# Project Milestone 1 – Problem Scoping

**Design Worksheet**

**C. Team Contributions**

**1. Problem Identification**: Task-level view.

What does NCN want your team to develop?

We have been asked to develop a simulation suite that is based on mathematical models for quantum dots and their applications, specifically for their photovoltaic properties. The deliverable will be a suite of simulations that will allow the user to better visualize the photovoltaic fabrication and applications. The criteria for success include: the accuracy of the model, ease of use, providing appropriate data to fit pre-existing decision making algorithms, and adaptability of the suite. We are constrained by development time, hardware and software.

**2. Problem Formulation**: Big-picture level view.

List stakeholders, each with relationship between the stakeholder and the deliverable. Clearly indicate which stakeholders are potential direct users for the deliverable.

Include in-text citations. Use a minimum of 6 citations.

1. Homeowners. These would possibly be direct users being sold residential solar panels by the next stakeholder. (Cuthbertson, 2014)
2. Sales representatives. These would be direct users, they would be using our suite to communicate to homeowners possible costs and benefits of installing solar panels of a specific type in their homes (or windows).
3. Solar panel fabrication companies. This stakeholder could be a direct user, as they would need some method of preliminary research in order decide how to best approach the issue. (Chandler, 2014)
4. Environmental agencies. These would most likely be indirect users they would take the information from our suite, provided to them by contractors, to develop usage and disposal guidelines. (Hardman, 2005)
5. Educational organizations. Direct. These would be schools introducing students about new technologies and inspiring them to maybe soon take part in the research. (Borovitskaya, 2002)
6. Material Suppliers. These would be indirect users that would take information that had been found by direct users (possible the fabrication companies) and then use it to adapt their search and removal tactics for the raw materials.
7. Television Manufacturers. These will be direct users of our suite, it will help them determine which materials to use and how to optimize the output of the quantum dots. (Hoffman, 2015).
8. Fisherman. Indirect. They would receive information about which quantum dots are needed by the direct users and decide how many shrimp to harvest. (Queen Mary University, 2015)
9. Hobbyists. Direct. These are people that are independently interested in the topic that could learn from our simulation.
10. Optical Sensor manufacturers. Direct. These companies would use our suite to find materials that meet specific criteria for their receptor needs.

**3. Direct User**

a. *Direct User Selection*: describe direct user and explain why your team wants to work with them

The memo indicated that we will be required to develop a suite to explore solar panel fabrication and applications. Because of this we are selecting the solar panel fabrication/manufacturing company as our direct user of primary focus. This user is possibly the most closely associated branch of nano-tech to quantum dots. It is important for them to have accurate and rapidly supplied information about a specific ‘cocktail’ of QD materials. This suite would help them in their preliminary feasibility research, helping them to get a quick idea which combinations of materials would be worth looking at more closely. We would like to work with this user, because we see an unique opportunity to provide an useful product to a meaningful field that has the potential to increase our energy efficiency as a species.

b. *Direct User Profile*: list 20 pieces of relevant information about your direct user that will help you develop a high quality simulation suite for our project partner that meets the stated criteria. Include in-text citations. Use a minimum of 6 additional citations.

1. The client wants bright pure colors (Sigma-Aldrich, 2015)
2. Want to minimize negative environmental impact (Hardman, 2005)
3. “Market penetration of competitive PV technologies is limited mainly by cost, which in turn depends on device efficiency, material availability and the energy requirement of production process.” (Ahmed, 2013)
4. “Size of particles is a definite point of interest.” (Ahmed, 2013)
5. QDs absorb photons of a shorter wavelength (blue region) and emit them back at a longer wavelength (red region) where the device has high quantum efficiency. This enhances the photo response and efficiency of the cell. (Ahmed, 2013)
6. Wants to develop innovative ways of using the technology (Ambrosiano, 2014)
7. Fabrication companies are all on deadlines.
8. They have a specific threshold for tolerance.
9. PV-manufacturers will need some information but other info could be useless.
10. They may not have resources to learn a non-standard interface.
11. They may have specific standards that must be adhered to.
12. They have a variety of data to process.
13. They have a specific design process.
14. They will have certain criteria for success.
15. PV manufacturing companies have specific decision making process. (Gunasekaran, 2001)
16. Solar Cell fabrication teams have their own decision making algorithms.
17. They are being regulated by the government.
18. They want to be able to turn light into electricity (SEIA, 2014).
19. They are trying to reduce labor costs.
20. They need information on how best to iterate their product.
21. They are looking for systems to mesh well with their current procedures.

