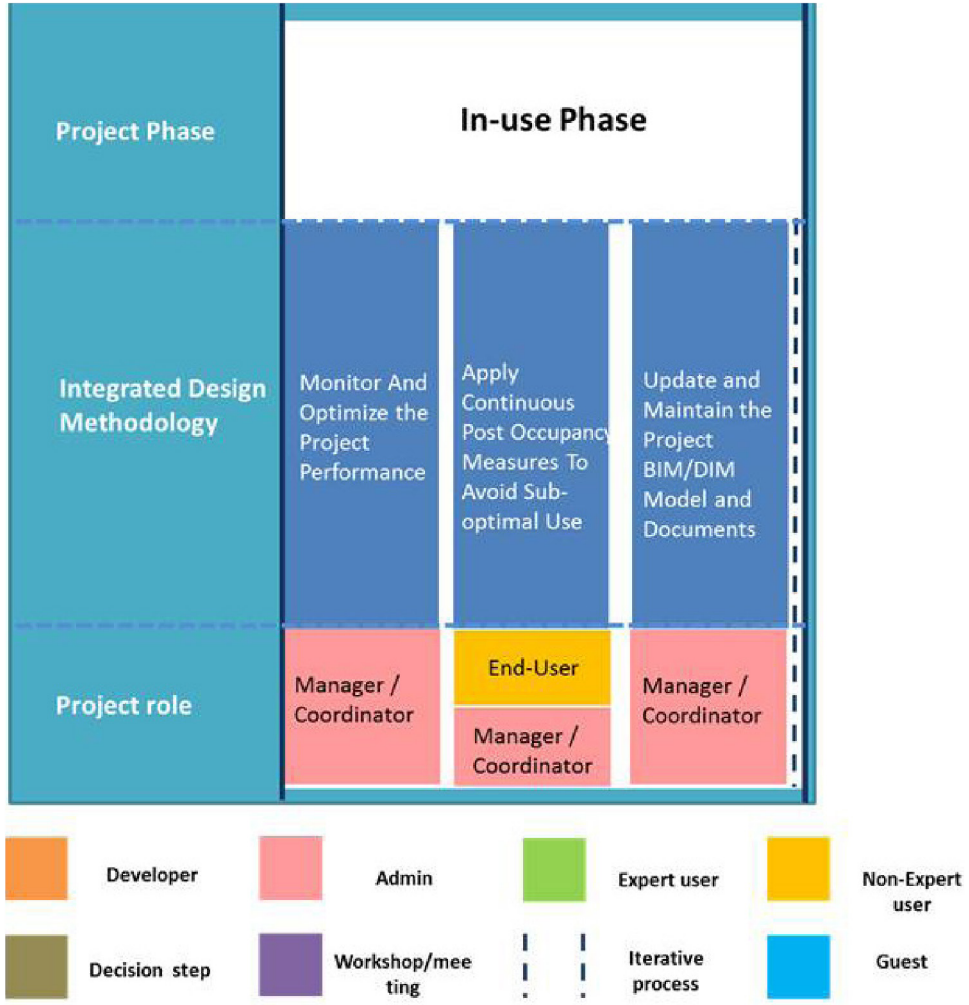


Figure 13: Overview of the IDM process in the In-use phase

As the outcome of activities carried out in the in-use phase, the Project Team is expected to achieve the following objectives:

1. Monitor and optimize the project performance to achieve and maintain the designed performance targets
2. To apply continuous post occupancy investigation measures to avoid sub-optimal use
3. To update the project BIM/DIM model and project documentation.

14.1 Innovative participatory methods in the in-use phase

The purpose and degree of occupant and user participation during the in-use stage can vary widely. Where occupants and users have been central to the design process, it will be important at this point to offer them the opportunity to assess the results of the project in-use, the degree to which it fulfils their desires and expectations, and the success of the new energy-saving measures. Where detailed measurements and studies of occupant and user behaviour have played a role in the design of the retrofit, it will be important to test the effectiveness of energy-saving measures applied. In other instances, occupant and user engagement will be limited to dealing with any problems as they arise.

