Chapter 8
Use and Development of New Technologies in Public Welfare Services: A User-Centred Approach Using Step by Step Communication for Problem Solving

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Abstract Demographic changes and the resultant projected increase in older people needing care and support combined with a concurrent decrease in numbers of professional carers has led to increasing focus on possible technical care solutions. These solutions are supposed to support people who need care with their health, quality of life and level of independence on the one hand, and on other achieve cost savings in the health care system by keeping more people in their own homes rather than nursing homes. Against this background, this chapter shows contextual factors in this area in the first section, key drivers in the second and finally factors affecting success in the development and implementation of technical solutions. It takes account of the perspective of voluntary care services and focuses on lessons learnt in practice. In this way, this chapter provides important tips for implementing new projects—without going beyond the bounds of general knowledge.

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8.1 Contextual Factors in the Assistive Technology Area

Demographic changes and the resultant projected increase in older people needing care and support combined with a concurrent decrease in numbers of professional carers has led to increasing focus on possible technical care solutions (Hülsken-Giesler 2015). These solutions are supposed to support people who need care with their health, quality of life and level of independence on the one hand, and on other achieve cost savings in the health care system by keeping more people in their own homes rather than nursing homes (Hülsken-Giesler 2015). Against this background, this chapter shows contextual factors in this area in the first section, key drivers in the second and finally factors affecting success in the development and implementation of technical solutions. It takes account of the perspective of voluntary care services and focuses on lessons learnt in practice. In this way, this chapter provides important tips for implementing new projects—without going beyond the bounds of general knowledge.

8.1.1 Health, Illness, Disability

The World Health Organisation (WHO) takes the view that illnesses cannot be seen in isolation but unfailingly involve functional problems that entail additional loss of abilities. These can include, for example, restricted or impaired mobility, and an impaired ability to communicate, carry out day-to-day tasks at home, take care of oneself and interact with the outside world (Schuntermann 2006). For older people, this means that as well as compensating for age-related problems, such as hearing loss or being unsteady on their feet, they have to deal with restrictions in other areas, such as communication or social interaction. The challenge for support models, therefore, is not to alleviate individual problems but to provide an appropriate response to a medley of different factors.

A clear description of the functional problems makes it easier to perform a targeted intervention. The International Classification of Functioning, Disability and Health (ICF) (limiting information in: Bartholomeyczik et al. 2006) is useful for this. It delivers consistent terminology across all disciplines, allowing different service providers easily to understand one another and name limitations and daily routines. In addition, it covers different aspects of a person's functional health. Thus, according to Schuntermann (2006), a person is considered to be functionally healthy if, in the context of their overall, life:

1. their body functions and structure correspond to generally accepted norms. This includes emotional and mental functions (concept of body functions and structure)
2. they can do the things that are expected (concept of activity) from a person who doesn't have health problems (ICD—International Classification of Diseases)

Fig. 8.1 Activities as central factor in determining health problems. This representation of the model of disability that is the basis for ICF has been reprinted with permission of the World Health Organization (WHO), and all rights are reserved by the Organization (WHO 2002)
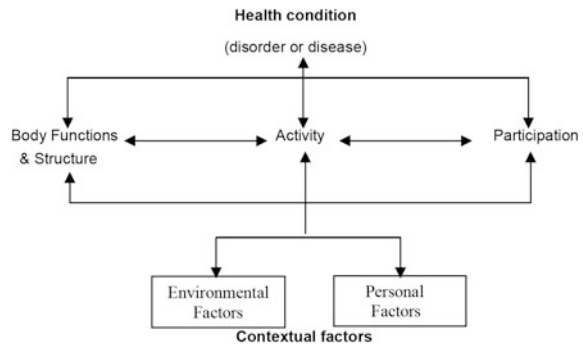
3. they can behave in all important areas of life as a person with no impairment would be expected to behave (concept of participation in areas of life).

The ICF model augments a purely biomedical perspective (concept of body functions and structure) with the idea of the individual as an active participant (concept of activity). The individual is viewed as an equal and autonomous participant in society and in their surroundings (concept of participation in areas of life). In this view, all external circumstances (environmental factors) and personal characteristics and attributes (personal factors) become important. For the purpose of the ICF, a person's state of functional health is a result of the interplay between functional-structural problems and contextual factors (Fig. 8.1). The paradigm shift achieved by the ICF's bio-psycho-social model is no longer to view functional problems as a personal attribute. Rather functional problems are the result of an interplay.

With this interdependent model, new perspectives on how to handle impairments to functional health open up. This means that solutions (and also undesired effects) can be sought not just by influencing body functions and structure but also in environmental factors, personal factors and in an individual's participation in their surroundings. Furthermore, each individual contextual factor influences the health problem and the remaining contextual factors. If one factor in the model changes, this will always effect the other factors, be that positively or negatively.

In the following chapter, these multi-factorial influences are outlined using the examples of selected technical solutions.

8.1.2 State of Development of Assistive Technologies

The study 'Supporting care-dependent people through technical assistance systems' provides a market overview of new systems on behalf of the German Federal Ministry of Health. The aim of this study is to identify assistance systems that improve the home care situation of care-dependent people or delay or prevent residential care. These technologies are supposed to be integrated into the catalogue of services offered by social care insurance in Germany at the same time.

Care-dependent people, their relatives and professional and informal carers were identified as the target groups. From 45 technical solutions, sometimes represented by several actual products, 12 technical solutions were identified that in principle are suitable to support home care and keeping people in their own homes for longer. After a cost-benefit analysis, six products were in the end identified that support living independently at home for longer (Weiß et al. 2013):

