

# Health, well-being and a sustainably built environment: From the new research area of psychology of sustainability and sustainable development to innovation in architectural research

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*Riassunto*

Il ruolo del progettista, dalla scala urbana a quella architettonica, può essere determinate nella promozione sia di stili di vita attivi che di scenari e ambienti in armonia con il benessere psicologico dell'essere umano, con la progettazione di quartieri, strade e spazi aperti ma anche nella realizzazione di edifici. Fulcro dell'articolo è il tema dello sviluppo sostenibile dell'ambiente antropizzato. Dalla sostenibilità di luoghi ed edifici spesso solo apparente, per tecnologie edilizie avanzate e rispetto delle normative, si impone una nuova ridefinizione di sostenibilità in architettura, con nuovi scenari e paradigmi. La nuova sensibilità progettuale richiede un ragionamento organico complessivo multiprospettico, ancorato anche alle recenti acquisizioni psicologiche in tema di salute e benessere, e di psicologia della sostenibilità e dello sviluppo sostenibile.

*Abstract*

The role of the designer, from the urban to the architectural scale, can be determined in the promotion of both active lifestyles and scenarios and environments in harmony with the psychological well-being of the human being, with the design of neighbourhoods, streets and open spaces but also in the construction of buildings. The focus of the article is the theme of sustainable development of the urbanised environment. From the often only apparent sustainability of places and buildings, to advanced building technologies and compliance with regulations, a new redefinition of sustainability in architecture is required, with new scenarios and paradigms. New design sensitivity requires overall organic multi-perspective reasoning, anchored also to the recent psychological acquisitions on health and well-being, and the psychology of sustainability and sustainable development.

*Parole chiave:*

salute; città in salute; sostenibilità urbana; ambiente costruito; architettura sostenibile; design sostenibile.

*Keywords:*

health; healthy city; urban sustainability; built environment; sustainable architecture; sustainable design.

## Introduction

The 21<sup>st</sup> century is characterized by complexity (Landy & Conte, 2016), acceleration (Rosa, 2013), change and globalization (Blustein, Kenny, Di Fabio, & Guichard, 2018), with insecurity, economic instability and continuous turbulence. In this framework the health and well-being of individuals seems particularly at risk (Di Fabio & Kenny, 2016b).

Sustainability is an issue with a global impact and United Nations (2018) proposes the seventeen sustainable development goals as the main aims of the Agenda 2020-2030. In September 2015 at an historic UN Summit world leaders adopted the 17 Sustainable Development Goals (SDGs) of the 2030 Agenda for Sustainable Development. These SDGs came officially in to force in 2016 with the Paris Agreement on climate that addresses the need to limit the rise of global temperatures.

These sustainable development goals referred to: no poverty; zero hunger; good health and well-being; quality education; gender equality; clean water and sanitation; affordable and clean energy; decent work and economic growth; industry, innovation, and infrastructure; reduced inequalities; sustainable cities and communities; responsible consumption and

production; climate action; life below water; life on land; peace, justice and strong institutions; partnership for the goals (United Nations, 2018). These goals highlighted the relevance to increase the possibility of progress, facilitating the development of individuals, families and communities, for a sustainable development in a sustainable world.

Good health and well-being represent a key sustainable development goal to reach good quality of life for everybody. The biopsychosocial model (Engel, 1977) in line with the definitions of health by World Health Organization (1947) pointed out the shift from health not simply considered as absence of illness but as optimal functioning. Actually, well-being is considered as a state of complete physical, mental, spiritual and social well-being rather than merely the absence of disease or infirmity" (World Health Organization, 1998; 2007). In the literature, following in details the review by Di Fabio (2014a; 2016; 2017a; 2017b), it is possible to distinguish between two forms of well-being: hedonic well-being (Watson, Clark, & Tellegen, 1988) and eudaimonic well-being (Ryan & Decy, 2001; Waterman et al., 2010). Hedonic well-being comprises an affective evaluation in terms of positive and negative affects (Watson et al., 1988) and a cognitive evaluation in terms of life satisfaction (Diener, Emmons, Larsen, & Griffin, 1985). Eudaimonic well-being concerns optimal functioning and self-realization (Ryan & Decy, 2001), life meaning and purposefulness (Waterman et al., 2010), and positive functioning (Ryff, 1989).

