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Geraedts, RP; van der Voordt, DJM

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The New Transformation Meter;
A new evaluation instrument for matching the market supply of vacant office buildings and the market demand for new homes

Rob Geraedts [1]
Theo van der Voordt [2]

[1] Associate Professor, Delft University of Technology, Faculty of Architecture, PO Box 5042, 2600 GA Delft, The Netherlands, r.p.geraedts@tudelft.nl

[2] Associate Professor, Delft University of Technology, Faculty of Architecture, PO Box 5042, 2600 GA Delft, The Netherlands, D.J.M.vanderVoordt@tudelft.nl

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Abstract
It is important to have an effective means of determining the transformation potential of office buildings that are unoccupied or are likely to become unoccupied in the near future. We need to be able to measure this transformation potential both at location and at building level, and it will be convenient to be able to carry out both a quick, superficial appraisal (which we may call a 'quick scan') and a more thorough, detailed study (a 'feasibility scan'). To this end, we have developed what we call a 'transformation potential meter' (Geraedts and Van der Voordt, 2000, 2003). The meter has been tested in practice by a number of market players, and has also been widely used by students of architecture who are nearing the end of their degree course. As befits good students, they have subjected the instrument to critical appraisal. This practical application has allowed the transformation potential meter to be evaluated and refined in 2006. Two new steps - the financial feasibility scan and the risk assessment checklist – have also been added to permit further investigation of the feasibility of a transformation project. In this paper, we describe the principle of the new transformation potential meter and its position in the Go/No Go decision-making process in the initial phase of a transformation project.

1. The transformation prospects of unoccupied office buildings
According to experts from the world of professional practice, the transformation prospects of the current offering of office buildings depend primarily on the following three factors:

1 Duration of vacancy: The longer an office building is unoccupied, the readier the current owner will be to convert it so that it can be used for another purpose.

2 Reason for vacancy: market, location or building: When an office building is unoccupied because of market factors, transformation would not seem to be an attractive option from the owner's viewpoint if the market is strengthening. If the location is unsuitable for office purposes and/or the building does not meet (or no longer meets) the requirements for office use, transformation may be a good idea. If the vacancy is due to building-related factors, the transformation potential is highly dependent on the extent to which the building can be converted by design interventions into an attractive residential property meeting the requirements and wishes of local target groups. Financial feasibility and permission to modify the zoning plan are critical factors for success in this context.

3 *Municipal policy:* When the office building in question lies in an area that has been prioritised for residential use by the municipal authorities, transformation into residential housing would seem to be an obvious solution since this is in line with municipal policy. If on the other hand the building is in an area earmarked for (re)development for office use, renovation and reuse for office purposes would seem to be more appropriate.

2. Demand for housing

Transformation of unoccupied offices into housing only makes sense if the dwelling units produced meet a need. The supply must be in line with the demand, as regards both the location – which should be a residential environment – and the features of the building (an office building will in general be converted into a block of flats comprising individual dwelling units). Since nearly a quarter of people looking for housing are under 25 (including many students), transformation into low-cost accommodation may be a good choice. Where high-rise office buildings are concerned, transformation into accommodation for families with young children is less appropriate. Conversion into flats for senior citizens might be a good choice here. Tests of the ability of a transformed building to meet the desires and preferences of potential target groups may be based on the results of various studies of the factors determining the choice of dwelling (see e.g. De Jong, 1997; Priemus, Wassenberg and Van Rosmalen, 1995). Where possible and appropriate, such studies differentiate between the various target groups concerned. The type and size of the housing, an attractive, safe dwelling environment and affordability are important criteria for all target groups. The main differences concern such matters as price and quality level, preference for a family house or a flat, and the desire to live in a lively environment with plenty of facilities or in a more peaceful environment.