Community Design Model/Collaborative Design Model/ Deliberative Model

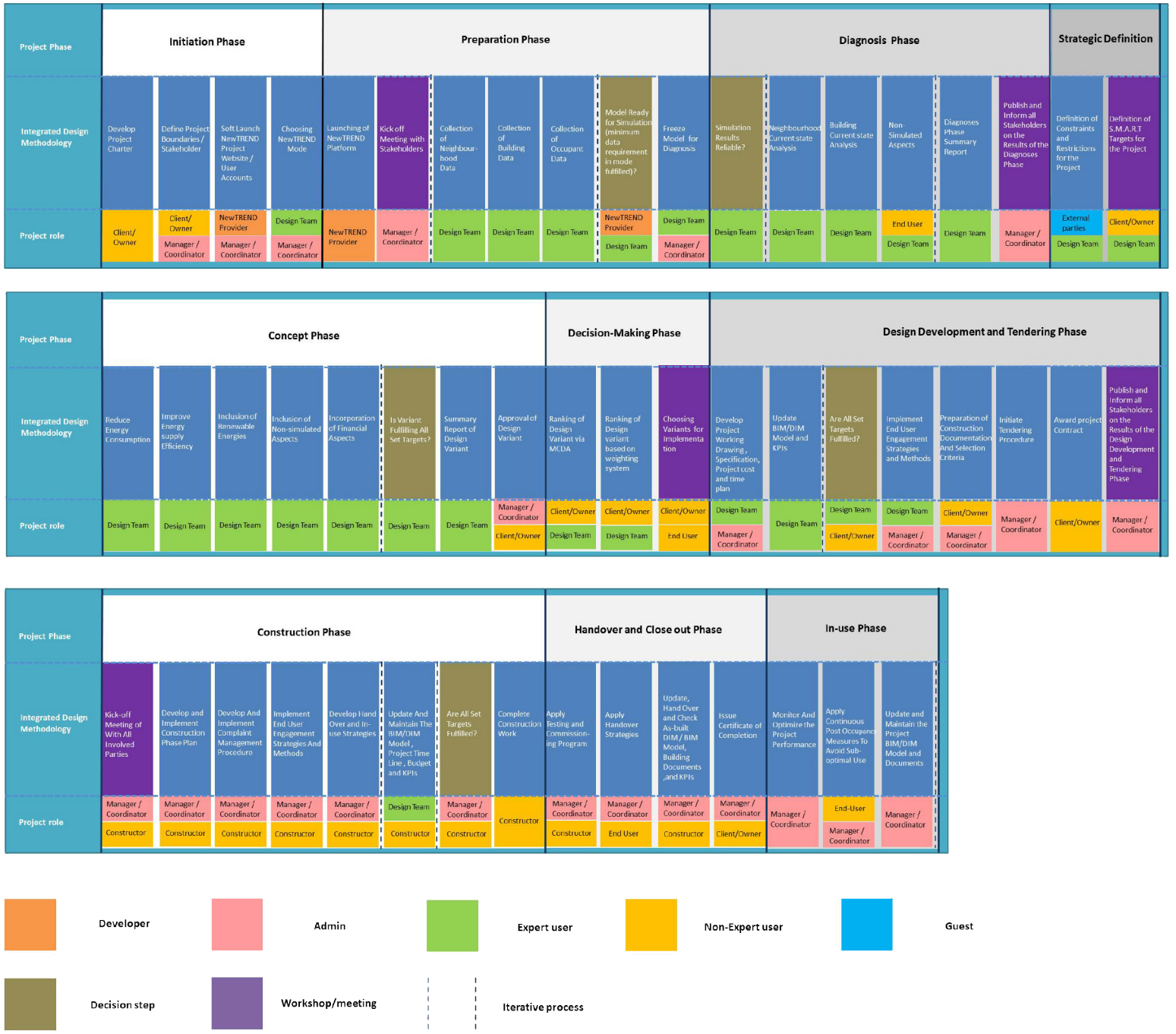
In each of these models a detailed Post-Occupancy Workshop should be held early in the post-occupancy phase. The purpose is for occupants and users to assess the success of the project, the degree to which it fulfilled their expectations, and raise any snags or problems with the buildings and in particular energy efficiency measures. From the perspective of the project team, this workshop can also help them assess the success of the project and the degree to which its objectives, including energy saving targets, have been meet, and if not, why. The workshop should be strongly participatory and inclusive, with input from occupants and users throughout, including in setting the agenda. At a more informal level, an online forum and social media accounts will provide an ongoing space in which individual occupants and users can raise issues of concern as they arise, and where the project team and building management can provide information and updates.

Behavioural Research Model

In this model a focus group will be held early in the post-occupancy phase. This differs from a post-occupancy workshop in being driven more by the concerns of the project team than occupants and users. Its focus will be on assessing the success of the project from their perspective, and in particular whether or not it has reached its targets in terms of energy savings. The ways in which occupants and users interact with energy technologies will be assessed, including any changes in occupant and user behaviour as a result of the retrofit. Lessons will be drawn for future projects based on the level of success or failure in achieving the project's objectives. At a more informal level, an online forum and social media accounts will provide an ongoing space in which individual occupants and users can raise issues of concern as they arise, and where the project team and building management can provide information and updates.

Information and Consultation Model

Occupant and user engagement at the post-occupancy stage will be through an online forum and social media accounts, which will provide an ongoing space in which individual occupants and users can raise issues of concern as they arise, and where the project team and building management can provide information and updates.



OVERVIEW MAP OF THE MAIN IDM PROCESSES IN THE DIFFERENT PHASES OF THE PROJECT

15. Conclusion

The energy retrofitting of existing buildings and neighbourhoods is a complex and work intensive task that requires the active involvement and cooperation of all stakeholders in coordinated and structured manner to achieve the desired results. The high complexity of retrofitting projects on neighbourhood scale requires a thoughtful methodology which guides the planners and stakeholders through all phases of the project. Therefore, this task represented a clear and structured integrated retrofit design methodology (IDM) which guide all involved stakeholders of neighbourhood scale retrofitting projects in finding the most effective energy retrofitting solutions. The developed integrated retrofit design methodology (IDM) is designed to support the stakeholders throughout the project life cycle in a structured and systematic manner that considers the required communication and participation mechanisms between all involved stakeholders and the possible software tools that can help the project team achieve the project targets.

The developed IDM is intended to be used as a stand-alone guidance in which the user can chose wither to relay on the support of the NewTREND CDP functions or to conduct the retrofitting project without them. However, to follow all steps included in the different phases of the IDM and to take full advantage of the different analysis approaches may prove to be challenging and require a lot of time and effort to do, thus rendering this approach not very effective without using appropriate support by the NewTREND CDP functions. Vice versa the use of the NewTREND CDP functions without a clear methodology and objective that guide the user throughout the different steps and phases might not be very helpful for the user to achieve to achieve meaningful and resilient results. Only the joined use of the IDM with the supporting functions can ensures an efficient work flow and increases the probability for a successful completion of the retrofitting projects.

The developed IDM is to be further complimented with a manual describing the conduct of the developed collaborative design methodology that is developed to help the IDM user better navigate through the different phases and steps of the IDM and to ease the applicability and usability of the IDM.

To further refine the IDM, the developed methodology is planned to be tested and validated during the NewTREND project in practice in the three case sites and is to be updated according to the lessons learned and feedback of the users in demo sites

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