- *Toilet with wash function*: equipping the toilet bowl with a washing and drying function means visits to the toilet need no longer always be carried out in the presence of a carer. This greatly increases the independence of people cared for as outpatients. Even more importantly, it protects a person's privacy and sense of worth, and this can affect the relationship between the care-dependent person and the carer (Weiß et al. 2013). It simplifies self-care and in the ICF system, for example, addresses the activity of 'using the toilet'. Causal factor: structures and functions used in movement, for example arm movement, can be so altered by the ageing process that manual cleaning of the genital area is impeded.
- *Intelligent flooring*: A sensor mat can distinguish between people walking normally and falling. Using step recognition, orientation lights can, for example, be turned on. If several mats are used, it's possible to impute a fall if there is no activity for a long, unexplained period. Help can then be notified through an alarm system. Controlling lighting can reduce the risk of falls caused by not seeing things. After a fall, the time taken to find the person is reduced, preventing hypothermia and dehydration. Increasing the person's sense of security, counteracts anxiety as a factor in falls (Weiß et al. 2013). In the ICF system, for example, this addresses the activity of 'walking'. Causal factor: structures and functions used in movement, such as balance, sensitivity, circulation, and the musculoskeletal system, can be so altered by the ageing process that an increased risk of falling arises.
- *Electric medicine box*: the medicine dispenser provides reminders to ensure prescribed medicines are taken at the right time. In addition, connection to a telemedical centre means the situation is monitored by professional staff. This supports autonomy in administering the correct drugs, particularly for people on a number of drugs. The risk of taking too low or too high a dosage is reduced (Weiß et al. 2013). In the ICF system, for example, this addresses the activity of 'taking care of your health'. Causal factor: mental functions may not be sufficient to handle the demands of frequently administering precise doses or—as a personal factor—may deliberately not be focused on medication.
- *Automatic shut-off*: using a timer, the cooker is turned off after pre-set intervals. This reduces the risk of fire caused by forgetting to turn the cooker off, increasing the sense of security for care-dependent people and their relatives (Weiß et al. 2013). In the ICF system, for example, this addresses the activity of 'preparing meals'. Causal factor: mental functions are so focused on other things, due, for example, to stress, that the risk of fire caused by a forgotten cooker rises.
- *Mobile help standing up*: the process of standing up is supported through electromotive power reinforcement. This reduces the risk of a fall when standing

up and sitting down. Care-dependent people can move more independently, which reduces the burden on carers (Weiß et al. 2013). In the ICF system, for example, this addresses the activity of 'changing a basic body position'. Causal factor: structures and functions used in movement altered by the ageing process in the entire body.

- *Networked accommodation*: an information and communication system allows all kinds of facilities to be delivered through static and mobile touch displays, including telephone and video call services. Ease of making contact and interacting socially from a person's immediate surroundings is believed to make it easier for them to stay in their own home or to make lasting contacts quickly in their district after a move (Weiß et al. 2013). In the ICF system, for example, this addresses the activity of 'community life'. Causal factor: taken together physical limitations can lead directly or indirectly to changed social behaviour.

The study shows that both simple devices and complex systems that connect different service providers can contribute to improving care-dependent people's quality of life, independence and sense of security. With reference to the ICF's environmental factors, it also shows how interdependent and fragile the living environment of care-dependent people can be:

1. Products and technologies (for example, aids and medicines). Here, it can be seen that the availability of simple and reliable everyday aids, from wet wipes to walking frames, can raise the threshold for investment in a technical solution.
2. The natural and man-altered environment (for example, buildings, streets and footpaths). Existing infrastructure, such as hand showers, bidets, banisters and light switches that are easy to reach can qualify the additional functional benefit of a technical solution. At the same time, missing infrastructure, such as mains water, electric or telecommunications connections can prevent technical solutions from being deployed.
3. Support and relationships (for example, family, friends, employers, and health and social care experts). Here, it's been shown that technical solutions can relieve informal and professional carers. Resources can then be reallocated— with the risk that they may go away.
4. Attitudes, values and convictions of other people in society (for example, the economic system's attitude to part-time work). Beliefs and practices in the areas of hygiene, security, self-determination, welfare, consumption or social interaction can affect how relevant a functional or structural problem is considered to be.
5. Services, systems and operational principles (for example, the health and social system with its benefits, services and legislation). Financial constraints, building regulations and questions of legal liability mean an innovation may not be implemented for financial or legal reasons.

Reliable cost-benefit analyses are not possible at the moment, because only a few approaches are as yet ready for market and there are no large-scale studies available quantifying their benefits. To develop the area further, effectiveness studies, business models and information models should be implemented. Furthermore, ethical

and legal issues must be clarified. From a social law perspective, independence, participation, promoting a sense of security and relieving carers can be used as arguments for financing. The prevention of care dependency can be re-imagined through these new options (Weiß et al. 2013).

It's beyond the limits of individual research projects to determine whether hoped for potential savings will be offset by follow-up or additional costs. We should remember that reductions in staff may mean additional expenses for nuisance alerts, maintenance and administration. Last but not least, we should reflect on the effect of (false) expectations from the technology on our understanding of values and behaviour (Manzeschke 2013).

8.2 Key Concepts for Problem Solving

If problems are to be solved in a sustainable way, it's important to ensure that the solution doesn't create new problems. This is particularly true of problems whose consequences for the individual or society are no better or even worse than the problem itself. In this respect, it's important to observe that solutions have their own momentum. The paramount objective of solutions must be to optimise balance in life and give everyone the greatest possible freedom. When targeting an objective, the cost-benefit equation must be balanced (Illich 1998). In such a cost-benefit equation, it is helpful to analyse the problem to be solved closely, to set considered goals and finally to weigh up the resources needed and potential outcomes of the measures. The paramount objective of 'giving everyone the greatest possible freedom' introduced by Illich already implies that this consideration should go beyond technical aspects to ethics.

8.2.1 Problems—Problem Analysis

Problem analysis is repeatedly used in day-to-day practice and in science to overcome problems strategically. For this, the problem should be described as exactly as possible. This involves identifying patterns of cause and effect connected with the problem (Elsbernd 2013). To recognise concrete problems, it's helpful to understand how they generally arise: problems arise when a targeted objective cannot be reached either because the necessary means are absent or because it is not known how to reach the objective. Problems are characterised by a (1) barrier or gap, which prevents a transformation from an (2) undesired initial state to a (3) desirable end state (Duncker 1966; Dörner 1987; Lüer and Spada 1992). When dealing with problems, the perception of the problem as well as its context must be considered (Lüer and Spada 1992). Unsolved problems in the sense of high maintenance are one of the conditions for care needs (Hasseler and Görres 2010).