Table 1 Relevant Aspects on Demand Side Residential Accommodation

Location (dwelling environment)	Building (residential)
1. Tone a. Nature of built environment b. Social image c. Liveliness d. Amount of green space	1. Dwelling type 2. Access 3. Dwelling size a. Number of rooms b. Living room c. Kitchen d. Bedrooms e. Sanitary facilities f. Storage space
2. Amenities a. Shops b. Restaurants, bars etc. c. Schools d. Bank/Post Office e. Medical facilities f. Recreative facilities	4.Arrangement of dwelling 5. Level of facilities 6. Outside space (garden etc.) 7. View from dwelling + privacy 8. Evnironmental aspects a.Heating b. Ventilation c. Noise d. Exposure to sun and daylight e. Energy consumption f. Materials used
3. Accessibility public transport a. Distance to bus stop b. Frequency and times c. Distance to tram or underground d. Frequency and times e. Distance to railway station f. Frequency and times	
4. Accessibility by car a. Distance to motorway b. Congestion level c. Parking facilities	9. General conditions a. Accessibility b. Safety c. Flexibility d. Adequate management
	10.Costs a. Purchase price/rent b. Other costs

If one wishes to use a Quick Scan to determine whether an unoccupied (office) building is suitable for transformation to residential accommodation for one or more specific target groups, a demand profile must first be created for each target group. This is also necessary when looking for a suitable building for a specific target group. The five target-group profiles shown in Table 2 have been defined on the basis of the dwelling preferences of the persons concerned.

Table 2 Five Target-group Profiles with dwelling preferences for inner-city transformations

Target group 1: Starters Young, low-income singles Shared accommodation
Location (dwelling environment)
1. Urban environment 2. Plenty of amenities
Building (features of dwelling)
3. Unit in group of 3-7 occupants 4. Bedsit, average 22 m2 5. Shared sanitary facilities 1 shower/toilet per 4 units 6. Shared kitchen with table for meals 7. Shared outside space (garden, etc.) 1.5 m2/unit 8. Shared cycle storage 9. Shared washroom 10. Total 50 m2; useful floor area 35 m2
Costs
11. Max. rent 160 - 220 Euro

Target group 2: Starters Young, low-income singles Semi-independent accommodation
Location (dwelling environment)
1. Urban environment 2. Plenty of amenities
Building (features of dwelling)
3. Semi-independent unit with shared facilities 4. Bedsit, average 22 m2 5. Sanitary facilities for 2 persons 6. Kitchen for 2 persons 7. Shared outside space (garden, etc.) 1.5 m2/unit 8. Shared cycle storage 9. Shared washroom 10. Total 50 m2; useful floor area 35 m2
Costs
11. Max. rent 220 - 320 Euro

Target group 3: Young, two-income Young couples with two incomes
Location (dwelling environment)
1. Urban environment 2. Plenty of amenities 3. Suburban (more space, green) 4. Easily accessible by car 5. Good parking facilities
Building (features of dwelling)
6. Big luxury flat 7. Own outside space (garden, etc.)
Costs
8. Max. rent 550 - 750 Euro 9. ditto 750 - 1000 Euro for top flat 10. Purchase 100,000 - 200,000 Euro

Target group 4: Senior citizens 55+ Low to modal income
Location (dwelling environment)
1. Safe dwelling environment (social safety) 2. Shops, daily amenities and public trans- port within walking distance (<500 m) 3. Urban environment 4. Suburban (more space, green)
Building (features of dwelling)
5. Preferably not on ground floor 6. With lift in building 8. Preferably not with internal staircase 8. At least 3 rooms 9. Living room 25 - 30 m2; bedroom > 11.5 m2 10. Direct link living room, bedroom, bathroom 11. Extra attention to acoustic insulation 12. Adaptable for disabled occupants
Costs
13. Max. rent 400 Euro 14. Purchase 75,000 - 110,000 Euro

Target group 5: Senior citizens 55+ Above-modal income
Location (dwelling environment)
1. Safe dwelling environment (social safety) 2. Shops, daily amenities and public trans- port within walking distance (<500 m) 3. Easily accessible by car 4. Good parking facilities
5. Some like urban, some like suburban
Building (features of dwelling)
6. Preferably not on ground floor 7. With lift in building 8. Preferably not with internal staircase 9. Access via entrance hall, not via gallery 10. 4 - 5 rooms 11.Living room 30 - 40 m2; big kitchen 12. Direct link living room, bedroom, bathroom 13. Amply sized bathroom 14. Balcony or roof garden 10 - 15 m2 15. Extra attention to acoustic insulation 16. Adaptable for disabled occupants
Costs
17. Rent 550 - 1100 Euro 18. ditto > 1100 Euro for top flat 19. Purchase 110,000 - 500,000 Euro