Psychology of sustainability and sustainable development is a new research area enriching the perspective with critical contribution to promote health and well-being (Di Fabio, 2017a; 2017b) and it is interesting to study in depth it to consider implications for architectural research too.

### **Psychology of sustainability and sustainable development**

Psychology of sustainability and sustainable development (Di Fabio, 2017a; 2017b; Di Fabio & Rosen, 2018) represents an innovative research area as recent contribution to the Sustainability Science (Rosen, 2009, 2013, 2017a, 2017b; Rosen & Abu Rukah, 2011; Rosen & Koohi-Fayegh, 2017; Dincer & Rosen; 2007; Komiyama, Takeuchi, Shiroyama, & Mino, 2011) and its trans-disciplinary configuration. The perspective of the Psychology of sustainability and sustainable development (Di Fabio, 2017a; 2017b) contributes to widen the concept of sustainability under many aspects, starting from not only seeing sustainability in terms of ecological and socio-economic environment (Brundtland Report, 1987) but also in terms of promotion of the well-being and quality of life of each human being.

The traditional perspective on sustainable development (Brundtland Report, "Our Common Future", 1987; Harris, 2003), centered on the 3 "E" of economy, equity, ecology, underlines the defence of the right of the future generations to enjoy the environment and natural resources as well as the current generations. In a psychological perspective sustainability is widened and it is viewed not only in terms of respect to the ecological and social environment but as psychological respect with the aim to promote well-being of all individuals and quality of life (Di Fabio, 2017b). Furthermore, the traditional definition of sustainability is centered on avoiding (exploitation, depletion, irreversible alteration) whereas an innovative definition of sustainability is centered on promoting (enrichment/equip, grow, flexible change, flourishing and well-being) (Di Fabio, 2017b).

Psychology of sustainability and sustainable development (Di Fabio, 2017a) introduces a complex vision on projects relative to natural, personal, social and organizational environments, also including the built environment, asking for reflexivity, meaning, purpose, for a sustainable development and well-being of people in the environments (Di Fabio, 2017a; 2017b). Following the author, in this new perspective, the construction and managing of a sustainable project is based not only on employing increasingly smaller amounts of resources but also on paying attention to regenerating resources. It is based on renewable resources, purifying and oxygenating processes, for the person and the environment and answers to the real construction of well-being with a process of regeneration (Di Fabio, 2017a; 2017b; Di Fabio & Rosen, 2018). In this framework a sustainable project is reachable, de-constructible, recoverable and includes oxygenating processes for promoting individual well-being for social well-being and sustainable development (Di Fabio, 2017b; Di Fabio & Rosen, 2018).

In a psychological framework the sustainability of the project calls for processes of reflexivity (Di Fabio, 2014b; Guichard, 2004; 2010) anchoring to the meaning in line with the innovative shift from motivational paradigm to meaning paradigm (Di Fabio & Blustein, 2016). In this perspective the meaningfulness plays a new and vital role for the real sustainability of a project (Di Fabio, 2017b). The projects are more sustainable if they are firmly rooted in a meaningful construction with coherence, direction, significance, and belonging (Di Fabio, 2017b; Di Fabio & Blustein, 2016). The meaning makes solid and really feasible every project increasing the person's involvement and the possibilities of the success and realization (Di Fabio, 2017b).

Sustainability and sustainable development is related to authentic meanings for people, also underling the relevance of connections, meaning and purpose (Di Fabio & Blustein, 2016), psychological respect, care and connectedness included the natural environment (Di Fabio, 2018; Di Fabio & Rosen, 2018).