Example:

In the context of counselling, a husband carer describes the practical relevance of looking at a problem in different ways: his wife, who has dementia, is complaining of pain in her abdomen (undesired initial state). She knows and seeks the state of pain-free well-being (desired end state). For the woman, the problem manifests as an unsatisfactory state of helplessness/powerlessness. She doesn't know how to achieve the state of being pain free (barrier). The husband has learnt how to resolve the situation. Both have a common interest in a state of well-being being reached. The husband has learnt that the painful stomach results in restive behaviour. However, he has also realised that the pain is the result of a full bladder. With this analysis of the problem, he can overcome the barrier that exists for his wife. He takes her to the toilet. There she realises what the problem is and can solve it herself.

Tip:

Question the problematic situation: what exactly is the problem? Who has the problem? Are other people involved? Why exactly has the problem occurred?

8.2.2 Problems—Problem Evaluation

For concept development in professional care, an evaluation of the problems to be tackled with the concept is vitally necessary (Elsbernd 2013). Otherwise, there is a danger of only solving problems 'in the test tube': instruments and procedures are used on their own or are not sufficiently aligned. Through various system archetypes, for example, problem transfer, this can lead to additional work or conflicts (Elsbernd 2013; Senge 2011). When evaluating problems, the relevance, dimensions and controllability of the problem and connected themes and problems should be reviewed. Relevance describes the consequences of not solving the problem from the perspective of different stakeholders. The dimensions of the problem refers to how deeply, for how long with what potential consequences the problem appears in everyday life. The controllability of the problem helps to broaden the gaze to different possible solutions in that it asks who can control the problem. Correlated problems and themes take account of areas and processes where a problem can take control and illuminate processes and structures that can prevent or support the problem being solved (Elsbernd 2013).

Example:

   If we look at Uli Anders' problem as being the risk of falling in the dark, it can be analysed more closely. The risk itself has no consequences for Uli. However, his relatives are already worried about the risk—which may encourage caring behaviour in them. For Uli, the relevance is noticeable in the problem's dimensions: because is afraid of falling he doesn't go to the toilet although he has a full, bulging bladder. As a consequence, his sleep is affected. In the long term, his urogenital tract could be damaged. In terms of a single night, the problem lasts until the morning. Then it becomes light and Uli can go to the toilet without bumping into anything. In terms of the longer view, the problem persists. Then a disturbed night's sleep could lead to changed social behaviour. The worry about urgency in the night could prompt Uli not to drink in the evening.

In the BMBF Project MOVEMENZ (Mobile, self-determined living for people with dementia in the neighbourhood), technologies were to be identified that contribute to preserving mobility and movement in people with dementia. To that end, the whole care arrangements for people with dementia were examined to develop technical solutions in a demand-pull approach. With an iteration loop, the technology developers formulated suggestions for solutions to the established problem areas. The project results were characterised by different problem perceptions at all levels (Weinberger and Decker 2015). Even in connection with the question of acceptance of technologies and assistance systems, the MOVEMENZ project showed how important it is to analyse the problems at hand accurately and in their context. In the example of a tendency to run away, it becomes clear that even here different problem perceptions exist. A tendency to run away is connected with the risk of loss of orientation. That can lead to false assessment of a situation or helplessness. Connected with that is the risk—sometimes fatal—of an accident or hypothermia. It's difficult to show this risk statistically (see the section 'Risk and security'). While the risk itself has no relevance for people with dementia, it's of great importance to carers and relatives and leads—possibly conditioned by a media-distorted perception of the actual, numerical, recordable risk or by focusing on worst-case scenarios—repeatedly to worry (for example, reproaches and loss of control) and concern (for example about the person with dementia or third parties). Thus a risk repeatedly becomes the tangible dimension of diffuse fears. This is also true for the affected people themselves when they try to return to their own four walls because of worry, stigmatisation or disorientation. So the dimensions of the problem lie on the one hand in an accident happening. The frequency, duration and consequences of the risk can be estimated here on a case-by-case basis. On the other hand, changes to everyday freedom and participation in social life must be considered. In this case, the actual handling of the risk must be assessed: should structures be put in place in daily life that reduce or prevent the occurrence of the risk—or should structures be created that alleviate the consequences that arise when

the risk occurs? Movement itself has an influence on well-being, cognition, sleep, mood and the cardiovascular system (Andrews 2012a, b; Baillie et al. 2012). The correlated themes and problems clearly demonstrate how diverse an isolated problem, such as a tendency to run away, can be. The structures and processes of the (health) systems in the western world are oriented to economic efficiency. The opportunities to correct mistakes are therefore small. This increases the demands on all who play a part in the system—including service recipients, such as people with dementia. Symptoms, causes and triggers of mistakes often aren't perceived as being different as the question of 'blame' is raised. At the end of this chains stands a person with dementia who is often perceived as problematic or even as a problem. If the symptom (malfunctioning of the system) is confused with the cause (increased susceptibility to malfunctioning) and guilt assigned to the trigger (for example, people with dementia who act or employees who react), it can lead to problem displacement and escalation (Senge 2011): Challenging behaviour, Specialling, Forcible confinement, Monitoring.

> Tip:
>   Explore the context for a problem: what exactly is the current initial state? Are there structures and processes that are influencing the problem. How do other stakeholders answer these questions?

8.2.3 Goals

Dörner divides problems into four types, according to whether the level of awareness of the solution is high or low and the goal criteria are clear or less clear (Dörner 1987). Goal criteria can be understood as reduced but sufficient descriptions of goals. In practice, the description of goals appears complex. However, formulations such as SMART (specific, measurable, achievable, relevant, time-bound), RUMBA (relevant, understandable, measurable, behavioural, achievable/attainable) or DREAM (distinct, relevant, evidence-based, achievable, measurable) support this description (Koutoukidis et al. 2013; Schiemann and Moers 2004). Goals should be viewed as mental anticipation of a desired end position. Explicit goals can be expressed in conversation or on request. Implicit goals, by contrast, are hard to recognise. Different players in the same situation can pursue complementary or contradictory goals (Röhner and Schütz 2016). Alongside problems, goals are a further factor influencing care needs. For the individual goal of daily personal hygiene, carers could set the care goal of obtaining self-reliance or of passively compensating limitations. In goal setting, professional, cultural, societal and social values and norms come into play (Hasseler and Görres 2010). In particular, individual moral values and mental models mean that misunderstandings

Fig. 8.2 Levels of deviation
in goal determining
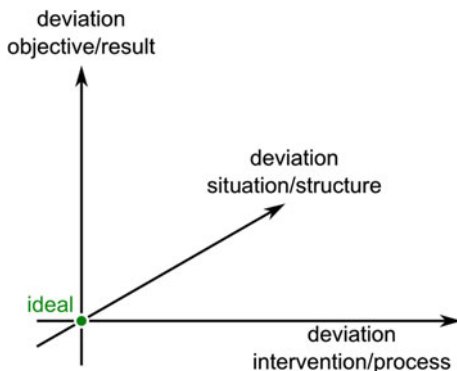
occur on various axes. Therefore goals can only ever be reached with limited accuracy. Figure 8.2 shows the axes that determine goal deviation.