3. The New Transformation Potential Meter

The information collected about the transformation prospects, the housing requirements of potential occupants and the target-group profiles has been used as a basis for a number of checklists that can be used to appraise the potential of the stock of unoccupied office buildings for transformation into residential housing. This appraisal takes place in a number of steps, from more superficial to more detailed and specific. Step 0 is the inventory of the unoccupied office space. Step 1 is a Quick Scan of the transformation potential of this stock, with reference to a limited number of veto criteria which fall under the headings Market, Location, Building and Organisation. Failure of a building to meet these criteria means that it does not have sufficient transformation potential and thus leads to a NO GO decision. Step 2 is a more detailed feasibility scan, which shows with reference to appropriate criteria which features of the location and the building lend themselves to transformation and which do not. This then leads in step 3 to the assignment of an overall score expressing the transformation potential of the building(s) in question on

a scale varying from non-transformable to highly suitable for transformation. Depending on the results, this leads either to a NO GO decision or to further refinement of the feasibility study in two subsequent phases: step 4 (financial feasibility scan) and step 5 (risk assessment checklist). Depending on the nature of the project involved, step 5 may come before step 4. The transformation potential meter is particularly intended for use in the initial phase of the plan development process, from the first quick scan to the taking of a well-based decision as to whether or not to proceed with the project.

Table 3 The various steps of the New Transformation Potential Meter

Step	Action	Level	Outcome
Step 0	Inventory market supply of unoccupied offices	Stock	Location of unoccupied offices
Step 1	Quick Scan: initial appraisal of unoccupied offices using veto criteria	Location Building	Selection or rejection of offices for further study; GO / NO GO decision
Step 2	Feasibility scan: further appraisal using gradual criteria	Location Building	Judgement about transformation potential of office building
Step 3	Determination of transformation class	Location Building	Indicates transformation potential on 5-point scale from very good to NO GO
Further analysis (optional, and may be performed in reverse order if so desired):			
Step 4	Financial feasibility scan using design	Building	Indicates financial/economic feasibility Sketch and cost-benefit analysis
Step 5	Risk assessment checklist	Location Building	Highlights areas of concern in transformation plan

Step 0: Inventory of supply at district level

Before starting to use the transformation potential meter proper, an inventory should first be taken of the market supply of office buildings in a given municipality that have been unoccupied in the long term or may be expected to become unoccupied in the near future. Information for this purpose may be obtained from literature surveys, data from estate agents or the investigator's own observations. If adequate information is already available about a given unoccupied building, this step can be skipped.

Step 1: Quick Scan; first impression, evaluation with aid of veto criteria

The instrument offers the user the possibility of performing a quick initial appraisal of the transformation potential, which is not very labour-intensive and does not require much data. This quick scan makes use of eight veto criteria that fall under the headings Market, Location, Building and Organisation.

Table 4 Step 1 – The Quick Scan with the aid of Veto Criteria

STEP 1 QUICK SCAN: INITIAL ASSESSMENT USING VETO CRITERIA		
ASPECT	**VETO CRITERION**	**DATA SOURCE**
MARKET		
1 Demand for housing	1 There is no demand for housing from local target groups	Estate agent/municipality
LOCATION		
2 Urban location	2 Zoning plan does not permit modification 3 Serious public health risk (pollution, noise, odour)	Zoning plan/munic. policy Estate agent/on-site inspect.
BUILDING		
3 Dimensions of skeleton	4 Free ceiling height < 2.60 m	Estate agent/on-site inspect.
ORGANISATION		
4 Backer for transformation plan	5 There is no enthusiastic, influential backer	Local investigation
5 Internal veto criteria of property developer	6 Does not meet criteria for region/location/accessibility 7 Does not meet criteria on size and character of building	Property developer Property developer
6 Owner/investor	8 Not willing to sell office building	Owner

A veto criterion is a criterion which if satisfied (if the answer to the relevant question is 'Yes') leads to immediate rejection of the idea of transforming the office premises in question into residential accommodation. Further detailed study is then no longer necessary. This is thus an effective means of picking out promising candidates for transformation quickly from the overall potential market.

The veto criteria apply to all target groups. Veto criteria 2 and 3 at location level concern the situation of the building within the urban fabric. If for example the office building is located on an industrial site where serious public-health hazards have been discovered, or if the municipal authorities do not allow any modification of the zoning plan at this location, there is little point in taking the investigation of the transformation potential any further.

