Example

Suppose that a developer who owns a vacant office building has worked with an architect to convert the vacant office into a mixed-use building by incorporating residential apartments, shops, and co-working spaces into the building configuration. After exploring the CBA strategies included in the CBA-AR framework, they selected 21 strategies to implement in the project, and therefore, they incorporated these strategies into the plan and definitive design of the project. Following are the selected strategies along with their practical solutions (examples):

- **Design standardization** (of doors and windows).
- **Separation of the building layers** (by using dry connections in all services, installations, and fit-outs).
- **Providing an open space** as a co-working area on the first floor.
- **Providing a multi-purpose hall** on the ground floor.
- **Modularizing the configuration of spaces** and layout of MEPs.
- **Utilization of standardized building products** (MEP fixtures, wall panels, and office fit-outs)
- **Providing two cores for building services** (elevators and MEPs).
- **Design for surplus capacity** by oversizing the heating system and providing a rooftop extension
- **Compartmentalization of design** by dividing the floor plan horizontally into independent zones with their own MEP supply and other services.
- **Design for mixed-use** by using high-quality façade materials, oversizing the MEPs and providing residential and commercial uses within the building function.
- **Utilization of biobased (biological) materials** by using bio-based wall panels and desks.
- **Utilization of circular materials/products** by using reusable glass panels and frames.
- **Alignment of the interconnection between the floor plans** by coordinating and connecting all floors by a stair and elevator.
- **Alignment of the building design with the real estate strategy** by including different functions in the buildings as a means to diversify organizational income.
- **Utilization of dismountable building components** by using demountable lighting fixtures, demountable ceilings, demountable partitions, and PnP cubicles.
- **Provision of shareable spaces** by providing a shareable lounge and seating area in the building.
- **Utilization of renewable energy technologies** by using façade and rooftop PVs and geothermal heat pumps.
- **Procurement of the service of building products** by leasing the new elevators.
- **Selective dismantling** by selectively dismantling old curtain walls.
- **Sending back the** selectively dismantled curtain walls for **reuse**.
- **Implementation of proactive maintenance** of the MEP systems by adopting a maintenance program for all MEPs

In this example, the developer and architect would fill out the worksheet as shown in the following pages, and thereby, they determined the promotion of CBA, considering the corresponding building layers and R-measures from the R-ladder model. The 10 determinists of CBA have been promoted through four layers of the shearing layer model. Reflecting on the R-ladder model, the architect and developer have been able to achieve a high level of circularity, as 16 out of the 21 CBA strategies are exclusively related to the so-called smarter product use and manufacture

Strategies for Circular Building Adaptability in Adaptive Reuse		Phase to implement	Related Layer(s) S1. Site S2. Structure S3. Skin S4. Services S5. Space S6. Stuff	Examples	Related Rs from the R-ladder R0 Refuse R1 Rethink R2 Reduce R3 Re-use R4 Repair R5 Refurbish R6 Remanufacture R7. Repurpose R8 Recycle R9 Recover	Determinants of Circular Building Adaptability											S3. Skin	S4. Services	S5. Space	S6. Stuff
						Adaptability Determinants			Interrelated Determinants				Circularity Determinants								
						Functional Convertibility	Volume Scalability	Asset Refit-Ability	Configuration Flexibility	Product Demountability	Asset Multi-Usability	Design Regularity	Material Reversibility	Building Maintainability	Resource Recovery					
Passive Strategies	1. Design Standardization	Design	S4, S5. S6	Consisted use of walls, doors and windows	R2				X	X		X				✓			Doors and windows	
	2. Separation of the Building Layers (e.g. Separated Walls)	Design	S3, S4, S5, S6	Partitions are independents connected by dry connections	R2		X		X	X						✓		Dry connections	Dry connections	Dry connections
	3. Open the Floor Plan	Design	S5	Open office space	R2		X		X							✓			Open co-working space on the FF	
	4. Provision of Multi-Purpose Spaces	Design	S5	Spaces that can be used as offices and meeting rooms	R1						X					✓			Multi-purpose hall	
	5. Modularization of Spatial Configuration (Layout)	Design	S4, S5	Unitized and repetitive pattern of rooms	R2	X						X				✓		The layout of MEP systems is regular	Modular configuration of offices	
	6. Utilization of Standardized Building Products	Design	S4, S5. S6	Using standardized doors, ceilings and partitions throughout the building	R2							X	X			✓		Standardized MEP fixtures	Standardized wall panels	Standardized office fit-outs
	7. Provision of a Core for Building Services	Design	S5	Central area providing an elevator and a shaft	R2	X										✓			Two cores accommodating lifts and MEPs	
	8. Design for Surplus Capacity	Design	S3, S4, S5	Oversizing spaces and systems	R1 and R0	X	X	X								✓		Oversizing the heating system	Rooftop extension	
	9. Compartmentalization of Design	Design	S4, S5	The building is divided into independent zones	R1	X		X								✓		Each floor has its own MEP supply	The floor are independent from each other	
	10. Design for a Mixed Use (Multifunctionality)	Design	S3, S4, S5, S6	The building includes and can accommodate different function	R1	X										✓	High quality façade materials	Oversizing the MEPs	Residential and commercial spaces	
	11. Utilization of Secondary (Reused/Recycled) Materials/Products	Design	S4, S5. S6	Using second hand furniture	R3 and R8								X		X					
	12. Utilization of Biobased (Biological) Materials	Design	S3, S4, S5. S6	Using timber-based products	R2								X		X	✓			Bio-based panels	Bio-based tables
	13. Utilization of Circular (Reusable/Recyclable) Materials/Products	Design	S3, S4, S5. S6	Glass panels can be reused and recycled at the end of their use	R2								X			✓			Reusable glass panels and frames	
	14. Alignment of the Interconnection Between the Floor Plans	Design	S5	Horizontal zones are vertically coordinated with other zones through circulation means	-		X									✓			All floors are connected by a stair and elevator	
	15. Alignment of the Building Design with the Real Estate Strategy	Design	S5	The building horizontal zones are coordinated with other zones	-				X							✓			Different functions are incorporated to diversify income	