Goals can be misleadingly formulated and outcome indicators can be unclear. Situations can deviate from mental models and structures may not correspond to actual requirements. Last but not least, measures or processes implemented can be variously understood and a goal may thus not be reached.

Example:

In care counselling, Uli Anders can agree a primary goal for his problem 'risk of falling in the dark'. The goal can be oriented to compensation, rehabilitation or prevention. This overarching objective decides and justifies if and why resources are maintained or promoted. If necessary, it also justifies why removal of resources must be approved.

The BMBF project QuartrBack (intelligent emergency chains for people with dementia) is supposed to enable people with dementia to have more mobility, independence and participation in social life. People affected are supposed to be able use a technical device to request support from volunteer or professional helpers (www.quartrback.de). During the project, it became ever more clear through the user-integrated approach and deepening research that the shape of daily life for people with dementia needed to be acknowledged in the QuartrBack system. For the structures, processes and goals that an emergency chain must connect to are anchored in daily life. For everyone involved that means using the technology in daily life with added value, so that it can be used in an emergency. Experience with home emergency call devices was transferred for this. The label 'emergency button' acts as a barrier here. This is partly because the subjective perception can dominate that the predicament isn't an 'emergency' (for example, underestimation, trivialisation, shame, anxiety about consequences) and so the button deliberately isn't pressed. Sometimes the emergency button isn't worn on the body—sometimes so as not to damage it, to keep it for an emergency or because it's annoying to wear—and

can't be reached in case of need. This is also a reason why use of the emergency button needs to be practised to overcome inhibitions. This can also answer practical questions: which arm does the emergency button feel more comfortable on? Would it be better worn round the neck? Is communication with the home emergency call centre possible from all rooms? Even if the radio or TV is on?

Furthermore, through problem analysis and problem evaluation, the shape of daily life was revalued by placing the problems to be solved in the context of daily life. Thus the idea of designating railway tracks and rivers as dangerous zones was scrapped. It is technically doable to estimate current hazard potential. However, having a helper at the right place at the time of the emergency requires this helper to be alerted in good time. Timely alerts increase the number of false alarms and lead to lower acceptance of the system through to collapse of the helper network. This reflection shifts the needs and concerns of the helper to the foreground. An essential element in QuartrBack is therefore the support of established offerings for people with dementia in their local area or the promotion of new offerings. Networking all players is now of particular significance.

Dialogue on an equal footing is essential for this process, as is appreciation for the expertise of all those involved and above all constant effort to metabolise and understand the perspectives of others. In this process, it's challenging to exchange different interests and moral values, to speak about conflicting values and find a consensus and a common way forward. Appreciation of the role of society and professional service providers with regard to technical innovation doesn't just lead to a successful balance of interests. The supposed or relative 'devaluation' of the importance of technology leads to ascertainment of responsibilities and demands. This puts a brake on excessive expectations of the technology—we considered sensitivity to the limits of technology to be an important success factor and a counter measure to the idea of omnipotent technology.

> Tip:
> People's objectives vary even more from person to person that their perception of problems. In inter- and transdisciplinary collaboration in particular, it's helpful to communicate governing values and norms with trust, as well as to communicate unease. Don't just send a signal that voicing concerns is allowed. Make discussing these subjects a duty.

8.2.4 Resources

With his division of problems, Dörner doesn't just address the clarity of goal criteria, but also the awareness level of the means to a solution (Dörner 1987).

Resources are the abilities, skills and influences that are at a person's disposal to reach his demands, that is his (potential) goals. Resources can be bound to a person or a person's body as physical, mental or spiritual resources (for example, statics, motor skills, sensors, cognition, feelings, self-confidence, resilience, creativity). They can also be unleashed by him, for example spatial (for example, living space or living environment), social (friends, relatives, social network, state), economic (for example, money, possessions) or spiritual resources (for example, belief, piety).

They can be available, perceived, activated and developed as material and as intra- and interpersonal quality and they can be built up and they can be degraded (Hölzle 2011; Thieme 2015; Zwingmann 2007; Mahler 2012).

> Example:
>   By clarifying resources, it can be seen that the problem only predominates at night. Only at night does worry about falling stop Uli from emptying his bladder. With regard to walking, Uli Anders has adequate physical and mental resources, including cognition and motivation.

In the BMBF project QuartrBack introduced above, objectives were reflected in a picture of separate functions. Technology takes over the sensors' functions. It oversees critical parameters, evaluates them and sends alarms to the Service Centre Care. The people in the Service Centre Care analyse and assess the situation. They decide and are responsible for the help and support measures that are implemented by the helper network in a help scenario. In the final analysis, the people in the helper network are the actors. As executive forces, they look for the place of the happening in order to help the helpless person. Problem analysis, problem assessment and definition of objectives extended the work area. A significant part of the additional outlay that is necessary for lasting implementation of the concept could thereby be discerned early on and included in work plans. Considering carers' and relatives' existing strategies for handling existing problems limits the above mentioned additional outlay as established concepts and experiences can always be built upon.