Step 2: Feasibility scan based on gradual criteria

If the results of the Quick Scan indicate that there is no immediate objection to transformation (no single question is answered 'Yes'), the feasibility of transformation can be studied in greater detail with reference to a number of 'gradual' criteria, i.e. criteria that do not lead to a GO / NO GO decision but that express the transformation potential of the building in question in terms of a numerical score. Taken together, these criteria allow a more rounded picture to be built up of the feasibility of the transformation project under consideration.

Table 5 Step 2a – Appraisal of suitability of an office building for transformation to residential housing with reference to features of its location

STEP 2 FEASIBILITY SCAN USING GRADUAL CRITERIA			
LOCATION			
ASPECT	**GRADUAL CRITERION**	**DATA SOURCE**	**Appr Yes**
FUNCTIONAL			
1 Urban location	1 Building in industrial estate or office park far from town centre	Town map	
	2 Building gets little or no sun	On-site inspection	
	3 View limited by other buildings on > 75% of floor area	On-site inspection	
2 Distance and quality of amenities	4 Shops for daily necessities > 1 km.	On-the-spot investigation	
NB:	5 Neighbourhood meeting-place (square, park) > 500 m.	ditto	
The quality of amenities can be described	6 Hotel/restaurant/snackbar > 500 m.	ditto	
in terms of number, variety and level	7 Bank/Post Office > 2 km.	ditto	
of services provided.	8 Basic medical facilities (practice, health centre) > 5 km.	ditto	
	9 Sports facilities (fitness, swimming pool, sports park) > 2 km.	ditto	
	10 Education (from kindergarten to university) > 2 km.	ditto	
3 Public transport	11 Distance to railway station > 2 km.	Town map	
	12 Distance to bus/underground/tram > 1 km.	Map or transport services	
4 Accessibility by car and parking	13 Many obstacles; traffic congestion	On-the-spot investigation	
Obstacles: narrowing of road, speed bumps, bridge	14 Distance to parking sites > 250 m.	Inspection/new design	
Congestion: 1-way traffic, no parking, tailbacks	15 <1 parking space/100 m2 road surface	Inspection/new design	
CULTURAL			
5 Tone of neighbourhood	16 Situated on or near edge of town (e.g. near motorway)	Map or estate agent	
NB:	17 No other buildings in immediate vicinity	Map or estate agent	
Assessment depends on target group, e.g.:	18 Dull environment	On-the-spot investigation	
young people not in monofunctional neighbourhood	19 No green space in neighbourhood	On-the-spot investigation	
55+ not on edge of town	20 Area has poor reputation/image; vandalism	Inspection and local press	
	21 Dangerous, noise or odour pollution (factories, trains, cars)	On-the-spot investigation	
LEGAL			
6 Urban location	22 Noise load on façade > 50 dB (limit for offices 60dB)	Municipal authorities	
7 Ownership of ground	23 Leasehold	Estate agent	

The feasibility scan at location level (Table 5) comprises 7 main criteria, subdivided into functional, cultural and legal aspects, and 23 sub-criteria. The feasibility scan at building level (Table 6) comprises 13 main criteria, subdivided into functional, technical, cultural and legal aspects, and 13 sub-criteria. An answer 'Yes' to any question indicates somewhat lower suitability for transformation – though not severe enough for out-and-out rejection. At the end of the scan, the Yes's are added up to obtain the overall transformation potential score – the lower the better. This is described under step 3 below. It may be noted that the criteria vary somewhat, depending on the target group under consideration. For example, students will prefer to live in the city centre where there is more night life, while young families with children will tend to opt for a peaceful suburban environment.