### **Psychology of sustainability and sustainable development for well-being**

The acceptance of the extended definition of health not only centered on the absence of disease (World Health Organization, 1998, 2007) and of the distinction between hedonic well-being (Watson et al., 1988) and eudaimonic well-being (Ryan & Decy, 2001; Waterman et al., 2010) introduced a focus on healthy people (Di Fabio, 2014; 2016; 2017a; 2017b) as flourishing and resilient individuals and a focus on positive environment factors to promote health and well-being in a positive primary preventive perspective (Di Fabio & Kenny, 2015; 2016a; Hage et al., 2007; Kenny & Hage, 2009). This approach could be the reference for positive healthy societies and healthy cities, recognizing the relevance of designing healthy physical spaces sustaining well-being of people.

Designing healthy physical spaces could be considered a promising action in a positive primary prevention perspective (Di Fabio & Kenny, 2015, 2016a; Hage et al., 2007; Kenny & Hage, 2009). This positive prevention perspective is focused on enhancing individual resources to deal with the challenges of the current post-modern era increasing well-being of individuals (Di Fabio & Kenny, 2015; 2016a; Hage et al., 2007; Kenny & Hage, 2009). There is a shift from a more

traditional perspective based on the elimination of risks to a more innovative perspective centered on promotion of development and growth of positive resources (Di Fabio & Kenny, 2015; 2016a; Di Fabio & Saklofske, 2014a; 2014b).

In a positive primary preventive perspective the efforts to increase resources of individuals are fundamental aiming at building strengths (Di Fabio, 2016; Di Fabio, Kenny, & Claudius, 2016; Di Fabio, Kenny, & Minor, 2014).

The psychology of sustainability and sustainable development in a psychological framework (Di Fabio, 2017a; 2017b) strengthens a positive primary preventive perspective (Di Fabio & Kenny, 2015; 2016a) and helps to promote well-being. In this perspective the meaningfulness has an essential role for sustainability and sustainable development (Di Fabio, 2017a; 2017b; Di Fabio & Blustein, 2016), considering how it is possible to find meaning in light of many challenges, transitions and changes for reaching well-being.

Psychology of sustainability and sustainable development (Di Fabio & Rosen, 2018) introduces a new awareness regarding the necessity to construct early and in a primary prevention framework attention and intervention for sustainable well-being, considering details of meaning for individuals also in relation to the environment (Di Fabio, 2017a; 2017b; Di Fabio & Bucci, 2016; Di Fabio & Rosen, 2018).

Challenges are inherently and first of all opportunities also in relation to designing healthy physical spaces sustaining well-being of people (Di Fabio, 2017a; 2017b). The psychology of sustainability and sustainable development perspective represents a contribution to respond more and more adaptively in constructing opportunities for well-being coping with the challenging and changeable scenarios of the current post-modern era, also in relation to the environment and built environments.

### **Architecture and sustainability**

Architecture, understood in its broadest and general connotation, is the synthesis of innumerable factors, first of all history, understood both as an evolutionary process and as the historical context in which it was born and developed.

In the historical evolution of architecture and styles, from classical antiquity, to the Romanesque, to Gothic, through the Renaissance and the Baroque, up to the Modern, with the Bauhaus and international movements of the last century, it is clear that all styles of architectures communicate the spirit of the era expressed through its own architecture, from buildings to public spaces.

The architectural forms, with the related construction techniques and materials used, as well as the result of the needs and technologies of the time, seek out the satisfaction of the primary human needs, such as the performance of daily activities in a favourable environment and shelter from the elements (Rossi, 1978), with, in parallel, the most spiritual and ritual activities coming up to the necessity of the demonstration of prosperity, strength and wealth of a community, through the construction of specialized architectures.

A significant example can be found with the comparison between two images (Martek, Hosseini, Shrestha, Zavadskas, & Seaton, 2018): Stonehenge (United Kingdom) and the Marina Bay Sands Resort, in Singapore. Both structures represent an iconic expression of the architecture and the technique of the time. In relation to the sustainability of the building structure, it is natural to ask a question about these two images: which of the two structures represents a more sustainable solution? The answer to such a question can be given in analytical terms but only by defining models of analysis and reference parameters and taking into account that, although we have witnessed a continuous development of technologies, in most cases we tend to build using always the same technologies. This habit, almost a sort of mental laziness as *habitus*, involves in fact the exploitation of resources and the production of wastes in constant increase (UNEP, 2012).