Inclusion of existing strategies can also cause a change in the way of thinking. In severely restricted people with a deficit-oriented perception, the question of which everyday objects can house a geolocation and communication system led to arm and foot bindings with a trick lock and aids with a dependency relationship such as rollators and walking sticks. The reverse question formulation with a question about resources brought additional options: 'Which communication medium can be located and has attractive functions for daily life?' This question formulation opened the eyes and broadened the gaze to owning a smartphone. Equipping a Smartphone with additional features doesn't just draw on the resources of the

people in the QuartrBack system. It also brings additional resources into play in project development. Smartphone-based experiences can be used as a basis for developing independent devices.

> Tip:
>   Analyse players' existing solutions. Use the experience and knowledge of these experts.

8.2.5   Needs

Needs are the gap between the resources necessary to reach a goal (desired situation) and the resources available to a subject (current situation). This need also expressly includes perception and knowledge deficits. This can be relevant when qualitatively and quantitatively all the resources needed to reach a goal are available but are not adequately orchestrated actually to reach the goal (Fig. 8.3). Needs are also discussed when a goal cannot be reached or can only partially be reached. A care need exists when the goal in question is a care goal. If the care goal has been determined by third parties, such as the care profession, the need can be defined as an allocation-ethical need. Thus it is afflicted with the risk that individual needs will be overlooked and nominating, standardised needs formulated. This risk must be counteracted with participation concepts such as Shared Decision Making. Needs
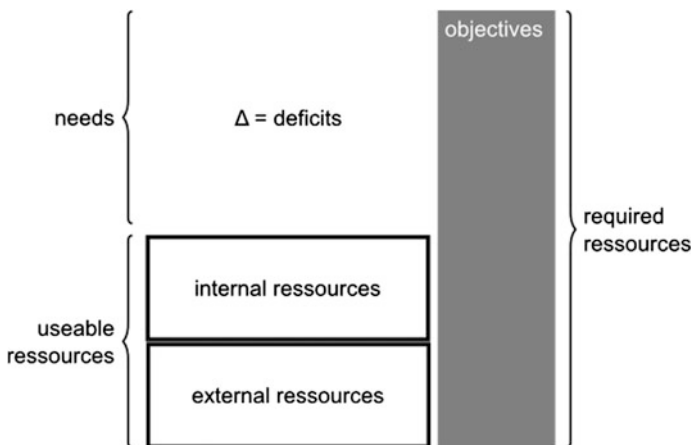
Fig. 8.3 Needs are the difference between necessary and available resources that are relevant for reaching the goal set

are an objectified quality that however always stand in a subject-related context (Hasseler and Görres 2010; Gründger 1977).

This definition deviates from economically inspired concepts of need, which define a need as a requirement that can be met with purchasing power or market demand. For on the one hand, in contrast to goals, individually felt needs can only be argued for from a supra-individual level to a limited extent. On the other hand, as a monetary resource, buying power must be allocated to resources and would therefore be listed twice (Hasseler and Görres 2010; Gründger 1977).

Example:
 On first consideration, Uli Anders' need can be established through the difference between going to the toilet during the day and at night. The only changing constant is the light. Uli Anders' need lies initially in lighting the way between his bed and the toilet, be it with a torch, a night light or remote control of the regular lighting. However, there is further access to need in the constant environment. Here is the question: why is Uli Anders afraid of falling at night—but he wasn't a year ago? Considering it this way leads to the conclusion that back then Uli Anders would have had the power and speed to get his balance back after colliding with a dresser. Simply moving the furniture or introducing night-time lighting only compensates one resource loss. Uli Anders' actual need is to build up strength and speed, either through movement training at home or collectively in public.

In the BMBF project QuartrBack, the strong focus on the goal of preventing emergencies and providing rapid help when there were emergencies led to an overemphasis of this need situation. This is understandable as the goal of 'security' is attractive for all participants. If 'security' is brought into connection with the risk of disorientation, then the questions arises if the objective should be prevention, compensation or rehabilitation. Emergency is designated as rehabilitative: what is done when someone loses their orientation? This is a question of individual and general resources. Involving the police or rescue services is every bit as imaginable as phoning someone who knows the area and can suggest a direction to go looking. Using a navigation device or human accompaniment or restricting the person to known paths and routes can be designated compensatory. Prevention means shaping processes and structures in such a way that orientation is constantly updated. This can be done with cards, signs and way markings at the structural level and with close comparison of the person's own position with physical and mental cards at the procedural level. By considering the situation in this way, the broad spectrum of needs becomes apparent. The interplay of emergency and daily life also becomes clear. Thus, good signage can prevent loss of orientation, but also compensate and rehabilitate. When it comes to orientation, it can serve both the affected person and third parties.

Tip:

Differentiate between needs groups and target groups. Needs groups sharpen the focus and answer the question: 'what does a social circle require?' They are narrowly defined groups of people who have the same need, that is to say they exhibit the same resource profile in pursuit of the same objective. Target groups by contrast answer the question: 'which social circle is interested in a given matter?' They widen the focus and address more broadly defined groups, which exhibit a high or increased probability of belonging to a needs group.

8.2.6   Resource Balance Sheet

With the term positive resource balance sheet and the demand for a high degree of individualisation and the retention of everyday skills and promotion of development potential, Lindenberger et al. (2011) introduce three criteria that age-appropriate technologies must satisfy. These criteria address the intervention and evaluation levels equally. The positive resource balance sheet means measures are only justified when the outlay is less than the benefit. If learning results or loss of competence are included, both short and long-term effects must be considered. Furthermore, the objective (created by a third party) and the subjective resource balance sheet my vary. A higher level of individualisation is reached when a measure is in a position (for example, in the interests of a positive balance sheet) to support and claim available resources based on individual standards. The demand to maintain everyday skills and to promote development potential aims to prevent the person being stressed by swings between being overstrained and not challenged enough. When people are overstrained their available resources are subsumed by demands and the burdens of everyday life. This can lead to resignation. When people are not challenged enough, by contrast, too few demands can be put on resources, which can lead to degeneration because of missed training (Lindenberger et al. 2011).

Example:

For night-time lighting Uli Anders can arrange a torch, a permanent night light, automatic lighting or a remote control. The criteria are (1) cost, (2) influence on sleep and (3) manageability. A torch is cheap and doesn't affect sleep but must be carried to the toilet. A permanent night light is cheap and easy to use, but does disturb sleep with its light emissions. Automatic lighting and remotely controlled lighting come with higher costs, but don't disturb sleep and are easy to use. In the resource balance sheet, automation of the lighting performs poorly—it means that Uli Anders gives up

responsibility for controlling the lighting and its physical implementation. Therefore, Uli Anders decides on a remote control solution. To promote movement, he decides to go to a sports group and do morning exercises in bed. The sports groups brings him particular added value in the area of social participation.