Table 6 Step 2b - Appraisal of suitability of an office building for transformation to residential housing with reference to features of the building itself

BUILDING			
ASPECT	**GRADUAL CRITERION**	**DATA SOURCE**	**Appr Yes**
FUNCTIONAL			
1 Year of construction or renovation	1 Office building recently built (< 3 years)	Year of construction	
	2 Recently renovated as offices (< 3 years)	Year of renovation	
2 Vacancy	3 Some office space still in use	e.g. NEPROM	
	4 Building unoccupied < 3 years	ditto	
3 Features of new dwelling units	5 ≤ 20 -person units (50 m2 each) can be made	≤ 1000 m2 useful area	
	6 Layouts suitable for local target groups can't be implemented	Design sketch	
4 Extendability	7 Not horizontally extendable (neighbouring buildings)	On-the-spot investigation	
	8 No extra storeys (pitched roof; insufficient load-bearing cap.)	On-the-spot investigation	
	9 Basement cannot be built under building	Inspection and/or estate agent	
TECHNICAL			
5 Maintenance	10 Building poorly maintained/looks in poor condition	External visual inspection	
6 Dimensions of skeleton	11 Office depth < 10 m	Estate agent or inspection	
Module of façade determines placing of walls	12 Module of support structure < 3.60 m	On-site or estate agent	
	13 Distance between floors > 6.00 m	On-site or estate agent	
7 Support structure (walls, pillars, floors)	14 Support structure is in poor/hazardous condition	On-site inspection	
8 Façade	15 Can't be made to blend with surroundings or module > 5.40 m	On-site or estate agent	
External spaces dependent on target group	16 Façade (or openings in façade) not adaptable	On-site inspection	
Protected monuments: limits on adaptation	17 Windows cannot be reused/opened	Inspection/new design	
9 Installations	18 Impossible to install (sufficient) service ducts	Inspection/new design	
CULTURAL			
10 Character	19 No character in relation to surrounding buildings	On-site inspection	
cf. Location, 'Tone of neighbourhood'	20 Impossible to create dwellings with an identity of their own	Inspection/new design	
11 Access (entrance hall/lifts/stairs)	21 Unsafe entrance, no clear overview of situation	Inspection/new design	
LEGAL			
12 Environment	22 Presence of large amounts of hazardous materials	On-site or municipality	
Exposure to sunlight, air and noise	23 Acoustic insulation of floors < 4 dB	Inspection/new design	
pollution, hazardous materials	24 Very poor thermal insulation of outer walls and/or roof	On-site or municipality	
	25 < 10% of floor area of new units gets incident daylight	On-site inspection	
13 *Requirements of Bouwbesluit (Dutch official regulat*	26 No lifts in building (> 4 storeys), no lifts can be installed	On-site or estate agent	
and standards for the building industry)	27 No (emergency) stairways	Inspection/new design	
concerning access and escape route	28 Distance of new unit from stairs and/or lift ≥ 50 m	Inspection/new design	

Step 3: Determination of the transformation class

The results of the feasibility scan can be used to calculate a transformation-potential score for the building in question, on the basis of which the building can be assigned to one of five transformation classes ranging from ‘ideal for transformation’ to ‘not suitable for transformation’.

Total number of Yes's (Location):	8	x	Total number of Yes's (Building):	11	x
Default weighting:	5	=	Default weighting:	3	=
Score (Location):	40	A	Score (Building):	33	B
Max. possible score (23x5):	115		Max. possible score (28x3):	84	

Fig. 1 The total transformation-potential scores at Location and Building level are determined by multiplying the number of Yes’s in the Appraisal column by the default weighting factor

The total scores for the location and the building are determined by multiplying the number of Yes’s in the respective tables by a weighting factor, which has provisionally been chosen as 5 for the location and 3 for the building to reflect the greater relative importance of the location in these considerations. The maximum possible score for the location is thus 23 x 5 = 115, and that for the building 28 x 3 = 84, to give a grand total of 115 + 84 = 199 (see Fig. 1). The minimum score is zero, which would indicate that no single feature of the location or the building is considered unsuitable for transformation. On the basis of the transformation-potential score, the building can be assigned to one of five Transformation classes. Buildings in Transformation Class 1 (score lower than 40), are highly suitable for transformation to residential accommodation, while those in Class 5 (score higher than 161) are totally unsuitable for transformation. All five Transformation classes are given in Table 7.

