



UNIVERSITÄT HOHENHEIM

Institut für Interorganisational Management & Performance  
Beschaffung und Produktion 580 B  
Supply Chain Management 580 C



Vortrag

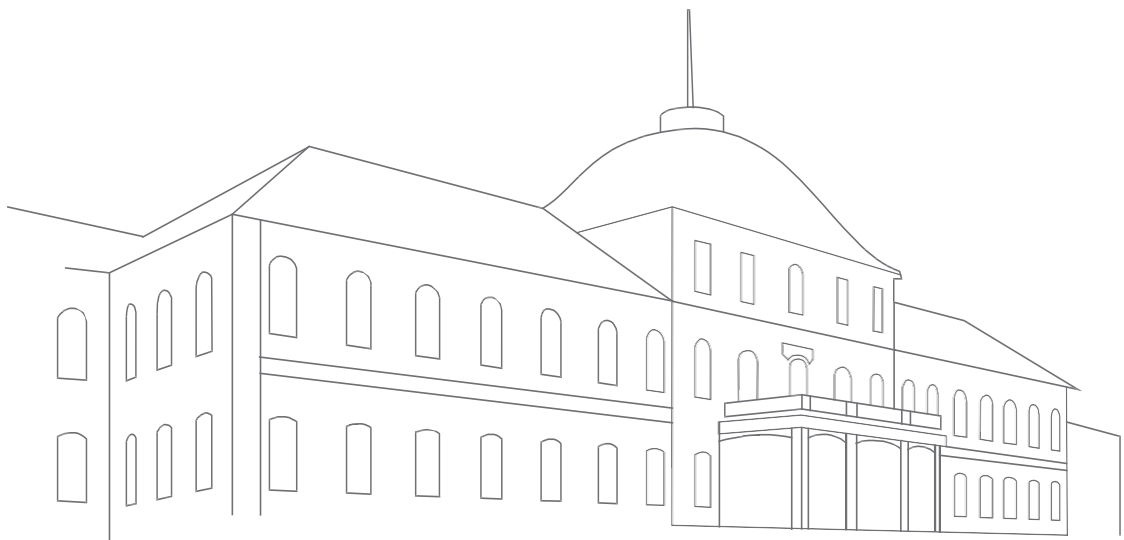
**Improving Pilgrims Safety during Hajj:  
An Analytical and Operational Research  
Approach**

Prof. Dr. Knut Haase  
Universität Hamburg

Donnerstag, 11. Juni 2015  
12:15 bis 13:45 Uhr

Hörsaal 10

Interessierte sind herzlich eingeladen!  
Eine Anmeldung ist nicht erforderlich.



## Abstract

The Hajj - the great Islamic pilgrimage to Makkah, Saudi Arabia - is known to be the largest annually occurring pedestrian problem in the world with more than 3 million pilgrims each year. Pilgrims perform several religious rituals, including Ramy al-Jamarat - the stoning of the devil ritual - which is known to be particularly crowded. Until 2006, several sad crowd disasters with hundreds of casualties occurred. In the aftermath of the Hajj in 2006, several measures have been taken to improve safety and to avoid crowd disasters. One particular measure is the development of a time schedule for the pilgrims to perform the stoning ritual. In this talk, Knut Haase will present a model and a solution approach to the Pilgrim Scheduling Problem.

The model minimizes the deviation of the scheduled stoning time from the preferred stoning time, while taking into account resource capacities (street width, for example) in order to avoid critical densities of pilgrims. To solve the Pilgrim Scheduling Problem an intelligible fix-and-optimize heuristic is used. The approach has been an integral part of the planning of Hajj in 2007. Variants of it are still applied. Since 2007 no further crowd disaster has happened. Computational results for the Hajj in 2013 will illustrate the work.