**Citations (*minimum 12*):** In APA format in alphabetical order.

Ahmed, R. (2013, February 10). Photovoltaic news and pv jobs. Retrieved February 21, 2015, from <http://www.pv-magazine.com/archive/articles/beitrag/quantum-dots--the-pros-and-cons-in-pv-_100010173/572/#axzz3SPuCZHdm>

Ambrosiano, N. (2014, April 14). Shiny quantum dots brighten future of solar cells. Retrieved February 21, 2015, from <http://www.lanl.gov/discover/news-release-archive/2014/April/04.14-shiny-quantum-dots.php>

Borovitskaya, E. (2002). *Quantum dots*. River Edge, N.J.: World Scientific.

Chandler, D. (2014, May 28). New breed of solar cells: Quantum-dot photovoltaics set new record for efficiency in such devices. Retrieved February 21, 2015, from <http://phys.org/news/2014-05-solar-cells-quantum-dot-photovoltaics-efficiency.html>

Cheap solar cells made from shrimp shells. (2015, February 19). Retrieved February 21, 2015, from <http://www.qmul.ac.uk/media/news/items/se/148963.html>

Cuthbertson, A. (2014, April 22). Solar-Panel Windows Made Possible by Quantum Dot Breakthrough. Retrieved February 21, 2015, from <https://richarddawkins.net/2014/04/solar-panel-windows-made-possible-by-quantum-dot-breakthrough/>

Get your energy from the sun. (2003, December 6). Retrieved February 21, 2015, from <http://www.nrel.gov/docs/fy04osti/35297.pdf>

Gunasekaran, A. (2001, March 7). A model for investment justification in information technology projects. Retrieved February 21, 2015, from <https://www.umassd.edu/media/umassdartmouth/businessinnovationresearchcenter/publications/it_justification.pdf>

Hardman, R. (2005, September 20). A Toxicologic Review of Quantum Dots: Toxicity Depends on Physicochemical and Environmental Factors. Retrieved February 21, 2015, from <http://www.ncbi.nlm.nih.gov/pmc/articles/PMC1367826/>

Hoffman, C. (2015, January 14). What Exactly is a Quantum Dot TV? Retrieved February 21, 2015, from [http://www.howtogeek.com/207061/what-exactly-is-a-“quantum-dot”-tv/](http://www.howtogeek.com/207061/what-exactly-is-a-)

Konstantatos, G. (2013). *Colloidal quantum dot optoelectronics and photovoltaics*. Cambridge University Press.

[Photovoltaic (Solar Electric). (2014). Retrieved February 21, 2015, from](http://iopscience.iop.org/1742-6596/276/1/012175/pdf/1742-6596_276_1_012175.pdf) <http://www.seia.org/policy/solar-technology/photovoltaic-solar-electric>

Quantum Dots. (2015, January 1). Retrieved February 21, 2015, from <http://www.sigmaaldrich.com/materials-science/nanomaterials/quantum-dots.html>

Tianze, L. (2011). Retrieved February 21, 2015, from <http://iopscience.iop.org/1742-6596/276/1/012175/pdf/1742-6596_276_1_012175.pdf>

**D. Individual Contributions**

***Individually***, identify your contribution to M1. Please use the following stem sentences to help structure your description:

1. **Apoorva Kharch** contribution was:

* I completed these tasks: Research and citation.
* I contributed to these tasks: writing and formatting
* I completed everything I was assigned.

2. **Yash Shah** contribution was:

* I created the citations.
* I contributed to the wording and final decisions on which path to take. I also assisted in locating sources.
* I did not fail to complete any assigned tasks.

3. **Broderick Schwartz** contribution was:

* I completed these tasks: I typed everything out and shared the doc with the rest of the team.
* I contributed to these tasks: research and citation
* I completed all assigned tasks

4. **Rashid Sarwar** contribution was:

* He did not attend the meeting.