Legend

R0- R2 = Smarter product use and manufacture

R3- R7 = Extend life of product and its parts

R8- R9 = Useful application of materials

Strategies for Circular Building Adaptability in Adaptive Reuse		Phase to implement	Related Layer(s) S1. Site S2. Structure S3. Skin S4. Services S5. Space S6. Stuff	Examples	Related Rs from the R-ladder R0 Refuse R1 Rethink R2 Reduce R3 Re-use R4 Repair R5 Refurbish R6 Remanufacture R7. Repurpose R8 Recycle R9 Recover	Determinants of Circular Building Adaptability														
						Adaptability Determinants			Interrelated Determinants				Circularity Determinants							
						Functional Convertibility	Volume Scalability	Asset Refit-Ability	Configuration Flexibility	Product Demountability	Asset Multi-Usability	Design Regularity	Material Reversibility	Building Maintainability	Resource Recovery	YES/ NO	S3. Skin	S4. Services	S5. Space	S6. Stuff
Active Strategies	16. Utilization of Adjustable Building Products/ Components to Users	Design and use	S4, S5. S6	Folding walls and adjustable office desks	R0 and R1		X		X											
	17. Utilization of Dismountable Building Components	Design and Use	S4, S5. S6	Demountable walls and cubicles	R1		X	X	X	X			X			✓		Demountable lighting fixtures	Demountable ceiling and partitions	PnP cubicles
	18. Provision of Shareable Spaces	Design and Use	S5	Shareable meeting rooms, shareable kitchens and shareable lounge	R1						X					✓			Sharable lounge and seating area	
	19. Utilization of Renewable Energy Technologies	Design and Use	S3, S4	PV panels and PVT panels	R2										X	✓	Façade and rooftop PV	Geothermal heat pumps		
	20. Enabling the Use of Natural Lighting/Ventilation	Design and Use	S3, S4	Windows are accessible and can ease the use of natural lighting and ventilation	R2										X					
	21. Utilization of Flexible and Integrated Installations (e.g. Integrated MEPs, Plug-and-Play)	Design and Use	S4, S5	Integrated wall partitions that bring together different systems (e.g. acoustical insulations and electric connections)	R1			X	X			X								
	22. Utilization of Water Recovery System	Design and Use	S4	Using system that collects and treats the used water to be used for other purposes	R2 and R3										X					

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						Functional Convertibility	Volume Scalability	Asset Refit-Ability	Configuration Flexibility	Product Demountability	Asset Multi-Usability	Design Regularity	Material Reversibility	Building Maintainability	Resource Recovery	YES/ NO	S3. Skin	S4. Services	S5. Space	S6. Stuff
Operational Strategies	23. Provision of Shareable Facilities	Design and Use	S4, S6	Shareable office machines	R1						X									
	24. Application of (or update of) Material Passports	Design, Use Construction	S3, S4, S5, S6	Recording the performance and properties of all used products	R0					X			X	X						
	25. Procurement of the Service of Building Products	Design and Use	S3, S4, S5, S6	Leasing elevators, lightings, façade, or fit outs as a service	R1			X			X		X	X		✓		Leasing elevators		
	26. Selective Dismantling	Design, Use Construction	S3, S4, S5, S6	Removing old walls, part by part, to avoid inflicting damage	R3 and R6								X			✓	Selective dismantling of curtain walls			
	27. Send Back Discarded Material for Reuse/Recycling	Design, Use Construction	S3, S4, S5, S6	Send back decorticated ceiling tiles for recycling or reuse	R3, R7 and R8								X			✓	Sending back the old curtain walls for resue			
	28. Repurpose Old Building Materials/Products	Design and Construction	S4, S5. S6	Repurposing old timber in other forms of finishes	R7								X							
	29. Product Exchange	Design	S4, S5. S6	Exchanging old products with providers of second hand products	R2 and R3						X		X							
	30. Implementation of Proactive/ Predictive Maintenance	Use	S3, S4, S5	Implementation of a proactive maintenance of the MEP systems	R4									X		✓		Adopting MEP maintenance program		
	31. Repair of Old Building Components/Systems	Design and Construction	S3, S4, S5	Repairing old storing cabinets	R4 and R5									X						
	32. Preservation of Monumental/Old Parts	Design and Construction	S3, S4, S5,S6	Preservation of monumental finishes, doors and windows	R4 and R5								X	X						
	33. Utilization of Rented-Second-Hand Products	Design and Use	S5, S6	Leasing second hand office fit outs	R3				X				X							

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