In counselling situations and projects, irritations repeatedly arise when different care goals compete with each other. Thus, in the MOVEMENZ project, a situation was discovered where a person was passively driven to an activity although she could have walked there herself. This contrast was initially interpreted by those on the outside as a failure by the carers. That is understandable, as the focus of the MOVEMENZ project is on remaining mobile and promoting movement. The irritation disappeared when a further dimension of need in the field of participation and activation was opened up. The person affected can't take part in the singing group if she is exhausted. Independent walking would promote movement but endanger participation and activation. Therefore, in this case, the resource balance sheet is only positive if the person affected is passively conveyed to the singing group. The movement can be make up in connection with this activity and at other times of day.

Tip:
    Balance the outlay and benefit of measures from the perspective of all stakeholders. Strengthen common consensus decisions for measures that all participants can experience with a positive resource balance sheet.

8.3 Success Factors for Developing and Implementing Technology

Technology has an influence on the understanding of care through the risk of alienation and greater outlay due to administering the technology. In medically oriented intensive care, the necessary technology leads to an altered human image, for a functional, somatic-technical fundamental understanding is a prerequisite for connecting machines to people. As a consequence, measures concentrate on biological malfunction. Functionality is the most important thing. Deviations from the norm are met with certain standardised actions, care planning is performance and illness oriented, care is judgmentally classified as basic treatment care, and success is measured by the removal of the malfunction (Friesacher 2005). The influence of technology can spread to the whole care arrangements and is a particular factor that

co-determines the character of professional and informal care and can also change it. Technology cannot be considered in isolation. It is interwoven with social acts and relationships. Technology, social acts and relationships mutually influence each other in part and beyond that the roles for social actions, the actors and care arrangements are also assigned. Technology can split various activities and assign various groups of people or transfer them 'online' in the virtual space. The resultant changes for the whole arrangement should be taken into consideration (Krings et al. 2014). The consequences of technology for (professional) care activities are wide-ranging and potentially concern all parts of the care process. Against this background, we must handle the development and implementation of technology responsibly.

Quality criteria in care science
The effects and range of technology in care are known through care instruments: instruments provide structure. They are part of the care process. They work clearly and explicitly. However, instruments can depict the care situation in a way that simplifies and reduces it. Whether an instrument is useful or not depends not just on the quality of the instrument but also on the skills of the user (Bartholomeyczik 2009).

Therefore, technology as an instrument must be viewed like other instruments in care and satisfy the demands from a care science perspective that are placed on instruments. For 'instruments that don't lead to subsequent decisions and measures are superfluous in treatment' (Bartholomeyczik 2009). Thus technology either governs actions or is redundant. If it governs actions it can influence matters as profound as the human image and our understanding of care. Therefore, it must be professionally considered and evidence-based.

> Tip:
> Precisely plan the implementation of technology in advance. Make care structures, processes and goals transparent for all stakeholders. Demand transparency in relation to demands on the structures, processes and goals of affected stakeholders—in particular in the development and administration of technology.

8.3.1 Ethical Reflections

Added to the (1) complexity of care arrangements and the (2) limited range of each instrument is the further challenge (3) of people's obedient behaviour (Lüttke 2003). Therefore when using technology, as when using all instruments, 'departure from the rule' must be promoted and demanded in justified individual cases. For this, a strong ethical culture is necessary and corresponding instruments, such as

ethical guidelines, ethical case reviews or ethical councils. Professional and ethical reflection must thereby encompass the development process and implementation, as well as regular/permanent use of the technology. As reflection can only happen ex ante (for example, after becoming aware of a question) (Grunwald 1999), in the interests of sustainable development or implementation work, a fundamental sensitisation to ethical questions is useful, and ethical reflection should take place as soon as possible. Sensitisation could be thought of in terms of the categorical imperative: 'Act as though the maxim of your action were by your will to become a universal law of nature.'(Kant, Critique of Practical Reason). This can be consulted neither for moral legitimation nor adequate ethical reflection. This third formulation of the categorical imperative can, however, contribute to uncovering first questions. Here the questions might be: 'What concerns have the consequences of an innovation, development or implementation for myself and/or all of society?' or 'What conditions and exceptions must pertain for me and/or the whole of society for innovation, development and implementation to become law?' (Gethmann and Sander 1999) Moral assessment depends on socially rooted morality and is therefore fundamentally revisable (Grunwald 1999). Against this background, ethical reflection should be used as guidance, so that moral barriers and dangers can be recognised and target values reached. In case of conflicting values, ethical reflection provides the opportunity to protect endangered values (Grunwald 1999). Affected parties should be involved in this reflection, not least for sustainability, particularly when decisions involve palpable imbalances between beneficiaries and risk bearers (Renn 1999). In such as discursive process, it should also be disclosed which human image and which values and moral arguments are governing the development and implementation (Riedel 2015). If concerns exist when disclosing these points that can be a further sign that ethical reflection is necessary. In practice, this manifests repeatedly in products that want to skim off the financial potential of the so-called silver generation or target efficiency improvements with offering all those affected a balanced cost-benefit equation.

Smart technology is increasingly moving into the area of support options for older people, for one thing to support users themselves in the areas of security and comfort, and for another to relieve the heavy physical everyday burden on carers. With this use of technology the question of its moral tenability comes up again. Particularly in situations where different moral values collide, the moral question occurs of what is the right conduct (Ammicht Quinn et al. 2015). Ethics enable us to reflect on what benefit individual people and society derive from technology (Velasquez et al. 1987). In the next decade, the direction of development of our society and social attitudes to older people, will also depend on how we shape the introduction of technology and what expectations we have in connection with it. Technical assistance systems are not just a small practical support in the domestic environment of individual users, they demand a corresponding infrastructure coupled with high investment and a social picture of how we want to assure the care of older people in the future (Manzeschke et al. 2013).

