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Subject R&D innovation theme 4.1. from the Innovation Contract (page 25)  
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## 4.1 Support structures

### 4.1.1 The importance

The Netherlands has strong players with innovative production lines for wind turbine support structures. These companies are the market leaders, and want to secure and expand their position. Besides optimizing existing support structures by means of the right design methods and the application of integral design and optimization tools, it is possible to reduce costs by designing completely new types of support structures and, in the area of optimal production, by means of construction research.

### 4.1.2 The R&D activities

1. Design tools: Designing better and cheaper structures by using improved design tools based on the latest state-of-the-art design standards. The rules and methods according to which support structures are designed are still new. They are regularly updated and made faster and smarter on the basis of experience gained, while the foundations need to support increasingly heavy and large turbines. (Lengthy) condition monitoring can improve the design rules for fatigue and safety margins. Validation and certification are only possible by using test set-ups.
2. Sea(bed) research: Gaining more knowledge of the underground and waves, and their interaction with the foundation. The models for the calculation of support structures can be optimized further by conducting tests in demonstration windfarms.
3. New concepts: Designing and testing new concepts, such as new variants (Tripod, SIWT, Twisted Jacket), integrated design of the foundation and tower, research into smart connection technologies such as slip joints or welded joints to replace the grout and the application of other components and materials (composite materials, sandwich structures).
4. Construction research: fast, efficient serial production of the designs, as they appear.

### 4.1.3 The parties involved

Companies	Knowledge institutes
2-B Energy, Ampelmann, Ballast Nedam, Blue H Technologies, BMO Offshore, De Vries & Van de Wiel, Deltares, DHV, ESI Group, Essent, Geo Plus, GL Garrad Hassan, IHC Merwede, IMARES (Wageningen), MECAL, NNOW, Royal Haskoning, Siemens, SIF, Smulders Projects, SPT (Suction Pile Technology), Van Oord, Volker Staal & Funderingen, We@Sea, Wiertsema & Partners, Promorfo, Siemens, Snelwind, Suzlon Blade Technology, TRES4, We@Sea, XEMC Darwind	Deltares, ECN, Marin, MCN, University of Groningen, TU Delft, WMC