In a context showing a growing concern about the impact that humans can have on the environment, construction can be considered as the source of major environmental damage (Martek et al., 2018). The construction of buildings leads to the consumption of about a third of the resources available in terms of a sixth of fresh water used overall, a quarter of the wood used worldwide, and four-tenths of the other raw materials. The construction operations lead to the consumption of 50% of global energy resulting in the production of greenhouse gases in addition to 10% of energy consumed in the production of building materials; the initial construction and demolition of buildings generates 40% of all waste produced in the world (Martek et al., 2018).

It is also true that in the general panorama of the construction world we are witnessing a growing attention to consumption, with a simultaneous research and application of studies for their evaluation and quantification both in technical and economic terms. In this context, it is evident that architecture and construction are suitable for the application of circular economy models and in particular for the *circular supply chain, recovery and recycling* and the *extension of the product life*; The starting point for applying such a circular model is certainly a design that is aware, first of all, of the life cycle of the constructions and of the materials that compose them (Van de Westerlo, Ketelaars, & Roders, 2011).

Since the evolution of building performance measures has a long history, which has changed only recently, moving from concerns about financial performance and occupants' health and safety to environmental performance (Martek et al., 2018), today we are witnessing a growing interest also in the regulatory instruments towards these issues. This implies, as a consequence, an attention to research on the subject related to the determination of the instruments and parameters for the assessment of "green rating" and of sustainability in general. In relation to the numerous evaluation tools available, for a review see Martek et al. (2018), an important contribution offered by scientific research has been to promote changes and increase in the list of sustainability factors. This, in fact, has on the one hand encouraged strong competition among the numerous sustainability instruments offered, but on the other hand also a further boost for a further development of the research itself.

Numerous authors have ventured into the study of the theme proposing, from time to time, innovative and increasingly articulated solutions, with reference to the fundamental notion of sustainability such as economic, environmental and social balance. For the assessment of the sustainability of projects and building products, in addition to the traditional economic, environmental and social objectives, the three phases of the life cycle of a project are also important: production and construction, employment and use and demolition and re-use. The sustainability performance thus turns into a cumulative performance of many decades of the building's existence (Martek et al., 2018; Rios, Chong, & Grau 2015; Salama, 2017). Measuring sustainability, also thanks to the application of the Value Analysis Method -AV- (Maffei, 1999),

horizontally ranges across the value chain, starting from raw materials, through their processing and transformation, the production of components, transportation, construction, use, maintenance, renovation, dismantling, demolition and recycling (Martek et al., 2018; Rios et al., 2015; Salama, 2017 Wastling, Charnley, & Moreno, 2018). It also spreads vertically, among the building sectors, from residential to commercial, from industrial to manufacturing, to oil, energy and transport, and in various sectors and other infrastructural domains, which each have their own sustainability criteria customized with accuracy. In summary, the evaluation tools are different depending on what they measure whereas the evaluation of their real scientific accuracy is very complex (Martek et al., 2018).

It seems clear that sustainability is configured as a new paradigm of reference for architecture, which goes beyond the characteristics of the construction, where the design concept is an element directly connected to the real, effective and efficient measurement of sustainability itself, a new keystone of the sustainability project. The long-term impacts of the needs of present society, dictated by the contemporary global growth-oriented economy, should therefore be taken into consideration so that they do not compromise the needs of future generations.

If we can already identify the key points of sustainability, both in its wider definition and more specifically in the narratives of design and architecture in general, such as Environment, Economics and Society or even Environment, Economics, Education and Equity, it is necessary to introduce a new pillar on which sustainability should be based: health, understood in its broadest sense in terms of well-being for optimal functioning.

Welfare is conceived as a state of complete physical, mental, spiritual and social well-being rather than simply as the absence of illness or infirmity (World Health Organization, 1998; 2007). Well-being in its deep sense, which enriches the vision of sustainability, is articulated in hedonic and eudaimonic (Di Fabio, 2017a; 2017b). This new vision enriches urban and architectural planning and asks that these issues be declined operationally. This also means taking on an architectural and urban approach that responds to the principle of primary prevention, not only by reducing risks but by strengthening forces (Di Fabio & Kenny, 2015; 2016a; Hage et al., 2007; Kenny & Hage, 2009). The role of design, both architectural and urban, therefore returns to be fundamental and calls for new awareness and new preparation to respond to the new paradigm.

