The research proposed a developed methodology for evaluation the system performance in uncertainty associated with traditional modelling methodology is focused on either load *L* or resistance *R* variability, but not both. A two-dimensional (2D) fuzzy set (traditional model), represent with the one dimension for universe of discourse (in x-direction) and the second dimension of his membership degree (in y-direction), is not full sufficient to handle both, load and resistance variation of system performance. The theoretical principle basis of this research is based on development of the three dimensional (3D) of fuzzy set that includes system performance variability in load and resistance from two dimensional. The proposed methodology (traditional model) extends the acceptance level of partial performance of system concept to a 3D-dimantion representation. This representation allows to capturing the changing of preferences of decision makers in load and resistance. The major objective of the research is to proposed the original methodology for evaluate system performance and management that is capable of; (a) addressing uncertainty caused by load and resistance variability and ambiguity; (b) integrating objective and subjective evaluation; and (c) assisting system performance management decision making based on a more detailed certainty evaluation of load and resistance variability.

The study proposed two models for fuzzy reliability performance indexes: first traditional model included (I) 2D fuzzy reliability-vulnerability *Rv* index, (II) 2D fuzzy robustness *Ro* index; the second developed model (i) 3D fuzzy reliability-vulnerability *Rv* index, (ii) 3D fuzzy robustness *Ro* index; and comparing between them. These indexes have the capability of evaluating the operational performance of complex systems. Proposed methodology is illustrated by using the Al-Wathba Water Supply System (WWSS) as a case study**.**