Table 7 Transformation classes for office buildings; in the example shown, a total score of 77 corresponds to Transformation class 2 (transformable)

STEP 3: DETERMINATION OF TRANSFORMATION CLASS OF OFFICE BUILDING			
Transformation score Location + Building = 0 - 40	Transformation class 1: Excellent transformability	Total Score A + B:	77
Transformation score Location + Building = 41 - 80	Transformation class 2: Transformable	Max. Score Location + Building	
Transformation score Location + Building = 81 - 120	Transformation class 3: Limited transformability	= 115 + 84 =	199
Transformation score Location + Building = 121-160	Transformation class 4: Very poor transformability		
Transformation score Location + Building = 161-199	Transformation class 5: Not transformable	TRANSFORMATION CLASS:	2

Determination of the transformation class of a building completes the first three steps of the transformation potential measurement. If the results indicate that the building lends itself to transformation (i.e. that it falls into transformation class 1 or 2), the analysis can continue in two additional steps, aimed at studying the financial feasibility of the transformation project and carrying out a risk assessment for use in further planning.

Step 4: Financial feasibility scan

If the transformation project is not financially feasible, there is no point in taking the plans any further. The financial feasibility depends among other things on the acquisition costs, the current condition of the building, the amount of renovation or modification work required, the number of dwelling units that could be created in the building and the project yield in the form of rental income and/or sales prices.

In order to determine the financial feasibility, answers must be obtained to a number of questions concerning both the project costs and the expected revenue. On the revenue side, we need to know how many dwelling units can be created and for what target groups they are intended. These questions can only be answered if a sketch has been made of the intended layout of the building after transformation. The financial feasibility can be raised by increasing the size of the building, e.g. by adding extra storeys on top, or by the inclusion of commercial functions alongside the residential ones.

On the expenses side, it is necessary to know the acquisition costs for the premises, including the cost of the ground. Building and installation costs are also an important factor. What is the current condition of the building? Which parts can be reused, and which will have to be demolished? What is the ratio of façade surface area to gross floor area (GFA)? To what level should the building be finished? To what extent can the existing stairways, lifts and other means of access and façade proportions be maintained?

Table 8 Expected investment costs per dwelling unit and per m2 GFA for student accommodation created by transformation of office buildings (ref. Stadswonen Rotterdam, index April 2006)

Type of construction project		Type of budget	Costs per unit	Costs per m^2 GFA
Transformation	Much demolition and modification	Acquisition budget for student unit	10,000 - 15,000	
		Residual budget for renovation costs	27,000 - 33,000	540 - 660
	Much reuse (including façade)	Acquisition budget for student unit	20,000 - 25,000	
		Residual budget for renovation costs	21,000 - 26,000	420 - 540
New construction		Student unit	36,000 - 39,000	720 - 780
		Social housing		890 - 970
		Luxury flat		1.100

Table 8 gives some key figures that can be used for a quick cost-benefit analysis based on initial design

sketches. It shows the estimated range of total investment costs (acquisition and building costs) for the transformation of existing (office) buildings to student accommodation, per dwelling unit and per m2 of GFA, compared with the costs of comparable new buildings. After a rough cost-benefit analysis has been made on the basis of a sketch of the way in which various dwelling types and lay-outs can be fitted into the existing office building, these data can be used as input for the development plans of the property developer.

Step 5: Risk assessment checklist

When the Quick Scan indicates that the office building in question has transformation potential at both the location and the building level and the results of the initial financial feasibility analysis are also encouraging, work may proceed on the subsequent development phases. It is of great importance to be aware of the possible bottlenecks and risks that can occur during this process. Two checklists, based on experience gained in a large number of projects, that can prove useful in this context have been developed.

4. Conclusions

Practical trials of the Transformation potential meter in practice have revealed its utility for mapping the potential of given office buildings for transformation into residential accommodation in a number of steps from global to more detailed. It was found, however, that a number of veto criteria included in the original version of the meter were too stringent. Some buildings that failed to pass these criteria on paper were found in practice to lend themselves well to transformation to residential accommodation. For example, a project size of less than 20 dwelling units (2000 m2), a building that was still partially occupied, a duration of vacancy of less than three years or an age of less than three years for the building in question were not necessarily reasons for rejecting the idea of transformation. It was moreover found to be highly desirable to combine the first three stages of the Transformation potential meter (Quick Scan, feasibility scan and determination of transformation class) with a financial feasibility scan and a risk assessment (the readiness of the municipal authorities to approve any changes in the zoning plan required for success of the project is one of the points that needs to be thoroughly explored in advance in this context). Additional literature review is required to cover the international state of the art of the topic discussed in this paper.

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