Already starting from a generic definition of design, the role played in the creation of health and well-being is immediately clear. Architectural and urban planning can be defined as an iterative process able to identify forms, organizations and processes aimed at creating spaces, environments and dedicated artefacts in which man can perform specific activities - living, working, relaxing, caring, moving and standing still. A process able to identify also the distribution of uses and spaces and the way to use materials and technologies so as to create scenarios and images in which the human being associates a state of psychological and physical well-being (Santi, 2015; Wölflin, 1946).

These processes create and determine the "containers" in which the human functions are performed and consequently the latter must favour health and well-being in all their phases and components, from the design, construction and maintenance phase, to the choice of shapes, structures, materials, aesthetic finishes and technologies capable of being easily maintained and able to guarantee optimal functioning over time, responding to the new paradigm of sustainability also in terms of health and well-being, with new awareness and operational transferability of the coordinates of well-being not only hedonic but also eudaimonic.

## References

- Blustein, D. L., Kenny, M. E., Di Fabio, A., & Guichard, J. (2018). Expanding the impact of the psychology of working: Engaging psychology in the struggle for decent work and human rights. *Journal of Career Assessment*. doi: 10.1177/1069072718774002
- Brundtland Report (1987). *Our common future*. New York: Butterworth.
- Diener, E. D., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personality Assessment*, 49 (1), 71-75.
- Di Fabio, A. (2014a). Career counseling and positive psychology in the 21st century: New constructs and measures for evaluating the effectiveness of intervention. *Journal of Counseling*, 1, 193-213.
- Di Fabio, A. (2014b). "Constructing my Future Purposeful Life": A new Life Construction intervention. In A. Di Fabio & J.-L. Bernaud (Eds.), *The Construction of the Identity in 21st Century: A Festschrift for Jean Guichard* (pp. 219-239). New York: Nova Science Publishers.
- Di Fabio, A. (2016). Positive Relational Management for healthy organizations: Psychometric properties of a new scale for prevention for workers. In G. Giorgi, M. Shoss, & A. Di Fabio (Eds.), *From organizational welfare to business success: Higher performance in healthy organizational environments*. Research Topic in *Frontiers in Psychology. Organizational Psychology*, 7, 1523. doi: 10.3389/fpsyg.2016.01523
- Di Fabio, A. (2017a). Positive Healthy Organizations: Promoting well-being, meaningfulness, and sustainability in organizations. In G. Arcangeli, G. Giorgi, N. Mucci, J.-L. Bernaud, & A. Di Fabio (Eds.), *Emerging and re-emerging organizational features, work transitions and occupational risk factors: The good, the bad, the right. An interdisciplinary perspective*. Research Topic in *Frontiers in Psychology. Organizational Psychology*, 8, 1938. doi: 10.3389/fpsyg.2017.01938
- Di Fabio, A. (2017b). The psychology of sustainability and sustainable development for well-being in organizations. In G. Arcangeli, G. Giorgi, N. Mucci, J.-L. Bernaud, & A. Di Fabio (Eds.), *Emerging and re-emerging organizational features, work transitions and occupational risk factors: The good, the bad, the right. An interdisciplinary perspective*. Research Topic in *Frontiers in Psychology. Organizational Psychology*, 8, 1534. doi: 10.3389/fpsyg.2017.01534
- Di Fabio, A., & Blustein, D. L. (2016). Editorial. In A. Di Fabio & D. L. Blustein (Eds.), *Ebook Research Topic "From Meaning of Working to Meaningful Lives: The Challenges of Expanding Decent Work"* in *Frontiers in Psychology. Organizational Psychology*, 7, 1119. doi: 10.3389/fpsyg.2016.01119
- Di Fabio, A., & Bucci, O. (2016). Green positive guidance and green positive life counseling for decent work and decent lives: Some empirical results. In A. Di Fabio & D. L. Blustein (Eds.), *From meaning of working to meaningful lives: The*

challenges of expanding decent work. Research Topic in *Frontiers in Psychology. Section Organizational Psychology*, 7, 261. doi: 10.3389/fpsyg.2016.00261

Di Fabio, A., & Kenny, M. E. (2015). The contributions of emotional intelligence and social support for adaptive career progress among Italian youth. *Journal of Career Development*, 42, 48-59.