Experience from development history shows that every benefit that technology brings has a side effect. There are currently no clear, comprehensive answers to

ethical questions (Körtner 2016). This makes it all the more important to take account of informational self-determination for older people. Users must be included in technical innovations from the outset. They are the metronomes and decide on the construction and possible applications of the system. Technology represents an opportunity: we are in a process that we are accompanying and can help to form—or perhaps must help to form. Older people who need support in their everyday lives invest hope in the technical developments and cherish the desire to live a secure, self-determined 'good life' by using technology. Ancient philosophers around Aristotle were already focused on the 'good life'. Sen and Nussbaum define it in 'The Capability Approach' as a life that allows the maintenance and development of capabilities (Ammicht Quinn et al. 2015). Starting with the thought that the use of technology enables the development and maintenance of capabilities, the question arises of whether it is ethically acceptable to withhold supportive technologies from potential users. To answer this question in detail, the specific benefit of a technical assistance system must be presented in detail. The MEESTAR model (model for the ethical evaluation of socio-technical arrangements) can be used for structured ethical reflection.

Practice examples
In the context of the BMBF-sponsored project, Patronus, an ethical workshop was realised with the help of the MEESTAR model. This contributed to creating a sensitivity to ethical challenges that occur in the course of a project related to technical assistance systems. The interdisciplinary composition of the work groups meant that the ethical questions could be discussed from different perspectives. Furthermore, this ensured that sensitivity to moral unease in the different disciplines was disseminated.

In the course of the workshop, it was shown the moral assessment of individual questions depends heavily on the kind of technology used and must be regularly individually validated. Therefore, every moral problem area that occurs in the context of technological development must be considered from different perspectives and oriented to the individual needs of the technology user. Following the MEESTAR model, the focus should be on the dimensions of welfare, self-determination, security, justice, privacy, participation and self-understanding (Manzeschke et al. 2013). Welfare themes such as giving up capabilities were, for example, considered alarming in the workshop ('People who use technology can be tempted to give up personal capabilities and rely completely on the technology. If, for example, the technology reminds them to take their medication every day, the user can come to rely too much on this function and then doesn't think about it anymore themselves'). Security themes also gave pause for thought, such as the question of data protection ('Depending on the kind of data transferred, corresponding data security must be in place. The more data are transferred, the harder they are to secure').

In general in the implementation of technical assistance systems, the focus must always be on the most significant thing: supporting the user. It's also important to ensure that the implementation of technology doesn't obscure other good solutions.

Tip:

Ethical reflection is occasionally confused with moral concerns and experienced as a barrier. Use ethical reflection as a navigational instrument to circumvent moral barriers—plan ahead to involve them.

8.3.2 Sustainability

When looking at the sustainability of solutions it makes sense to compare the effect and outlay of a measure with alternative measures, against the background of collective targets. Effects include intended as well as unwanted effects. These can be differentiated into direct and indirect. Particularly with measures that cause efficiency enhancements, rebound effects can be observed: for occasionally an objective pre-existing improvement leads to an actual deterioration, because people's behaviour has changed (Buhl and Acosta 2015; Santarius 2012; Pirgmaier and Gruber 2012). To handle rebound effects, measures should not be thought of in isolation (Speck 2016). Faster transport connections don't lead to time savings if longer distances are travelled. Energy efficient components in computers and smartphones don't lead to energy savings if the potential won is deployed in better performance. Better performance can lead to new goals or forms of use and thereby to higher use. Safety measures (helmets, belts, air bags, ABS, occupational safety, assistance systems, condoms, nutrition, reduced tobacco consumption) can lead to riskier behaviour because of strong feelings of security (risk compensation). That means that other people's riskier actions must be reckoned with too (Bioly 2010; Osorio et al. 2015; Jetzek 2009). Included in outlays, after the Total Cost of Ownership (TCO), are outlays for creation, implementation, administration, maintenance, operation and disposal (Gronwald 2015). Particularly in institutional settings, implementation and administration are important for satisfactory application: if rules are implemented that go beyond pure operation/application and refer to individuals or user groups, then carers are affected at the conduct level. Regardless of whether their job is in administering the technology or in representation/advocacy for the person requiring care, the carers must deal with the technology at a structural level. They must make sweeping decisions and assessments as to whether a individual should/may/can/must be assigned to a particular group or rule. This has an influence on the actual conduct of carers and the allocation of their professional capacities. This influence can persist in the diagnostic view, because for all those involved individual and above all situational conduct is then only possible in the context of the control structure. A diagnostic view outside this context has no consequence and so loses importance. Therefore professional reflection is necessary

about how far and in what direction technical administration influences daily care conduct. For this, it must be explicit which obligations and conduct freedoms are affected in daily life and in particular in the care process. Where routines develop, and above all where they are introduced in standardised and automated ways, professional and ethical reflection or evaluation is indicated. Beyond that, on the organisation's side, the range of rules must be considered and a corresponding way created that doesn't just allow the validity of a rule for a particular situation to be based on a professional or ethical justification but requires it. At this point, professional or ethical councils or case conferences can be supportive.

Tip:
   Ensure transparency early on concerning outlays for administration and implementation as well as unwanted effects. Put particular emphasis on communication when transferring a solution from the protection of the laboratory into the context of reality.

8.3.3 Security and Risk

What is understood by security is the result of a social negotiation process. Security consists of a triad of components: value level, potential threat and protection level. The value level describes an asset worth protecting as well as its significance. This area is subjective, meaning that security is not clearly defined, being described, for example, as 'a situation in which a citizen is protected from threats—either by neutralisation, avoidance or low-risk behaviour' (Ziegleder et al. 2011). Security is a term that depends on the values and value systems of individual citizens. That's one reason why absolute security is not attainable (Müller 2015; Ziegleder et al. 2011; Daase and Deitelhoff 2013). If values compete in one person or among several people, ethical reflection can be used as an evaluation method. Threat potential combines threats, the likelihood of them happening and the potential scale of damage with risk. A clear evaluation of risk parameters must often be conditional. Establishing probability and damage scales helps to make threat potential more concrete in the face of unclear data (Müller 2015; Regenfus and Vieweg 2010).