Di Fabio, A., & Kenny, M. E. (2016a). From decent work to decent lives: Positive Self and Relational Management (PS&RM) in the twenty-first century. In A. Di Fabio & D. L. Blustein (Eds.), *From meaning of working to meaningful lives: The challenges of expanding decent work. Research Topic in Frontiers in Psychology. Section Organizational Psychology*, 7, 361. doi: 10.3389/fpsyg.2016.00361

Di Fabio, A., & Kenny, M. E. (2016b). Promoting well-being: The contribution of emotional intelligence. In G. Giorgi, M. Shoss, & A. Di Fabio (Eds.), *From organizational welfare to business success: Higher performance in healthy organizational environments. Research Topic in Frontiers in Psychology. Organizational Psychology*, 7, 1182. doi: 10.3389/fpsyg.2016.01182

Di Fabio, A., Kenny, M. E., & Claudius, M. (2016). Preventing distress and promoting psychological well-being in uncertain times through career management intervention. In M. Israelashvili & J. L. Romano (Eds.), *Cambridge Handbook of international prevention science* (pp. 233-254). Cambridge: Cambridge University Press.

Di Fabio, A., Kenny, M. E., & Minor, K. (2014). School-based research and practice in Italy. In M. J. Furlong, R. Gilman, & E. S. Huebner (Eds.), *Handbook of positive psychology in the schools* (2nd ed., pp. 450-464). New York: Routledge, Taylor and Francis.

Di Fabio, A., & Rosen, M. A. (2018). Opening the Black Box of Psychological Processes in the Science of Sustainable Development: A New Frontier. *European Journal of Sustainable Development Research*, 2(2).

Di Fabio, A., & Saklofske, D. H. (2014a). Comparing ability and self-report trait emotional intelligence, fluid intelligence, and personality traits in career decision. *Personality and Individual Differences*, 64, 174-178.

Di Fabio, A., & Saklofske, D. H. (2014b). Promoting individual resources: The challenge of trait emotional intelligence. *Personality and Individual Differences*, 65, 19-23.

Dincer, I., & Rosen, M. A. (2007). *Exergy energy, environment and sustainable development*. Amsterdam: Elsevier Science Publishers.

Engel, G. L. (1977). The need for a new medical model: A challenge for biomedicine. *Science*, 196(4286), 129-136.

Guichard, J. (2004). Se faire soi [Self-construction]. *L'Orientation Scolaire et Professionnelle*, 33, 499-534.

Guichard, J. (2010, March). *Les théories de la construction des parcours professionnels et de la construction de soi: Deux approches de la construction de la vie individuelle*. Paper presented at Colloque International INETOP, Paris, France.

Hage, S. M., Romano, J. L., Conyne, R. K., Kenny, M., Matthews, C., Schwartz, J. P., & Waldo, M. (2007). Best practice guidelines on prevention practice, research, training, and social advocacy for psychologists. *The Counseling Psychologist*, 35, 493-566.

Harris, J. M. (2003). Sustainability and sustainable development. *International Society for Ecological Economics*, 1(1), 1-12.

Kenny, M. E., & Hage, S. M. (2009). The next frontier: Prevention as an instrument of social justice. *The Journal of Primary Prevention*, 30, 1-10.

Komiyama, H., Takeuchi, K., Shiroyama, H., & Mino, T. (2011). *Sustainability Science: A Multidisciplinary Approach*. Tokyo: UNU Press.

Landy, F. J., & Conte, J. M. (2016). *Work in the 21st century, binder ready version: An introduction to industrial and organizational psychology*. Hoboken, NJ: John Wiley & Sons.

Maffei, P. L. (1999). *L'Analisi del valore per la qualità del progetto edilizio. Progettare e costruire*. Milano: Il Sole 24 Ore.

Martek, I., Hosseini, M. R., Shrestha, A., Zavadskas, E. K., & Seaton, S. (2018). The sustainability narrative in contemporary architecture: Falling short of building a sustainable future. *Sustainability*, 10(4), 981. doi:10.3390/su10040981

Rios, F. C., Chong, W. K., & Grau, D. (2015). Design for Disassembly and Deconstruction - Challenges And Opportunities. *Procedia Engineering*, 118, 1296-1304. doi: 10.1016/j.proeng.2015.08.485.

Rosa, H. (2013). *Social acceleration: A new theory of modernity*. New York, NY: Columbia University Press.

Rosen, M. A. (2009). Energy sustainability: A pragmatic approach and illustrations. *Sustainability*, 1(1), 55-80.

Rosen, M. A. (2013). Engineering and sustainability: attitudes and actions. *Sustainability*, 5(1), 372-386.

Rosen, M. A. (2017a). Sustainable development: a vital quest. *European Journal of Sustainable Development Research*, 1(1), 2.

Rosen, M. A. (2017b). How can we achieve the UN Sustainable Development Goals? *European Journal of Sustainable Development Research*, 1(2), 06.

Rosen, M. A., & Abu Rukah, Y. (2011). A pragmatic approach for sustainable development of the Red-Mediterranean-Dead Seas Canal Project: a case study. *International Journal of Ecology & Development*, 19(S11), 63-75.

Rosen, M. A., & Koochi-Fayegh, S. (2017). *Geothermal energy: Sustainable heating and cooling using the ground*. London: Wiley.

Rossi, A. (1978). *L'Architettura della città*. Torino: Città Studi Edizioni.

Ryan, R. M., & Deci, E. L. (2001). To be happy or to be self-fulfilled: A review of research on hedonic and eudaimonic well-being. In S. Fiske (Ed.), *Annual Review of Psychology* (Vol. 52, 141-166). Palo Alto, CA: Annual Reviews.

Ryff, C. D. (1989). Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *Journal of Personality and Social Psychology*, 57(6), 1069-1081.

Salama, W. (2017) Design of concrete buildings for disassembly: An explorative review. *International Journal of Sustainable Built Environment*, 6, 617-635. doi: 10.1016/j.ijbsbe.2017.03.005.

Santi, G. (2015). Progettare per il benessere. In V. Cutini & G. Santi (Eds.), *Una città in movimento. Architettura, spazio urbano e mobilità a Pisa* (pp. 64-99). Pisa: Pacini Editore.

UNEP (2012) *Responsible resource management for a sustainable world: findings from the international resource panel*. Retrieved from <http://wedocs.unep.org/handle/20.500.11822/10580>.

United Nations (2018). *About the sustainable development goals*. Retrieved from <https://www.un.org/sustainabledevelopment/sustainable-development-goals/>

Wastling, T., Charnley, F., & Moreno, M. (2018) Design for circular behaviour: Considering users in a circular economy. *Sustainability*, 10, 1743. doi:10.3390/su10061743.

Waterman, A. S., Schwartz, S. J., Zamboanga, B. L., Ravert, R. D., Williams, M. K., Bede Agocha, V., et al. (2010). The Questionnaire for Eudaimonic Well-Being: Psychometric properties, demographic comparisons, and evidence of validity. *Journal of Positive Psychology*, 5, 41-61.

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: the PANAS scales. *Journal of Personality and Social Psychology*, 54(6), 1063-1070.

Van de Westerlo, B., Ketelaars, J. & Roders, A. P. (2011) Cradle to cradle-rehabilitation of industrial heritage. The opportunities for cradle to cradle in the Netherlands. *International Journal of Sustainable Building Technology and Urban Development*, 2, 195-200. doi: 10.5390/susb.2011.2.3.195

Wölfflin, H. (1946). *Prolegomena zu einer. Psychologie der Architektur*. Basel: Schwabe AG Verlag.

World Health Organization (1998). *World Health Organization Definition of Health*. Available online at: <http://www.who.ch/aboutwho/definition.htm>

DOI: 10.14605/CS1131803