Protection level subsumes protection measures and their weighting. They usually reduce the likelihood of a threat happening or its effects (Müller 2015).

The BMBF project QuartrBack tried to protect the protection-worthy assets of movement and participation in social life from the threat potential that wandering brings with it. The level of protection should be defined according to the individual threat potential in a needs-based approach. Therefore, to develop proactive measures

the general threat potential must be established before determining the individual threat potential. However, currently there are no reliable figures on the frequency (likelihood of a threat happening) and affects (scale of damage) of running away and wandering among people with dementia. The police helicopter squadron in Baden-Württemberg provides information on the frequency of missing person searches (generally, not specifically for people with dementia): in 2015 there were 942 searches, and in 2014 there were 949. The police and Federal Border Guard and the 'Stelle zur trägerübergreifenden Qualitätssicherung im Rettungsdienst Baden-Württemberg' (Baden-Württemberg rescue service) cannot provide statistics on key words such 'helpless person'. Under the search term 'dementia', the 'blue light' section of the press portals lists: (http://www.presseportal.de/blaulicht/suche. htx?q=demenz) on 20.02.2016, 188 results from 2004 to 2016, of which 49 are reports from 2014 and 58 reports from 2015. Overall, there were 70 missing person reports and 25 people were found again. The portal reports on three deaths, seven spontaneous instances of help being offered without a preceding missing person report and seven fraudulent cases. The figures are not valid, but they do justify asking the question of whether there is a need for action at the state or federal level. To put the figures in the context of the overall population: in 2014 the population of Baden-Württemberg was 10.7 million, of whom 2.1 million were aged 65 and over and 1.1 million were aged 75 and over (https://www.statistik.baden-wuerttemberg. de/BevoelkGebiet/Bevoelkerung/99025010.tab?R=LA from 1.7.2016).

Poor data can neither make an efficient contribution to developing measures nor help with people's sense of security. Relatives and carers suffer repeatedly from the justified fear that a person with dementia might not find their way home. Sense of security describes security as absence of fear or anxiety from certain dangers. It is a multidimensional structure that exhibits an affective, a cognitive and a conative dimension (Ziegleder et al. 2011; Daase and Deitelhoff 2013).

Therefore, in QuartrBack defined scenarios, technologies and processes are developed with a describable and therefore manageable risk. Precise protection measures can be derived for these narrowly defined risks. Outside these areas, a risk culture must be established in everyday life. This involves weighing up values: does the person with dementia's freedom of movement prevail or their welfare with the need avoid potential harm? At this point it's less about a contextual decision for one value or another. It's much more about being aware that there is a conflict of values. It's about highlighting that one value has been decided upon and justified after careful consideration.

> Tip:
>   The need for security is based on ascription of values. The term security is a nebulous social convention. Make the term concrete by talking about the risks that a measure ensure against.

8.3.4   Transparency and Information Flow

In the BMBF project *Patronus an assistance syst*em was developed that automatically recognised challenging situations and autonomously launched a solution. Amongst other things, it encompassed emergency detection and help initiation and it was adjusted to the life and health situation of individual users and to their wishes and ideas. Underlying the project was Baltes' selective optimisation and compensation (Baltes et al. 1998), which describes capabilities in older age. By developing remaining resources and capabilities as far as possible, maximum quality of life is targeted and resource-based action strategies derived. At the beginning of the project a needs analysis was conducted to collect demands for the system from the point of view of older people and service providers. In the context of the assistance model the general needs of elderly people and general offerings in various areas were captured in a data bank, and the system was tested in a practical trial. The practical trial showed that the use of complex technologies requires a high degree of coordination. Furthermore, cooperation with third parties, not people primarily involved in the project (for example, electricians) played a deciding role in whether installation was successful. Because of the complexity of technical assistance systems, it became clear that a project leader with technical understanding needed to be in situ when the supportive technological solution was installed at home to bring the individual technical components together and coordinate the operation. Responsibilities had to be clearly defined and set out in a binding installation timetable.

From a social service point of view, the delivery of information and explanations to the older users plays an important role. The advantages and disadvantages of a technical system must be made transparent, so that each individual user can decide what added value the system's installation brings for them. Depending on their technical biographies, older people tend to react more sluggishly to new technological developments than younger people, because they must devote more time to learning new technologies (Lamsfuß 2012). For this reason, a large number of senior citizens initially consented to take part in the trial of the Patronus system because they had a lot of faith in the social institutions and their employees. This underlines the importance of enthusing employees about project proposals and the associated technical installation. Employees who are sceptical about a system convey that scepticism to the user consciously or unconsciously. Alongside reliable support in the test surroundings, previous experiences with technology installation play an important role. Residents who had already had bad experiences with technology installation in their homes were rather sceptical about the system. Comprehensive explanations of the system, for example in the context of information events, continual communication with the residents and corresponding transparency concerning the functionality of the system could lead to the users successfully completing the live test. Here, transparency on purchase costs and how they would be split was also important.

Tip:
Clarify the following questions and themes:

- *Organisation installation*: How complex will the system installation be? Define responsibilities. Establish a project manager. Get an installation timetable from the project manager.
- *Communication with residents*: Provide transparency. Clarify all essential themes. Cover things that are supposedly obvious. When is the system in active mode? Who reacts how to what (for example, system failure with emergency call triggering)? Who is the contact person for which areas?
- *Information materials*: Leave information materials in the user's home. Draw their attention in particular to contact people. Appeal to visitors as well in the information materials and explain to them any rules of conduct or restrictions on informational self-determination.
- *Costs*: Clarify early on what the costs are and who will pay them. These include, for example, conversion measures, energy supply and maintenance. Is the purchase price part of the investment costs or is it possible to get the care insurance to take on these costs?
- *Test function*: Make the system accessible by, for example, integrating a test mode like those found in smoke detectors. It's important for the residents to be able to reassure themselves that the system is working at any time—especially if it's a security system designed to be as unobtrusive as possible.

8.4   Conclusion

Thanks to the experience of this project, recognition is growing that technical as well as non-technical innovations should be founded on professional and ethical reflection as well as critical and open communication. Take your time. Speak to the people involved. Look for the small solutions that make a difference in everyday life—then you will automatically stumble upon the big challenges.

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